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ARTICLES

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FLINTS OF THE CHEŁM HILLS (REJOWIEC FLINTS) – ORIGIN, SEDIMENTATION ENVIRONMENT AND EXPLOITATION IN PREHISTORY – A CASE STUDY FROM THE LECHÓWKA SITE

ABSTRACT

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Rejowiec flint from the Chełm Hills occur among glacigenic sediments of the Odranian glaciation and is referred to as erratic flints. The authors, based on the analysis of the sedimentary succession of a kame in Lechówka – within the boundaries of the largest outcrop, in so-called 'Region I' (Rejowiec region) – indicate that: (1) the probable source of the flints were older series of glacigenic sediments – from before the Odranian glaciation, (2) their great accumulation directly under the surface and – as a result – their considerable accessibility for exploitation in prehistory were caused by the 'upfreezing of stones' in the conditions of a periglacial environment during successive glacial periods (Odranian, Wartanian and Vistulian glaciations). The analysis of archaeological data confirmed the use of the local flints as early as in the Middle Palaeolithic and their most intense exploitation during two main periods – the final stage of the Palaeolithic and a period from the Late Neolithic to the Early Iron Age.

Keywords: erratic flints, Rejowiec flint, glacigenic deposits, Chełm Hills, prehistoric use
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INTRODUCTION

The presence of flints accompanying glacigenic sediments within the range of the Chełm Hills has been known in the archaeological literature for nearly one hundred years (Krukowski 1939-1948), although the beginning of the considerable interest in this topic goes back to as late as the 1980s (*cf.* Libera *et al.* 2014, earlier literature there). This was the first time when, based on flint samples collected in the vicinities of Rejowiec, the local raw material was referred to as Rejowiec flint, and its macroscopic diversity became the base for the first classification (Rejniewicz 1985, 13). Somewhat later, the term Rejowiec-Sobibór flint was coined. This term conveys the much greater extent of the surface distribution of the raw material across the Chełm Hills, not limited to the vicinities of Rejowiec (Kozłowski 1989, 31). In the 1980s and 1990s, there was a dramatic increase in archaeological finds, especially flint artefacts, as a result of conducting intense surface survey within the framework of the Polish Archaeological Record (Polish: AZP). This had a considerable influence on gradually improving our knowledge of the range and character of processing local flints and the scale of using them in prehistory, which was later reflected by papers discussing archaeological materials, microregional studies (*e.g.*, Bargieł and Libera 1989; Bronicki 1990; 1993; Gołub 1990) and synthetic publications (*cf.* Kozłowski 1989; Libera 1995; 1998; 2001; Taras 1995; Zakościelna 1996).

