Archaeologia Polona, vol. 60: 2022, 163–185
PL ISSN 0066-5924
DOI: 10.23858/APa60.2022.3099

Striped Flint in Archaeological Materials Around the Outcrops of the Kraków-Częstochowa Striped Flint Variety

Magdalena Sudoł-Procyk[a], Magdalena Malak[b], Hubert Binnebesel[c] and Maciej T. Krajcarz[d]

Many varieties of siliceous raw materials can be found in the territory of Poland. Known exclusively from in situ outcrops in the Holy Cross Mountains area until recently, striped flint is distinctive in terms of its technical and visual features. The authors present the state of knowledge about the variety of striped flint from the Ryczów Upland, the outcrops of which were found only about a decade ago. New data obtained from the central part of the Kraków-Częstochowa Upland has cast interesting light on the issues of the origin of striped flint and the ways it was used by the prehistoric communities inhabiting the region. Identifying the sites of siliceous rocks outcrops, extraction and distribution are extremely important at not only the local but also trans-regional level.

KEY-WORDS: Kraków-Częstochowa striped flint, Kraków-Częstochowa Upland, prehistoric settlement, distribution of raw materials

INTRODUCTION

Amongst the various types of siliceous raw materials in Poland, there are few distinctive in terms of excellent technological properties and aesthetic values. Within this group we may place the Świeciechów flint, chocolate flint, and especially the striped

[a] Institute of Archaeology, Nicolaus Copernicus University, 44/48 Szosa Bydgoska Street, 87–100 Toruń (Poland); e-mail: sudol@umk.pl; ORCID: 0000-0003-4099-5893
[b] Institute of Archaeology, Nicolaus Copernicus University, 44/48 Szosa Bydgoska Street, 87–100 Toruń (Poland); e-mail: malak@umk.pl; ORCID: 0000-0002-9210-8179
[c] Institute of Archaeology, Nicolaus Copernicus University, 44/48 Szosa Bydgoska Street, 87–100 Toruń (Poland); e-mail: 291308@stud.umk.pl; ORCID: 0000-0003-3467-687X
[d] Institute of Geological Sciences, Polish Academy of Sciences, 51/55 Twarda Street, 00–818 Warszawa (Poland); e-mail: mkrajcarz@twarda.pan.pl; ORCID: 0000-0002-1240-0664

Received 4 May 2022; Received in revised form 8 June 2022; Accepted 10 June 2022

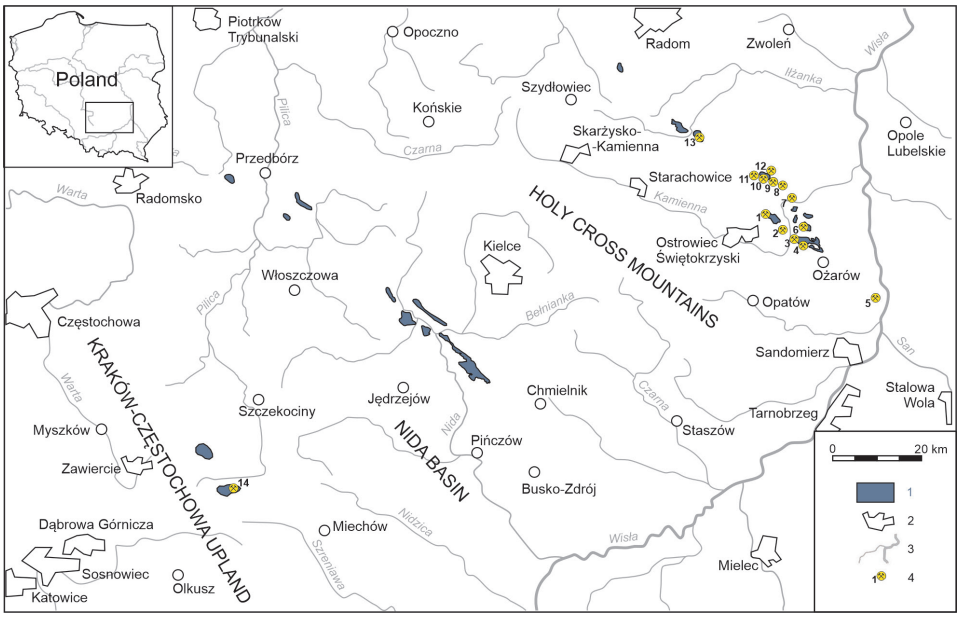

Fig. 1. Localization of known outcrops of rock bearing chocolate silicites (after Krajcarz *et al.*, 2012b, modified by authors) and the most important points of prehistoric exploitation of striped flint. Key: 1 – Upper Jurassic rocks with striped silicite; 2 – major towns and cities; 3 – major rivers; 4 – prehistoric points of exploitation of striped flint (1 – Krzemionki Opatowskie, 2 – Ruda Kościelna, 3 – Łysowody, 4 – Korycizna, Śródborze, Wojciechówka, 5 – Zawichost, 6 – Wiktoryn, 7 – Skarbka Dolna, 8 – Wólka Bałtowska, 9 – Eugeniów, 10 – Stary and Nowy Olechów, 11 – Karolów, 12 – Wodąca, 13 – Błaziny, 14 – Cisowa).

flint. This paper is dedicated to the latter, the striped flint (also banded flint, Polish: *krzemień pasiasty*). The qualitative and aesthetic properties of this raw material were appreciated from the prehistoric times.

There is a well-recognised zone of striped flint outcrops (Fig. 1) on the north-eastern margin of the Holy Cross (Świętokrzyskie) Mountains, extending from the Iłża River to Krzemionki Opatowskie and to Śródborze village (Krukowski 1923; Samsonowicz 1923; 1934; Budziszewski and Michniak 1984). Outside of this region, outcrops of this raw material were partially mapped in the south-western margin of the Holy Cross Mountains (Fig. 1), e.g., in the surroundings of Siedlce, Bocheniec, and Małogoszcz (Krajcarz and Krajcarz 2009). In both regions the striped flint occurs at the same stratigraphic position and in a similar limestone lithofacies.

Similar limestones are also known from the eastern edge of the Kraków--Częstochowa Upland, which made this region promising enough to extend studies on the occurrence of striped flint outcrops to that region too. Until now, our survey has focused in the central part of the Upland, the microregion of the Ryczów Upland (Krajcarz *et al.*, 2014). The research was initiated in 2007 and has been continuously carried out until present.

The issue of occurrence and utilisation of local raw materials in the southern part of the Ryczów Upland had already been tackled in the 1990s by Andrzej Pelisiak and Jerzy Kopacz (Kopacz and Pelisiak 1992; Pelisiak 2003; 2006). They distinguished several areas of the occurrence of Jurassic chert, in particular their variety G, among other places in the area of the Barańskie Hills and the Krztynia Valley. Striped flint shares some similar traits with the G variety of Jurassic chert, as well as with the so-called chert from Wierbka (Krajcarz *et al.*, 2012b; 2014). However, in this paper we focus only on the "typical" striped flint (see section 3). The outcrops of this raw material have been found until now only in the south-eastern part of the Ryczów Upland (Krajcarz *et al.*, 2014; Fig. 2). Some artefacts made of striped flint were described at nearby archaeological sites (Krajcarz *et al.*, 2012b; 2014; Sudoł-Procyk 2020; Sudoł-Procyk and Krajcarz 2021; Sudoł-Procyk and Cyrek in press) and this suggests that the local striped flint could have been known and used by prehistoric communities. In recent years, our knowledge on the occurrence of striped flint in the region has enlarged, both in terms of outcrops that could serve as raw material sources, and in the form of artefacts within archaeological assemblages. The aim of this paper is to summarize and synthesize this knowledge and to present a preliminary model of the prehistoric procurement and distribution of striped flint within the region.