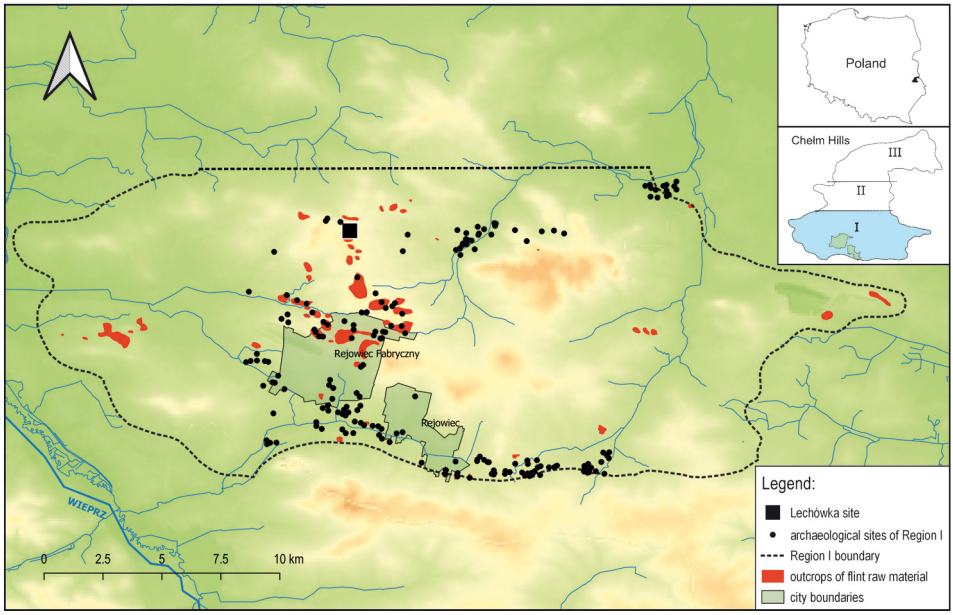

Fig. 1. Location of the analysed area and Lechówka site, as well as known archaeological sites (according to Libera and Szeliga 2006; Libera *et al.* 2014; 2016, modified by T. Wiśniewski)

The essential field and desk research of flints from the Chełm Hills – under the supervision of J. Libera – was initiated within the framework of a project entitled "Studies in the Occurrence of Flint Rock and its Mining, Processing and Distribution in the Territory of the Lublin Region" in 2002. The research – conducted at intervals until 2014 – mainly focused on determining the distribution ranges of local raw materials, cataloguing and presenting the chronological-cultural classification of archaeological sites associated with the exploitation and processing of such materials as well as on determining the provenance of the flints and attempting to classify them (Rejniewicz 1985; Libera and Szeliga 2006). The latter question recently became the subject of interdisciplinary research, where the main interest shifted to sedimentology and geomorphology (Libera *et al.* 2014; 2016). In the present article – which is a continuation of this approach – we are attempting to answer the following, still relevant, questions based on a detailed sedimentological analysis of glacigenic sediments from the site of Lechówka in the Chełm Hills. The first concerns the original source of the flints, which currently occur directly below the topographic surface, in the glacigenic sediments, the second issue is the mechanism of the deposition of the flint material. The third concerns what factors might have caused its widespread accessibility, and a fourth issue concerns the scale and degree of using the local flints in prehistory in the light of the present state of archaeological knowledge.

ARCHAEOLOGICAL BACKGROUND

The surface survey conducted within the limits of the Chełm Hills was carried out in the years 2002-2014, and resulted in documenting over 120 zones of flint surface occurrences – having the areas from several to several dozen hectares – as well as in discovering and verifying the total number of over 2800 archaeological sites representing various periods (from the Palaeolithic to the Middle Ages) and cultural attribution (Libera *et al.* 2014; 2016). Observations of the outcrops made it possible to classify flint concretions deposited within their ranges into two essential types having distinct shapes, sizes and being of different preservation states (*e.g.*, presence or absence of cortex), macroscopic features, and – which is especially important – their technological qualities (Libera and Szeliga 2006, 162, 163; Libera *et al.* 2014, 61). The great majority of the discovered artefacts were products made of the local flints, which indicated the intense and diverse character of activities performed by prehistoric communities within the limits of the outcrops and in their nearest vicinities. The presence of diagnostic artefacts made it possible to distinguish two essential phases of the exploitation of Rejowiec flint, which generally correspond to the Late Palaeolithic and a period from the Late Neolithic to the Early Iron Age (Libera and Szeliga 2006; Libera *et al.* 2014, 65-67). Certain discovered artefacts also attest to the presence of human groups as early as in the Middle and Upper Palaeolithic as well as in the Mesolithic, Early and Middle Neolithic and in the Iron Age (Libera 2006a; 2006b; Libera

and Szeliga 2006; Libera *et al.* 2014, 62; 2016, 159-165). Based on the layouts of the discovered sites, three main concentration zones were distinguished. They overlapped with the areas of intense surface occurrences of flints (Libera and Szeliga 2006, fig. 1). Especially numerous sites were recorded in areas included in so-called 'Region I' (Libera *et al.* 2014, fig. 3) located within the south-western part of the Chełm Hills, surrounding Rejowiec and Rejowiec Fabryczny (Fig. 1). This territory – where the largest, best preserved concretions of the best quality occurred – is the main focus of this paper. It appears to have a vital importance for understanding the process and conditions of the sedimentation of the local flint deposits, as well as for answering all questions concerning their exploitation and processing in prehistory.

AREA OF THE STUDY – GEOLOGICAL AND GEOMORPHOLOGICAL BACKGROUND

The Chełm Hills are a unique physical-geographical mesoregion in comparison with other territories of the European Plain (Fig. 1), characterised by the prominent transitory character of its landform. Elements typical of Polesie (vast basins with peat in their floors) co-occur with upland landforms – isolated remnant hills of variable heights (elevated from 10 to 80 m above the floor) and geological structure (Upper Cretaceous opokas often covered with sediments from the Neogene and/or glacial Pleistocene). Due to the fact that this is a territory where morphological features typical of the Polish Uplands co-occur with those of the Eastern Baltic-Belarusian Lowland, the discussed region is attributed either to the Lublin Upland or to Polesie (Chałubińska and Wilgat 1954, 11, 12; Kondracki 2002, 293, 294; Solon *et al.* 2018, 170; Dobrowolski and Chabudziński 2021, 585-590).

The present relief is the result of complex morphogenetic processes that shaped this territory from the Paleogene to the Holocene (Harasimiuk 1975). Still, the main morphological elements clearly refer to the lithology and structure of the bedrock. This relief determined the character of successive ice-sheet advances – including the last of them occurring in this territory and linked with the Odranian glaciation – and the areal character of its deglaciation (Jahn 1956, 315-321; Maruszczak 1972). It was the Odranian glaciation (the maximum stage of the Mid-Polish/Saalian glaciation according to traditional nomenclature) that notably influenced the morphogenesis of the discussed area. Its maximum stage and retreat stages – indicated by the occurrence of marginal accumulation forms – overlap with the main elements of pre-Pleistocene landforms (fossil Cretaceous hills and ridges) and are *de facto* the morphological boundaries of the Chełm Hills.

The predominant role in the geological composition of the Chełm Hills is played by the complex of carbonate rocks from the Mesozoic (mainly Cretaceous) and Cenozoic (especially glacial Pleistocene). The thickness of the Upper Cretaceous formations – making the main component of the Mesozoic complex – changes from *ca* 450 m in the north-eastern

part of the discussed region to c. 600 m in its south-western region (Krassowska and Niemczycka 1984, 45-52; Buraczyński and Wojtanowicz 1988, 31). As to the lithology, the Upper Cretaceous series is mainly composed of carbonate (limestones, chalk), marly (marl) and carbonate-siliceous (opokas) facies that represent all of its stratigraphic units. The top part, having the greatest thickness (*ca* 160 m) and the most diverse lithology, is composed of Maastrichtian rocks. They are commonly exposed in the most elevated parts of the terrain. Only in certain places are they covered with Cenozoic sediments – mainly Pleistocene glacigenic formations formed during the maximum extent of the Odranian glaciation (also during the retreat stages): tills of terminal moraines, sands and muds of crevasse fillings, as well as the sands and gravels of kames. In less elevated areas, the compact and thicker series of glacigenic sediments constitute the filling of fossil deep basins and valleys, including the valley of the Wieprz River.

REJOWIEC FLINT – ORIGIN AND DISTRIBUTION

Rejowiec flint is a cryptocrystalline sedimentary rock mainly composed of silica, with accessory calcite and clay minerals. It is genetically linked with the Upper Cretaceous carbonate rocks; it is mainly present *in situ* in the lower lithostratigraphic units of this complex. Its presence has been commonly attested in drill cores, especially in limestones and chalks from the Turonian, Coniacian, Santonian and – to a lesser degree – Campanian phases. At the same time, it is virtually absent in the Maastrichtian sediments (Krassowska and Niemczycka 1984, 46). On the surface, Rejowiec flint is redeposited and occur in relatively large accumulations within genetically diverse glacigenic forms from the Odranian glaciation (Libera *et al.* 2016, 149-155). This is why it is unanimously referred to as erratic flints (Krukowski 1920). The colours of Rejowiec flint are diverse, from white, grey, light brown-grey, to yellow, dark brown or black. It occurs in two main forms: a) rounded, flattened nodules with thin cortex, both regular, close to lenticular or and irregular, branched or even "knotty" with numerous notches (Fig. 2: A-C), and b) small and very small sharp-edged clasts without cortex and often having aeolised surfaces (Fig. 2: D).