STRIPED FLINT OUTCROPS IN THE RYCZÓW UPLAND

The striped flint variety from the Ryczów Upland is known as the "Kraków--Częstochowa striped chert". It was found during a field survey conducted by Maciej T. Krajcarz and Magdalena Krajcarz in 2008, and then it was described by Krajcarz *et al.* (2012a; 2012b). It occurs in the topmost Upper Oxfordian chalky limestone. Natural exposures of outcrops of this material do not currently exist. The best artificial outcrop known is on a ski slope in Cisowa village, which is being refreshed every several years by the owner with the use of bulldozers. After such refreshment, many fresh nodules can be easily collected. The collection from the Cisowa ski slope serves as a type locality of the Kraków-Częstochowa striped chert

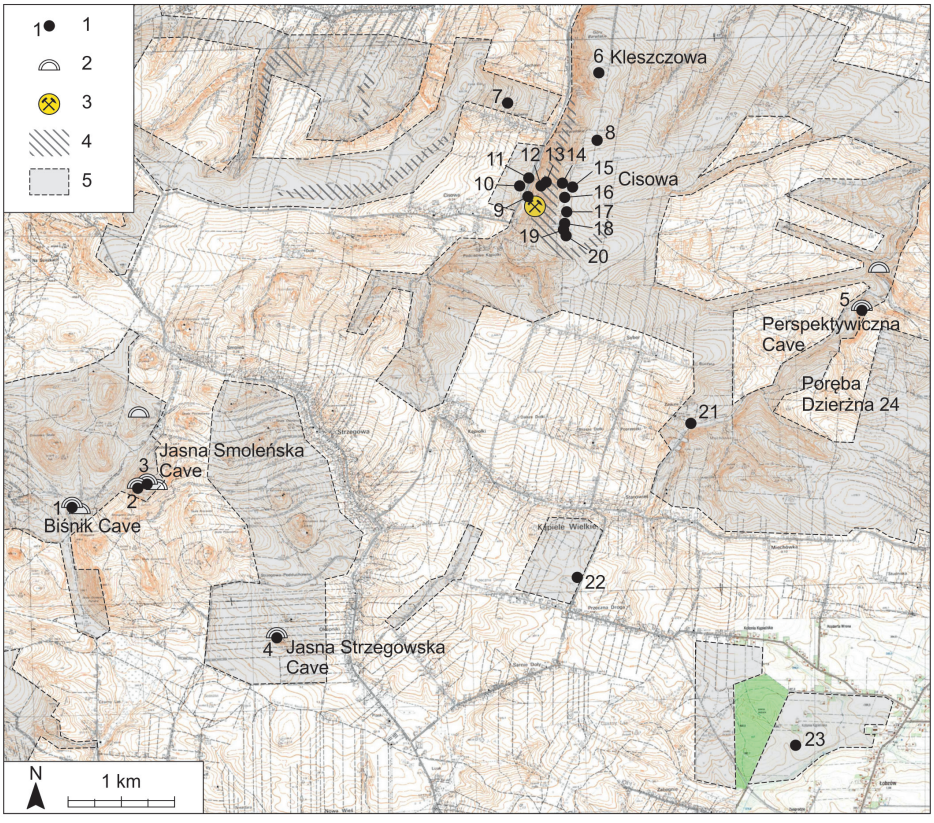

Fig. 2. Location of the striped flint outcrop in the central part of the Kraków-Częstochowa Upland and sites with assemblages of this raw material. Drawning: M. T. Krajcarz, M. Sudoł-Procyk. Key: 1 – sites with striped flint artefacts; 2 – larger caves; 3 – possible striped flint extraction point in Cisowa; 4 – outcrops of the striped flint; 5 – area covered by survey. Sites: 1 – Biśnik Cave; 2 – Shelter above the Zegar Cave; 3 – Jasna Smoleńska Cave; 4 – Jasna Strzegowska Cave; 5 – Perspektywiczna Cave; 6, 8, 12–20 – sites in the area of the village of Kleszczowa; 7, 9–11 – sites in the area of the village of Cisowa; 21–22 – sites in the area of the village of Kąpiele Wielkie; 23 – site in the area of the village of Zabagnie.

and is stored in the Institute of Geological Sciences, Polish Academy of Sciences (Warsaw, Poland) and in the Institute of Archaeology, Nicolaus Copernicus University in Toruń (Toruń, Poland). Apart from this outcrop, this flint can be found in the soil, regolith and within the colluvial mantle on nearby hills. The currently known range of its occurrence covers: the slope in Cisowa, where the ski slope is

situated; the plateau above the slope (occupied by agricultural fields belonging to Kleszczowa village), known as the Barańskie Hills; the slopes and plateau of the next hill situated to the west; and the alluvia of the valley of a temporary stream in Cisowa village (Fig. 2). Isolated and weathered specimens have also been found in Middle Pleistocene fluvioglacial sands and Cretaceous marine sands within a ~10 km radius around the outcrops, and these likely represent redeposited clasts.

MACRO- AND MICROSCOPIC CHARACTERISATION OF THE RAW MATERIAL

The characterisation of the Kraków-Częstochowa striped chert given below follows the description proposed by Krajcarz *et al.* (2014). The characterization is based on the collection coming from the type locality in Cisowa. Nodules are rounded, spherical, slightly flattened, sometimes weakly branched, and vary in size from a few centimetres to several dozen centimetres. The cortex is thin (1–5 mm, 2 mm on average) and smooth, white, dusty, clearly separated from the inner silica body and the outer rock.

Inside the nodule, within the silica body, there is usually an ellipsoidal nucleus consisting of light grey, opaque, matt and relatively coarse-crystalline silica (see a schematic structure at Fig. 3 and photographs in Figs. 4–11). In some specimens, the nucleus is large and may fill nearly the entire nodule (Fig. 3c). However, some specimens lack such a nucleus at all (Fig. 3a). Around the nucleus, or within the entire internal space in the case of specimens lacking the nucleus, there is a nearly pure silica material. In nucleus-bearing specimens, one to several series of concentric growth bands are often developed within the silica body around such a nucleus. Unconformities may occur between the series of bands. This internal structure is typical for bedded cherts, the type of chert described from Kraków-Częstochowa Upland by Matyszkiewicz and Kochman (2020) and Kochman *et al.* (2020): a nucleus represents an initial chert concretion and the silica around represents growth bands.