Erratic flints are widespread across Poland. Their occurrences correspond to the zones of maximum advances and retreat stages of ice sheets during successive glaciations (*e.g.,* Sobkowiak-Tabaka *et al.* 2016). The sources of flint materials in the environment of glacimarginal zones were: (1) glacial megablocks, rafts, or floes, various intrusions and diapirs – effect of glacitectonic disturbances that engaged the structures of the Cretaceous bedrock in the deformation process (Wyrwicka and Wyrwicki 1986; Dobrowolski and Terpiłowski 2006, 214-215; Aber and Ber 2007; Libera *et al.* 2016, 82) and/or (2) sediments carried from the ice bed (often accumulated during earlier glacial cycles) and next redeposited from the surface of the ice sheet (during the last glacial cycle occurring in

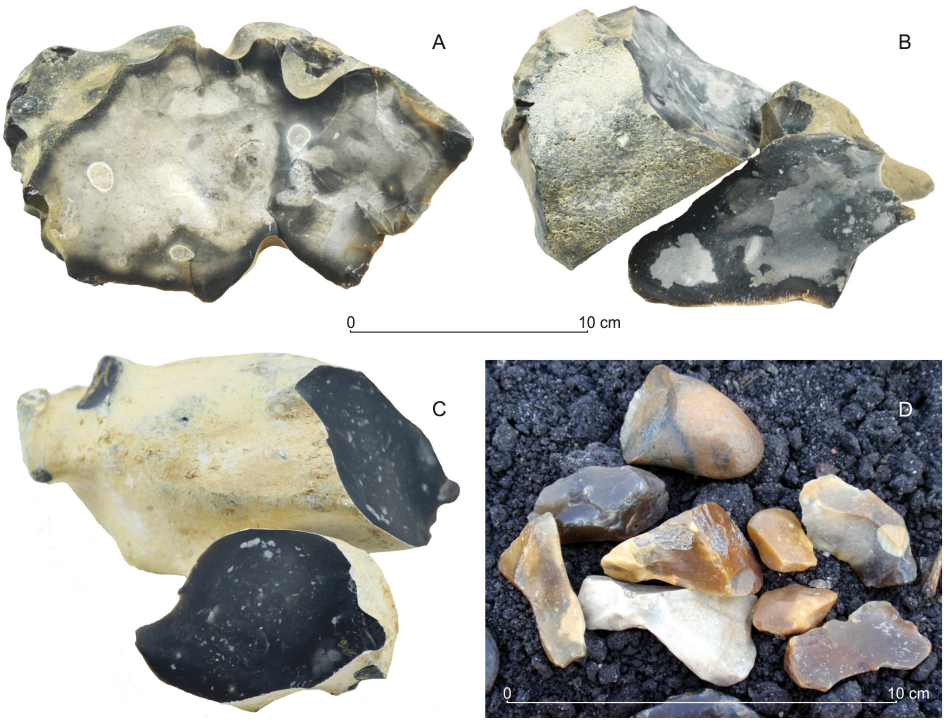

Fig. 2. Rejowiec flint nodules – examples from Lechówka (A-D), Chełm County (photo by T. Wiśniewski)

a particular area); they build glacimarginal forms – terminal moraines, dead-ice moraines or kames (Zieliński 1992; Terpiłowski 2008).

Although the sources of Scandinavian erratics deposited by ice sheets across the Polish territories are well documented (Górska-Zabielska 2008; Czubla 2015), the exact localisations of the original sources of erratic flints remain not fully known. The same applies to the occurrence of Rejowiec flint.

SEDIMENTARY AND POSTSEDIMENTARY ENVIRONMENT OF KAME DEPOSITS IN LECHÓWKA

Considering the above-mentioned key features characterising the geological structure and relief of the Chełm Hills, the site in Lechówka encompasses one of the most extensive flint deposits in so-called 'Region I' (Rejowiec region; Libera *et al.* 2016, 162, 170-171; Figs. 4-5). The extent of this deposit corresponds to a morphologically distinguished kame, which is a glacimarginal form from the Odranian glaciation (Harasimiuk *et al.* 2016). It is

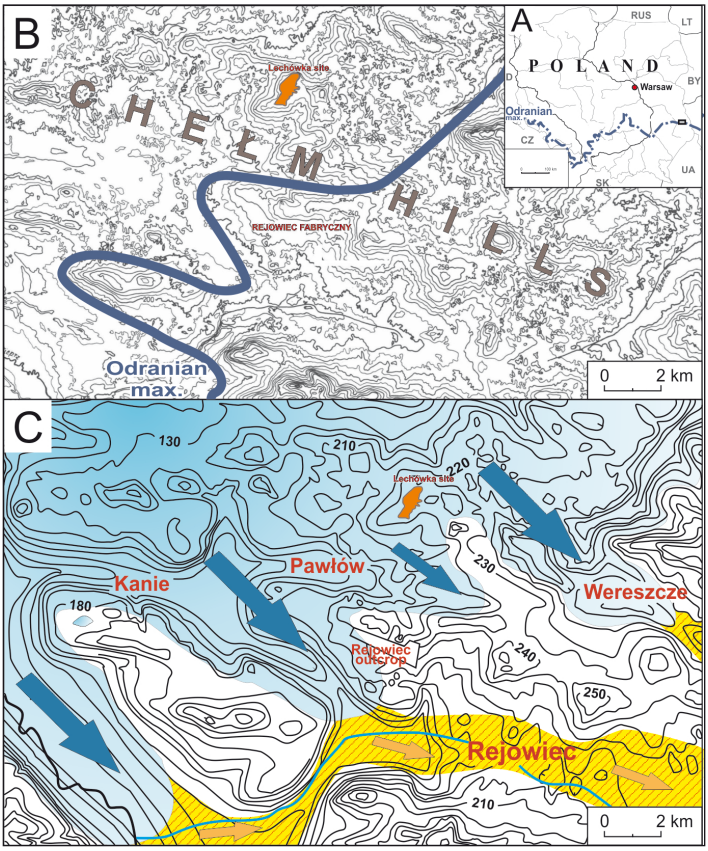

Fig. 3. Lechówka site against the background of the maximum extent of the Odranian ice sheet in Poland (A), the morphology of the western part of the Chełm Hills (B) and the reconstructed palaeomorphological situation of the western part of the Chełm Hills during the maximum advance of the Odranian ice sheet (after Dobrowolski and Terpiłowski 2006) (C)

a ridge, 500 m long and 20 m high, which has a submeridional orientation parallel to the lobe arrangement of the terminal forms of the Odranian ice sheet (Fig. 3; Harasimiuk *et al.* 2016; Marks *et al.* 2016). This form – composed of sands with gravels, sands and silts – covers an elevation of the Upper Cretaceous bedrock. The outcrops of the Upper Cretaceous (Maastrichtian) carbonate rocks are common in the vicinity of the kame. In places – mainly in land depressions (Pawłów basin, Wieprz River valley) they are covered with compact, thick layer of Pleistocene sediments. Their oldest units, predating the last (Odranian) glaciation occurring in this territory, are represented by tills, as well as by sands and gravels from the Sanian glaciation (Buraczyński and Wojtanowicz 1987, Harasimiuk *et al.* 2016; Albrycht 2020).

LITHOLOGY

The succession of the kame sediments in Lechówka (Fig. 4: A) is composed of three lithofacial units (Fig. 4: B-C): a – rhythmite of horizontally bedded sands and horizontally laminated silty sands (lithofacies Sh, SFh); b – rhythmite of massive gravelly sands and horizontally bedded sands (lithofacies SGm, Sh); c – rhythmite of massive sandy-gravelly diamictons and horizontally bedded sands (lithofacies SGDm, Sh).