The silica body outside of the nucleus is dark, from grey to black, slightly transparent to opaque, matte or with slight silky to glassy lustre. The silica body is relatively pure and usually lacks any intercalations, such as fossils, intraclasts or limestone fragments. Three subtypes of the silica body can be distinguished: specimens with a uniform dark colour (usually in specimens without the nucleus; Fig. 3a); specimens with concentric alternate light-dark banding (usually in specimens with a nucleus; Fig. 3b); and specimens with thin and slightly banded silica mass around the large nucleus (Fig. 3c). The second type resembles the typical striped flint from the Holy Cross Mountains, but usually the banding is weaker, as individual bands

are fuzzy and thicker than in the Holy Cross Mountains specimens. Dark bands are usually thin (around 1 mm) and well separated from the light bands. The light bands are wider (2–7 mm), usually darker in the central part and progressively lighter distally. Right below the cortex there is usually a zone of silica body that is whitish and banded. In some specimens, the banding in this zone seems independent from a general concentric banding of the nodule, and repeats the shape of the external surface of the nodule.

In weathered specimens, the silica substance is covered with a dull and opaque, milky white or grey-white patina, sometimes with a pattern of grey or bluish spots and lines. Weathered cortex usually changes its colour towards yellowish white or orange, sometimes with dark brown spotting.

Three of the most common types of the Kraków-Częstochowa striped chert are depicted in Fig. 3, but intermediate forms occur as well. These three types may represent various horizons within the parent rock; however, access to exposures in situ is limited. In the type locality at the ski slope in Cisowa, all three types were found scattered together in the reworked soil and regolith.

In terms of knapping properties, the chert in question is a very good raw material. It seems to be a better knapping material than the striped flint from the Holy Cross Mountains. This is probably due to the less distinct banding and greater homogeneity. Knapped surfaces display a conchoidal fracture with poorly marked waves.

In transmitted light, the Kraków-Częstochowa striped chert gives a similar image to the Holy Cross Mountains striped flint. The siliceous matter is transparent and contains inclusions of scattered, fine, dark brown fibres, which locally reduce transparency and are responsible for the macroscopic light bands. In the stereoscopic observation, in water immersion, this chert shows features intermediate between the striped flint from Krzemionki Opatowskie and variety G of the Kraków-Częstochowa cherts from Pradła (for their characterization see Přichystal 2009). In most specimens, there are black acicular microfossils (see Krajcarz *et al.*, 2014), which are typical of the Holy Cross Mountains striped flint (Přichystal 2009), but they are less common. The amount of white "suspension" is also clearly lower. The Fe-oxide accumulations, typical of the G variety, are present, but they are almost always associated with microfossils, especially with silica spicules. Some specimens show greasy spots, typical of the G variety chert.

Similarities to both materials, namely the Holy Cross Mountains striped flint and the G variety of the Kraków-Częstochowa cherts, suggest that the Kraków-Częstochowa striped chert may represent a transitional form between these two varieties. If so, the Holy Cross Mountains striped flint occurring over 100 km to the north-east, and the G variety being found further to the north of the Ryczów Upland, may represent the extreme end-members within one widely extending stratum of chert.

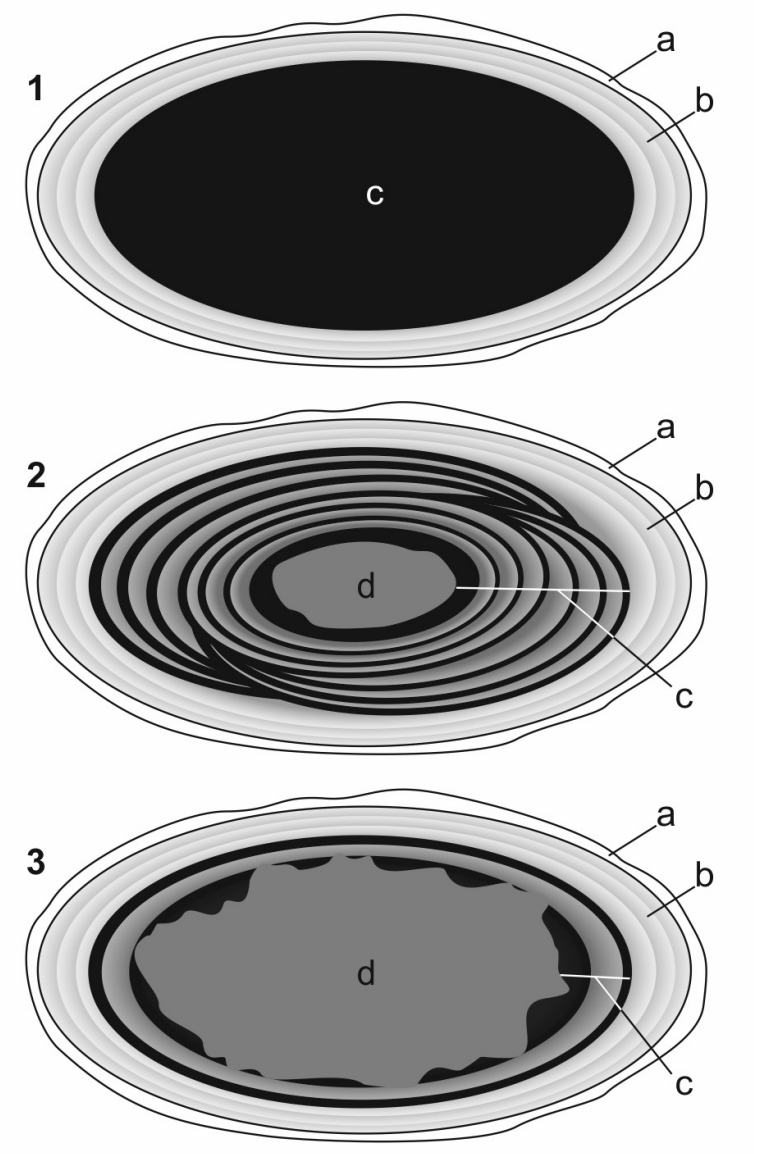

Fig. 3. Schematic internal structure of striped flint from Ryczów Upland (based on the collection from the ski slope in Cisowa): 1 – dark not-banded type; 2 – "typical" banded type with a nucleus; 3 – large nucleus type. Nodule components: a – cortex; b – sub-cortex smooth whitish silica band, usually internally banded; c – fine-crystalline smooth silica mass, dark or alternately dark-light banded; d – coarse-crystalline grey nucleus. Drawning: M. T. Krajcarz.

MATERIALS AND METHODS

Observations on the occurrence of the Kraków-Częstochowa striped chert within archaeological sites were collected in two ways:

1) Studies of lithic collections from known archaeological sites situated in the Ryczów Upland, stored in the Institute of Archaeology, Nicolaus Copernicus University in Toruń (Toruń, Poland) and the Archaeological and Ethnographic Museum in Łódź (Łódź, Poland).
2) Survey in the Ryczów Upland, in the vicinity of the outcrops.

The studied collections included the archaeological sites: Biśnik Cave; Jasna Strzegowska Cave; Shelter above the Zegar Cave; Jasna Smoleńska Cave; Perspektywiczna Cave; Shelter in Udórz II; Kleszczowa site without an assigned number; Poręba Dzierżna site 24; Deszczowa Cave; Krucza Skała Rockshelter; Kroczycka Cave; Cave IV in Birów Mt. and the Okiennik Wielki Cave. The survey was conducted during 2007–2022 and covered the area marked in Fig. 2.