Among the coarse-clastic fractions of the sediments (gravels), Scandinavian material is predominant. The presence of flints is accessory, usually as single nodules of a considerable size with thin, usually white cortex and various colours – from hues of grey to black (Fig. 2: A-C). In contrast, the unusual considerable accumulation of flints is somewhat common in the uppermost section of the sediment succession (up to the depth of 1 m). Fine and very fine clasts, sharp-edged, often vertically oriented and lacking cortex – referred to as concretions – are predominant (Fig. 2: D).

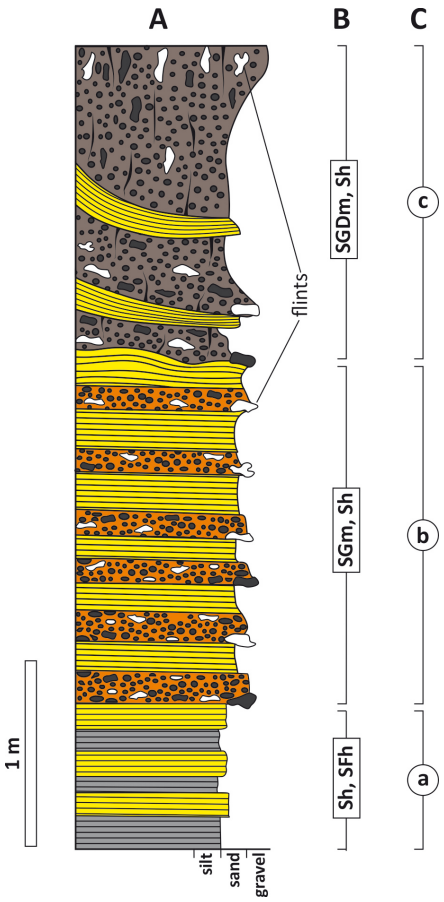

Fig. 4. Kame sediments in Lechówka:
A – synthetic profile, B – lithofacies, C – lithofacial units. Remaining explanations in the text

INTERPRETATION

The geomorphological situation and lithology of the sediments from Lechówka indicate that they are linked with the processes of glacigenic deposition in the submarginal zone of the Odranian ice sheet as well as with the post-deposition periglacial processes (Fig. 5: A). At the same time, the original lithofacial features of the sediments suggest their fluvial deposition and deposition from mass flows in the form of an alluvial fan (Fig. 5: B). Originally, it was an environment of short-lived sheet flows – where sediments were deposited during shallow flows, periodically disrupted by the deposition of suspended solids in virtually stagnant waters (origin of lithofacies Sh, SFh, of unit a). Next, the dynamics of meltwaters increased. During the cycles of high water, sandy-gravelly

materials were deposited. When the water level was low, they were substituted with sandy sediments (origin of lithofacies SGm, Sh of unit b). At the end, a visible reduction in the share of meltwaters occurred. Mineral materials covering the ice were redeposited mainly in the form of dense mass flows, and only in the final cycles they underwent fluvial redeposition (origin of lithofacies SGDm, Sh of unit c).

The upper, near-the-surface diamicton units (to a depth about 1 m) have the marks of post-sedimentation transformations. They can be attributed to periglacial conditions (forelands of ice sheets), which are characterized by frost and aeolian processes (Fig. 5: C). The considerable accumulation of the flints is probably an effect of the "upfreezing of stones" in the active layer of the permafrost (*cf.* Penner 1962, Xia 2006). Vertically-oriented flints are the indicators of this process. The great concentration of the flints might have also resulted from the disintegration of larger clasts caused by frost weathering. This would explain their small size and the shape of the concretions. Those with smooth surfaces have the features of ventifacts, which means that they were shaped by aeolian activity of wind – corrasion (*cf.* Antczak-Górka 2005).