Within lithic collections from the known archaeological sites and from the survey, we identified the raw material types, with a special focus on the striped flint. For an identification of raw materials, we used comparative collections of the Kraków-Częstochowa striped chert coming from the type locality at the ski slope in Cisowa. The comparative analysis included several basic criteria: the colour, lustre and transparency of the silica body; banding within the silica body; presence of intraclasts, fossils and other intercalations within the silica body; presence of inner nucleus (see Fig. 3); presence of whitish sub-cortex band (see Fig. 3); presence, smoothness, thickness and colour of cortex; separation of the cortex from the inner silica body and from the outer rock. In many cases, the identification was limited or even impossible, due to the varying preservation state of the artefacts, which included: fresh fractures (non-patinated), patinated (with different intensity of patina, from light grey until completely white), eolized, and discoloured, e.g., due to activity of water and soil.

Identified archaeological assemblages with the striped flint were studied in terms of their cultural and chronological affiliation as well as spatial distribution, which is expected to display the potential of the microregion in terms of its importance for ancient mineral procurement, processing and distribution.

STRIPED FLINT AT ARCHAEOLOGICAL SITES IN THE RYCZÓW UPLAND

It is noteworthy that the archaeological sites in the Ryczów Upland with striped flint artefacts are concentrated within no great distance from the recorded outcrops of the

Kraków-Częstochowa striped chert variety (Fig. 2). Amongst those sites there are a few distinctive locations, in the direct vicinity of flint outcrops that can be most likely identified as the extraction points, as well as caves and open sites with assemblages typical of both contemporary campsites and flint processing workshops (Sudoł-Procyk and Krajcarz 2021).

Until present in the south-eastern part of the Ryczów Upland, there have been recognised two zones that can be interpreted as flint acquisition points. One of them, well known thanks to the research currently being conducted there, is situated in the Udorka Valley (the region of Poręba Dzierżna village, Wolbrom commune, Lesser Poland Voivodeship), within the extent of the chocolate flint outcrops (Sudoł-Procyk and Krajcarz 2021; Sudoł-Procyk *et al.*, 2021a; 2021b). Another one, significant in respect of the presented topic, is located exactly in the region of occurrence of the striped flint outcrops, in the south-western part of the Barańskie Mountains, in the region of Cisowa and Kleszczowa villages, Pilica commune, Silesian voivodeship (Krajcarz *et al.*, 2014; Sudoł-Procyk and Krajcarz 2021). Here, LiDAR analysis has revealed several zones with a surface relief analogical to the chocolate flint mining fields confirmed by excavations. Although these zones have not yet been verified through excavations, there are certain premises which allow us to believe that these were the raw material acquisition points. First, the relief anomalies resemble pits analogical to e.g., chocolate flint mining pits from Udorka Valley (Sudoł-Procyk *et al.*, 2018). Here, the relief occurs in the closest surroundings of the striped flint outcrops. Secondly, most of striped flint nodules found nearby bear traces of testing and initial preparation (Fig. 4). Thirdly, the close proximity of flint exploitation points may also be indirectly suggested by a cluster of workshops concentrating along the edge of the plateau, directly above the Cisowa ski slope (Fig. 2).

This area must have been favourable in many aspects that were appreciated by prehistoric communities: proximity of the high-quality flint outcrops, a great observation point, and a well-situated communication hub, with gullies allowing easy routes up and down the slopes in many directions. Until now, direct evidence of exploitation consists of two pit-like features clearly visible in the artificial profile cutting through the lower portion of a slope, near the Cisowa ski slope management building (Fig. 5:1). This profile was recorded during one of the field surveys (in 2014), and was associated with construction work at the ski slope. Unfortunately, it is now inaccessible due to further construction works. The features were cut into the soil and limestone regolith and backfilled with limestone debris containing a large number of flint nodules (Fig. 5:2). Numerous flakes have been documented in their vicinity (Fig. 5:3). These features were probably the remains of exploitation pits.

Most of the excavated sites with numerous artefacts made of striped flint in the region are cave sites. Cultural levels recorded there confirmed that striped flint had been known from the Middle Palaeolithic until the Bronze Age. The oldest specimens made of this raw material come from the Biśnik Cave (Fig. 2) and occur within almost all of the Middle Palaeolithic cultural levels at this site (Krajcarz *et al.*, 2014; Sudoł-Procyk and Cyrek in press). The most representative, in terms of local utilisation of striped flint, are mainly younger, post-Vistulian cultural levels within layers 7–5, dated to OIS 4–3 (Early to Middle Plenivistulian). The flint materials found within these levels were characterised by concretions with test flakes, a high share of Levallois cores in various stages of exploitation, Levallois flake semi-products, and few tools, mostly sidescrapers (Fig. 6:1–3). Utilisation of local striped flint for production of blanks using the Levallois techniques confirms its excellent technical values, while the large amount of raw material at the site suggests undertaking of intentional provisioning episodes. The closest outcrops are within a distance of about 5 km from the cave. When compared with the older, significantly less numerous assemblages, the artefacts in question are covered with patina to much lesser extent, and many specimens are completely non-patinated. This may be explained by different lithological contexts: the older levels were deposited within loamy sediments with limestone clasts, while the younger were deposited in sands (Cyrek *et al.*, 2014; Krajcarz *et al.*, 2014).

Utilisation of local striped flint in the Middle Palaeolithic is also evident for the oldest Middle Palaeolithic cultural horizon in the Jasna Strzegowska Cave (Sudoł-Procyk and Cyrek in press), situated within a distance of *c*. 5 km from the Biśnik Cave (Fig. 2). There the striped flint is represented by a bifacial knife made on a Levallois flake (Fig. 6:4).

A few artefacts made of striped flint are also known from another Middle Palaeolithic site in the Ryczów Upland, the Okiennik Wielki Cave (Sudoł-Procyk and Cyrek in press), situated within a distance of c. 20 km to the north of the known striped flint outcrops. Amongst the tools found at this site especially noteworthy are bifaces and one circular sidescraper (*groshak*; Fig. 6:5–6).

Another trace of utilisation of this raw material in the Late Palaeolithic is represented by a few flint artefacts coming from the Perspektywiczna Cave (Fig. 2) in the Udorka Valley (Krajcarz *et al.*, 2014). Partly cortical blanks and flake semi-products discovered there are covered with an intense white patina and constitute a supplementary component of a larger assemblage dominated by another local raw material, namely chocolate flint (Krajcarz *et al.*, 2014; Sudoł-Procyk 2020). A significant analogue, in terms of raw materials used, is another, more numerous assemblage from an open-air site in Kleszczowa (Fig. 2), associated with the Magdalenian (Krajcarz *et al.*, 2014; Sudoł-Procyk 2020). The assemblage encountered at this site included

Fig. 4. Examples of nodules of striped flint with primary working: 1 – Cisowa (No. 7 in Fig. 2); 2 – Kleszczowa (No. 13 in Fig. 2); 3 – Kleszczowa (No. 17 in Fig. 2). Photo: W. Ochotny.

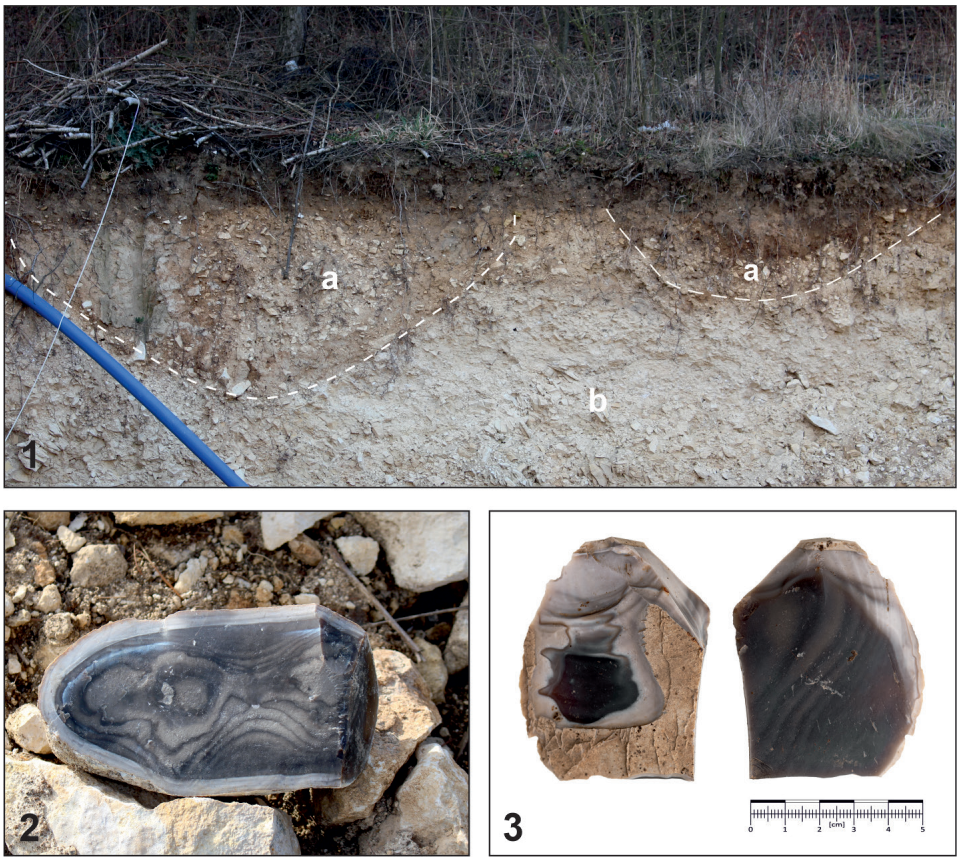

Fig. 5. Feature dug into weathered clay with concretions of the raw material. Key:
1 – the outline of the features; 2 – concretion of striped flint derived from weathered clay;
3 – flake. Photo: M. Sudoł-Procyk.

several dozen cores for blades, blades and tools, mainly endscrapers, made of striped flint (Fig. 7:1–6).

Striped flint is common at younger sites dated to the Neolithic and the Early Bronze Age. Sites from these periods are associated with production of dihedral and tetrahedral flint axes, and were recorded mostly in the region of the Wodąca Valley (Fig. 2), namely in the Biśnik Cave (Cyrek 2002), the Shelter above the Zegar Cave (Krajcarz *et al.*, 2012c), the Jasna Smoleńska and Jasna Strzegowska Caves (Stefaniak *et al.*, 2009), as well as in the surroundings of Strzegowa village (Pelisiak 2006). Flint

assemblages coming from these sites are characterised by a very similar state of preservation, like the materials collected from the surface around the striped flint outcrops in Cisowa and Kleszczowa villages, which has an intense, light grey or white patina (Krajcarz *et al.*, 2014). A great number of artefacts evidence an intentional acquisition of striped flints on a large scale, which were then brought to the region of the Wodąca Valley, and their intense utilisation at the turn of the Neolithic and the Bronze Age.

Interesting results were delivered by a preliminary field survey carried out in the south-eastern region of the Ryczów Upland. Although the investigations are still in progress and some parts of the research area have not been verified yet, there is a clear concentration of sites around the striped flint outcrops near Cisowa village (Fig. 2). The concentration of sites along the slope is the result of mechanical levelling associated with the current utilisation of this area as a ski slope, but also agriculture and road maintenance. It is very likely that the artefacts found along the slope were artificially relocated, and their primary deposition spots should be sought somewhere on the slope, most likely on its higher parts. All sites in this zone are workshops, with a significant number of cores for blades (Fig. 8:2–5), mostly in their initial stage of exploitation. Amongst the tools the most distinctive are burins, sidescrapers and retouched blades (Fig. 9:1–4). Flakes represent all stages of core processing (Fig. 9:5–8, 10:1–6). We must consider the fact that the assemblages found in this zone are of various chronology, most likely starting from the Mesolithic until the Bronze Age. The earlier epoch may be evidenced, among other things, by the presence of a splintered piece (core; Fig. 8:1).

Scarce finds made of striped flint, gathered from the area located to the south of the outcrops, near Kąpiele Wielkie and Łobzów villages (Fig. 2), in general are not characteristic (Fig. 11:1–2). Attempts to more accurately determine their cultural and chronological affiliation will be the subject of further studies. Some of these artefacts were small single-platform cores for blades, usually with changed orientation, which certainly can be linked with the Mesolithic (Fig. 11:3–4).

CONCLUSIONS

Systematic studies of siliceous raw materials in the central part of the Kraków-Częstochowa Upland have revealed the presence of many variants of flints in this region. Among them, apart from chocolate flint (Sudoł-Procyk *et al.*, 2021a; 2021b), a local variety of the striped flint was identified. The micro- and macroscopic features of this chert resemble the classic striped flint from the Holy Cross Mountains.

Fig. 6. Examples of Middle Palaeolithic artefacts made of striped flint. 1–3 – Biśnik Cave (No. 1 in Fig. 2), 4 – Jasna Strzegowska Cave (No. 4 in Fig. 2), 5–6 – Okiennik Wielki Cave. Photo: M. Sudoł-Procyk.

Fig. 7. Examples of Final Palaeolithic artifacts made of striped flint from the Kleszczowa open-air site (No. 6 in Fig. 2). Key: 1–3, 5 – blades; 4 – endscraper, 6 – core. Photo by W. Ochotny.

Fig. 8. Selection of cores made of striped flint. 1 – Kleszczowa (No. 12 in Fig. 2); 2 – Kleszczowa (No. 15 in Fig. 2); 3 – Kleszczowa (No. 19 in Fig. 2); 4 – Kleszczowa (No. 18 in Fig. 2); 5 – Kleszczowa (No. 20 in Fig. 2). Photo: W. Ochotny.

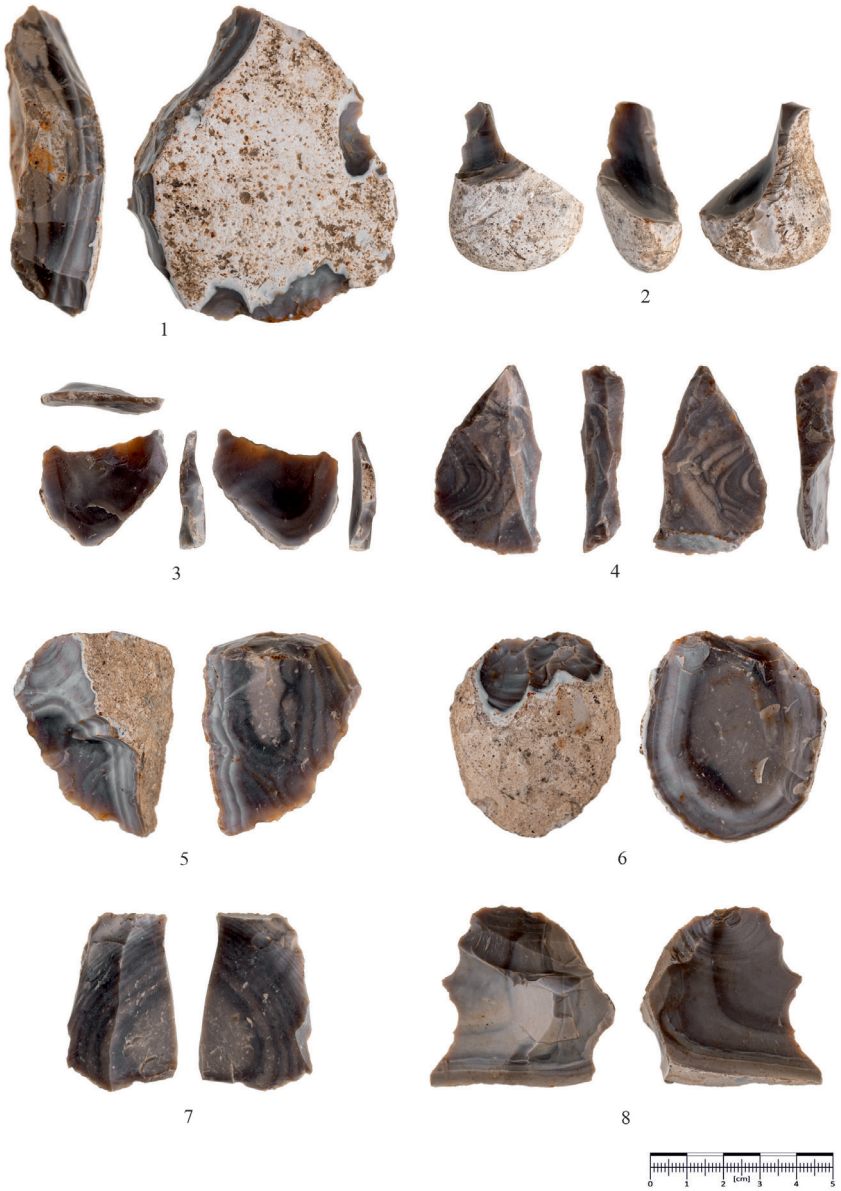

Fig. 9. Striped flint tools and flakes: 1 – sidescraper from Kleszczowa (No. 15 in Fig. 2); 3 – double perforator on rejuvenation flake from Kleszczowa (No. 18 in Fig. 2); 4 – dihedral burin from Kleszczowa (No. 16 in Fig. 2); flakes: 2, 7 – Kleszczowa (No. 16 in Fig. 2); 5, 6, 8 – Kleszczowa (No. 17 in Fig. 2). Photo: W. Ochotny.

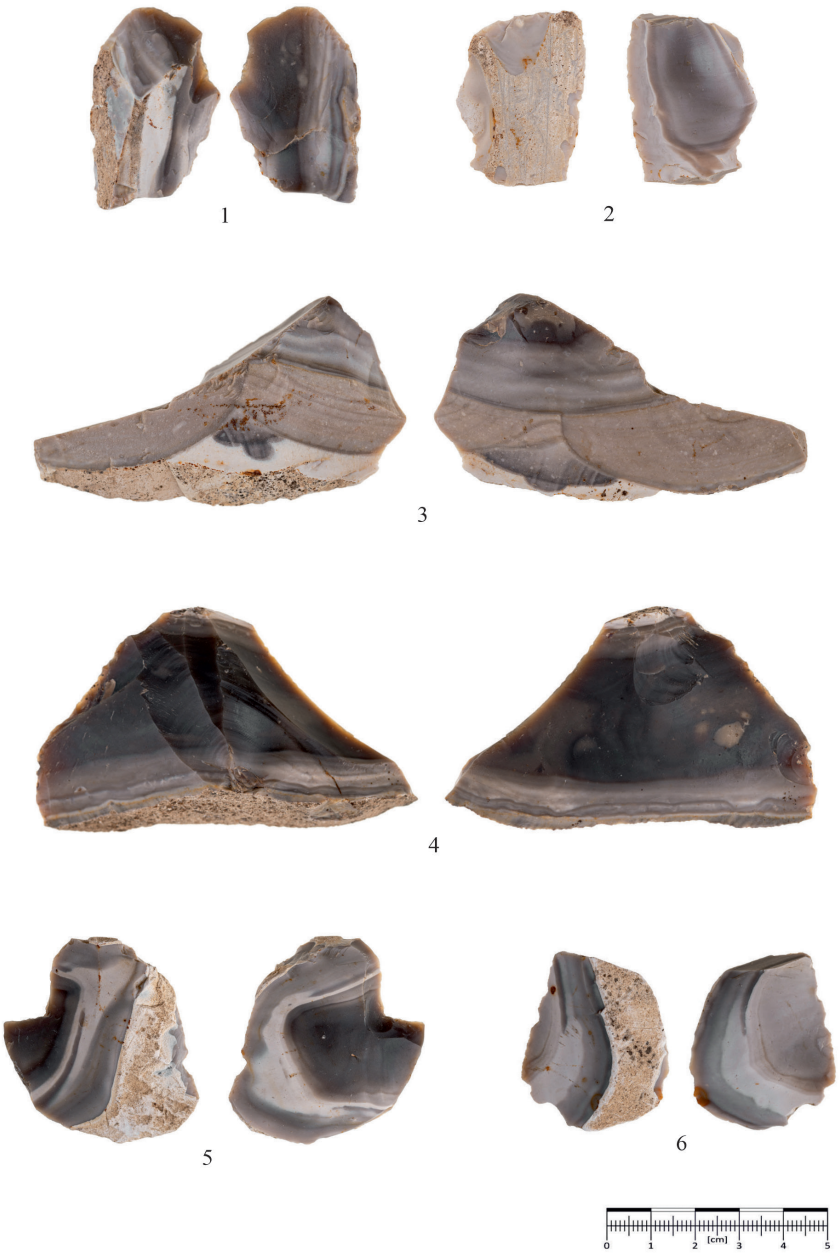

Fig. 10. Examples of striped flint flakes: 1–4 – Kleszczowa (No. 18 in Fig. 2); 5–6 – Kleszczowa (No. 13 in Fig. 2). Photo: W. Ochotny.

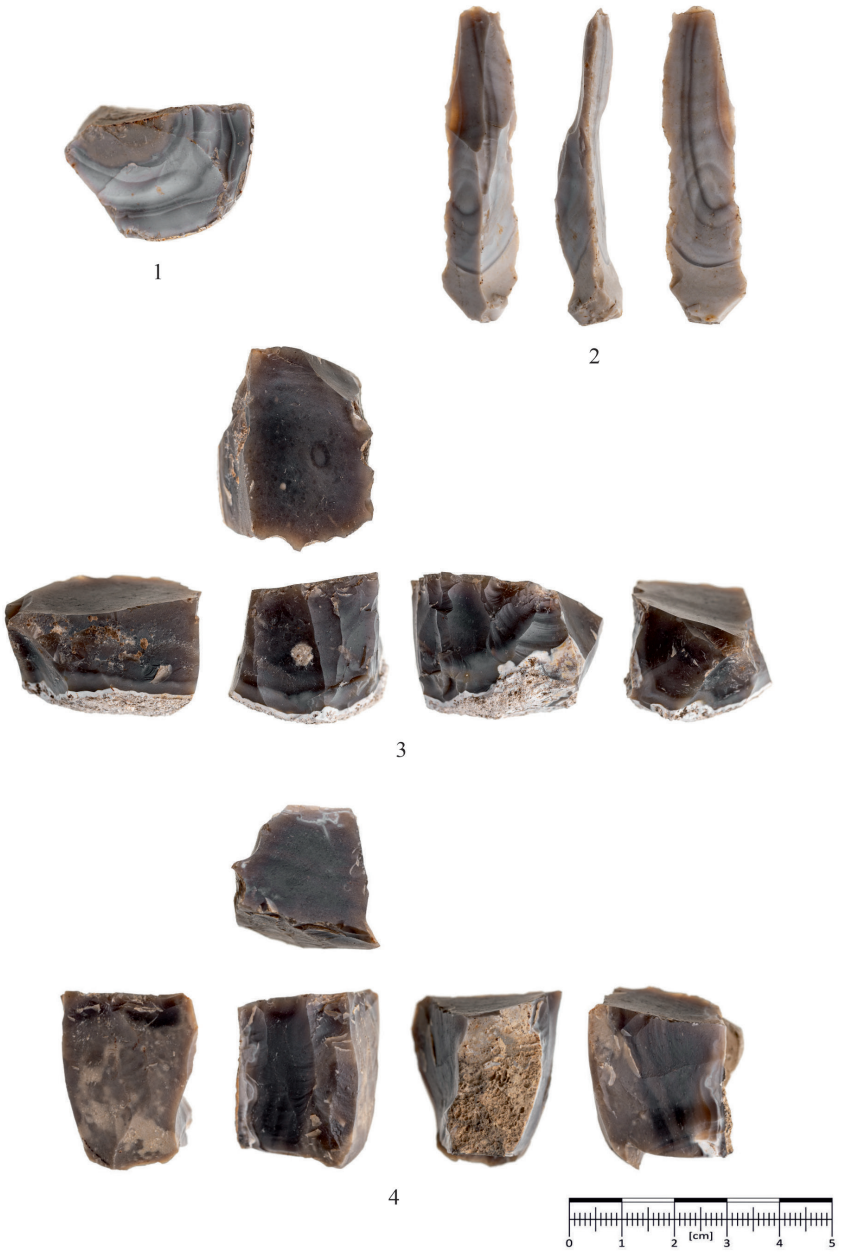

Fig. 11. Selection of striped flint artifacts: 1, 4 – Kąpiele Wielkie (No. 22 in Fig. 2); 2–3 – Kąpiele Wielkie (No. 21 in Fig. 2). Photo: W. Ochotny.

The material from the outcrops of striped flint in the central part of the Kraków-Częstochowa Upland discussed in this paper was undoubtedly of great economic significance in prehistoric times. Taking all the mentioned sites into consideration, we can see the broad picture of the local striped flint being a constant component of the assemblages in the microregion dated to various periods of the Stone Age. Exploitation of outcrops of this raw material is evidenced by numerous archaeological sites of workshop type, situated near these outcrops. Flint artefacts collected during excavations and those coming from field surveys, confirm that this raw material was used constantly, starting from the Middle Palaeolithic until the Early Bronze Age (Krajcarz *et al.*, 2014). Lithic artefacts made of local striped flint prove that even the Neanderthals appreciated its excellent utilitarian valour, although other raw materials were equally accessible (Krajcarz *et al.*, 2012b).

In the successive periods, particularly in the Late Palaeolithic and Mesolithic, the use of an increasing amount of the striped flint among the raw materials is clearly legible. At the Magdalenian site in Kleszczowa, the raw material analysis revealed that the contribution of striped flint reaches nearly 25% of the entire assemblage (Sudoł-Procyk 2020). We cannot also exclude that among the numerous initial cores for blades coming from workshops in the Barańskie Hills, there are specimens of the Late Palaeolithic and Neolithic periods. It is highly probable that this raw material had been known and utilised in the Mesolithic as well. Small single-platform cores for blades, mostly conical in shape, coming mainly from field surveys, were present over nearly the entire region under study. Although only some of them were made of striped flint, they were usually accompanied, in the very same stratigraphic context, by flakes, blades and pieces with test flaking made of striped flint.

Until the present, it has been impossible to determine univocally whether the materials made of striped flint found during field surveys contain forms classified as dating to the Neolithic. Nevertheless, it seems significant that the finds of flints of this material were lacking Neolithic pottery in their direct contexts. On the other hand, it is noteworthy that striped flint was the major raw material for production of Neolithic-Bronze Age axes. In the area of Udorka Valley a few workshops dated to the Early Bronze Age are known with numerous semi-products, mostly flakes, being waste from axe production (Krajcarz *et al.*, 2012b; 2014). Such mass production required high-quality raw material and must have engaged advanced methods of exploitation. The answer to the question whether the raw material used by the Early Bronze Age communities was extracted in the region of the Barańskie Hills remains open, and must be verified in the course of further studies.

New findings in this respect are extremely important from the viewpoint of the acquisition and distribution of siliceous materials, with regard to the Middle and

Upper Pleistocene, as well as the Holocene, since not only do they complement the current state of knowledge, but they also significantly change it. The discovery of an additional region, apart from the Holy Cross Mountains, where striped flint was acquired and processed, sheds a new light on the issue of importation and distribution of this raw material in the Stone Age. It was undoubtedly used on the scale of the microregion, but its inter-regional importance cannot be excluded and needs further studies.

ACKNOWLEDGMENTS

The field studies were partially financed by the National Science Centre of Poland under grant No. 2014/15/D/HS3/01302, and are being continued under grant No. 2018/30/E/HS3/00567.

REFERENCES

Budziszewski, J. and Michniak, R. 1984. Z badań nad występowaniem, petrograficzną naturą oraz prahistoryczną eksploatacją krzemieni pasiastych w południowym skrzydle Niecki Magoń-Folwarczysko. *Wiadomości Archeologiczne* 49(2): 151–187.

Cyrek, K. 2002. Rekonstrukcja zasiedlenia Jaskini Biśnik. In K. Cyrek (ed.), *Jaskinia Biśnik. Rekonstrukcja zasiedlenia jaskini na tle zmian środowiska przyrodniczego*, 9–132. Toruń. Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika.

Cyrek, K., Sudoł, M., Czyżewski, Ł., Osipowicz, G. and Grelowska, M. 2014. Middle Palaeolithic cultural levels from Middle and Late Pleistocene sediments of Biśnik Cave, Poland. *Quaternary International* 326–327: 20–63.

Kochman, A., Matyszkiewicz, J. and Wasilewski, M. 2020. Siliceous rocks from the southern part of the Kraków-Częstochowa Upland (Southern Poland) as potential raw materials in the manufacture of stone tools – A characterization and possibilities of identification. *Journal of Archaeological Science: Reports* 30(102195).

Kopacz, J. and Pelisiak, A. 1992. Z badań nad wykorzystaniem krzemienia jurajskiego odmiany G w neolicie. *Sprawozdania Archeologiczne* 44: 109–116.

Krajcarz, M. T. and Krajcarz, M. 2009. The outcrops of Jurassic flint raw materials from south-western margin of the Holy Cross Mountains. *Acta Archaeologica Carpathica* 44: 183–195.

Krajcarz, M. T., Krajcarz, M., Sudoł, M. and Cyrek, K. 2012a. From far or from near? Map of silicate raw material outcrops around the Biśnik Cave. In P. Neruda and Z. Nerudová (eds), *Abstract Book and excursion guide. 9th SKAM Workshop Moravian Museum, Brno, Czech Republic, October 8–11. 2012 Lithic Raw Materials – Phenomena of the Stone Age*, 15–16. Brno. Moravské Zemské Muzeum.

Krajcarz, M. T., Sudoł, M., Krajcarz, M. and Cyrek, K. 2012b. From far or from near? Sources of Kraków-Częstochowa banded and chocolate silicite raw material used during the Stone Age in Biśnik Cave (southern Poland). *Anthropologie. International Journal of the Science of Man* 50(4): 411–425.

Krajcarz, M. T., Sudoł, M., Krajcarz, M. and Cyrek, K. 2012c. Stanowisko późnoczwartorzędowych osadów jaskiniowych – Schronisko nad Jaskinią Zegar w Skałach Zegarowych (Wyżyna Częstochowska) [The site of Late Quaternary cave sediments – the Shelter above the Zegar Cave in Zegarowe Rocks (Częstochowa Upland)]. *Przegląd Geologiczny*: 60(10): 546–553.

Krajcarz, M. T., Sudoł, M., Krajcarz, M. and Cyrek, K. 2014. Wychodnie krzemienia pasiastego na Wyżynie Ryczowskiej (Wyżyna Krakowsko-Częstochowska) [Sum.: Outcrops of striped flint on the Ryczów Upland (Kraków–Częstochowa Upland)]. In D. Piotrowska, W. Piotrowski, K. Kaptur and A. Jedynak (eds), *Górnictwo z epoki kamienia: Krzemionki – Polska – Europa. W 90. rocznicę odkrycia kopalni w Krzemionkach* (Stone Age mining: Krzemionki – Poland – Europe. On the ninetieth anniversary of the discovery of the Krzemionki mine), 319–338. Ostrowiec Świętokrzyski: Muzeum Historyczno-Archeologiczne w Ostrowcu Świętokrzyskim.

Krukowski, S. 1923. Sprawozdanie z działalności państwowego konserwatora zabytków przedhistorycznych na okręg kielecki w r. 1922. *Wiadomości Archeologiczne* 8: 64–84.

Matyszkiewicz, J. and Kochman, A. 2020. The provenance of siliceous rocks from the Kraków--Częstochowa Upland (Poland) used as raw-materials in the manufacture of siliceous artefacts from Central-Eastern Europe; An old problem in new light. *Journal of Archaeological Science: Reports* 34(102600).

Pelisiak, A. 2003. Ze studiów nad wykorzystywaniem surowców krzemiennych ze środkowej części Wyżyny Krakowsko-Częstochowskiej w późnym neolicie w strefie karpackiej. Neolityczne pracownie w Strzegowej (Strzegowa, stan. 42). *Acta Archaeologica Carpathica* 38: 27–69.

Pelisiak, A. 2006. The Exploitation and Distribution of Flints from the Central Part of Polish Jura in the Late Neolithic Times. *Analecta Archaeologica Ressoviensia* 1: 73–86.

Přichystal, A. 2009. *Kamenne suroviny v pravěku. Vychodni časti středni Evropy*. Brno. Masarykova univerzita.

Samsonowicz, J. 1923. O złożach krzemieni w utworach jurajskich północnowschodniego zbocza Gór Świętokrzyskich. *Wiadomości Archeologiczne* 8: 17–24.

Samsonowicz, J. 1934. *Objaśnienia arkusza Opatów ogólnej mapy geologicznej Polski w skali 1 : 100 000*. Warszawa.

Stefaniak, K., Muzolf, B., Mirosław-Grabowska, J. and Socha, P. 2009. Studies in the caves of the Zegarowe Rocks. In K. Stefaniak, A. Tyc and P. Socha (eds), *Karst of the Częstochowa Upland and of the Eastern Sudetes*, 255–271. Sosnowiec–Wrocław. Faculty of Earth Sciences University of Silesia, Zoological Institute University of Wrocław.

Sudoł-Procyk, M. 2020. Magdalenian settlement in the south-estern part of the Ryczów Upland (Polish Jura). New data and the importance of the region. *Anthropologie. International Journal of Human Diversity and Evolution* 58(2–3): 285–302.

Sudoł-Procyk, M., Budziszewski, J., Krajcarz, M. T., Jakubczak, M. and Szubski, M. 2018. The chocolate flint mines in the Udorka Valley (Częstochowa Upland) – a preliminary report on the field and lidar surveys. In D. H. Werra and M. Woźny (eds), *Between History and Archaeology. Papers in honour of Jacek Lech*, 89–102. Oxford. Archaeopress Archaeology.

Sudoł-Procyk, M., Brandl, M., Krajcarz, M. T., Malak, M., Skrzatek, M., Stefański, D., Trela-Kieferling, E. and Werra, D. H. 2021a. Chocolate Flint: new perspectives on its deposits, mining, use and distribution by prehistoric communities in Central Europe. *Antiquity. Project Gallery* 95(383): 1–7. https://doi.org/10.15184/aqy.2021.48

Sudoł-Procyk, M. and Krajcarz, M. T. 2021. The use of landscape and georesources at microregional scale during the younger part of the Late Glacial in the southeastern part of Ryczów Upland (Polish Jura). In F. Bostyn, F. Giligny and P. Topping (eds), *From Mines to Users: Production and*

Procurement Systems of Siliceous Rocks in the European Neolithic and Bronze Age, 16–30. Oxford. Archaeopress Archaeology.

Sudoł-Procyk, M., Krajcarz, M. T., Malak, M. and Werra, D. H. 2021b. Preliminary characterization of the prehistoric mine of chocolate flint in Poręba Dzierżna, site 24 (Wolbrom commune, małopolskie voivodeship). *Sprawozdania Archeologiczne* 73(2): 109–135.

Sudoł-Procyk, M. and Cyrek, K. in press. Krzemienie jurajskie w paleolicie środkowej części Jury Polskiej [Jurassic flints in the Palaeolithic Age in the central part of the Polish Jura]. In W. Borkowski, B. Sałacińska and S. Sałaciński (eds), *Studia nad gospodarką surowcami krzemiennymi w pradziejach. Krzemień jurajski w pradziejach. Materiały z konferencji w Krakowie, 28–30 września 2017 r*. Warszawa-Kraków. Państwowe Muzeum Archeologiczne w Warszawie.