THE USE OF REJOWIEC FLINT IN PREHISTORY

So far, the surface survey of the analysed territory has led to discovering 35 areas of surface occurrence of flints and 211 archaeological sites localized within

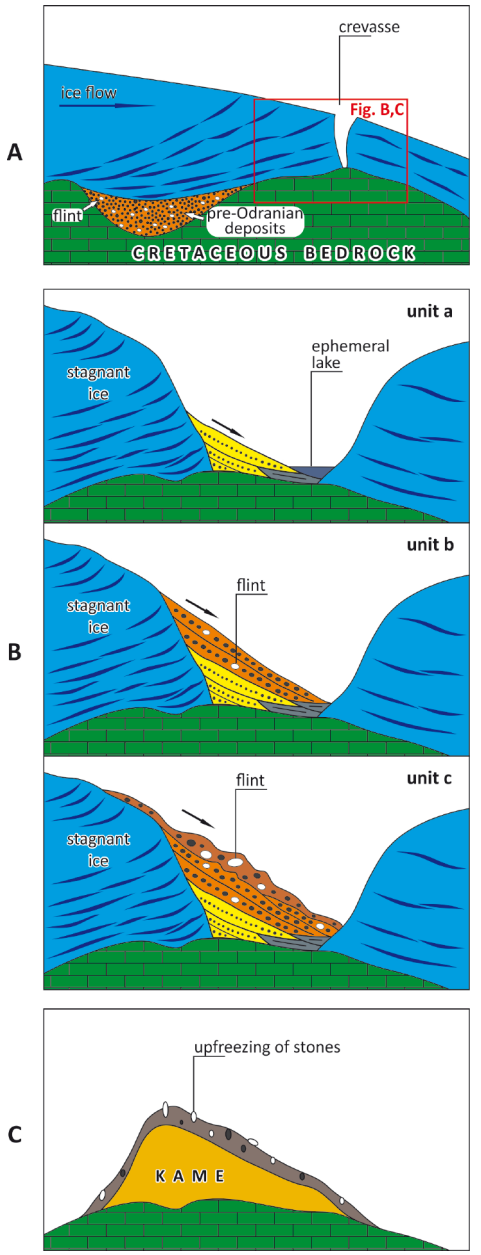

Fig. 5. Palaeoenvironmental model of the kame in Lechówka: A) forming of an ice crevasse, B) glacigenic phases of filling the crevasse with sediments, C) phase of post-glacial (periglacial) sediment transformations. Remaining explanations in the text

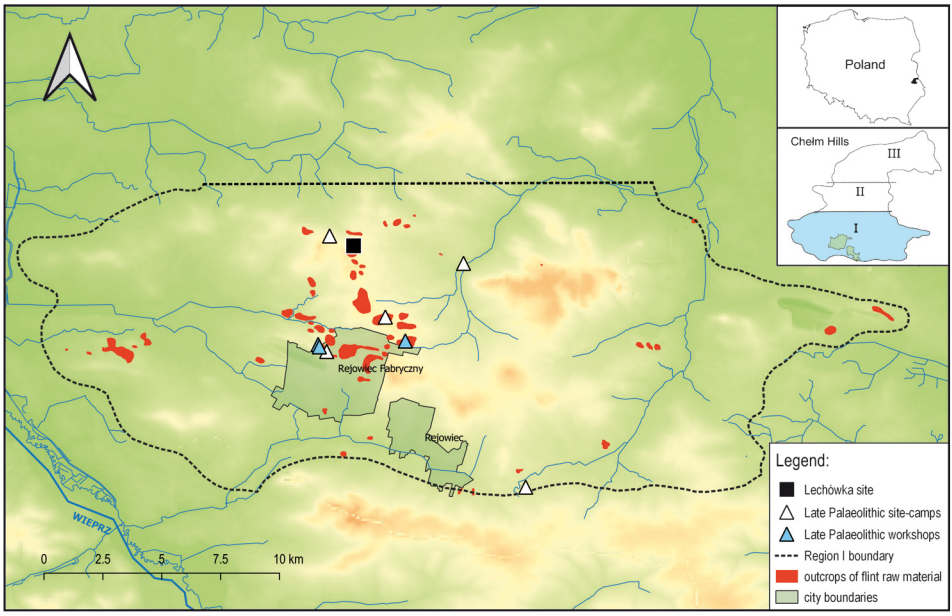

Fig. 6. Distribution of Late Palaeolithic sites within analysed 'Region I'
(acc. to Libera and Szeliga 2006; Libera *et al.* 2014, modified by T. Wiśniewski)

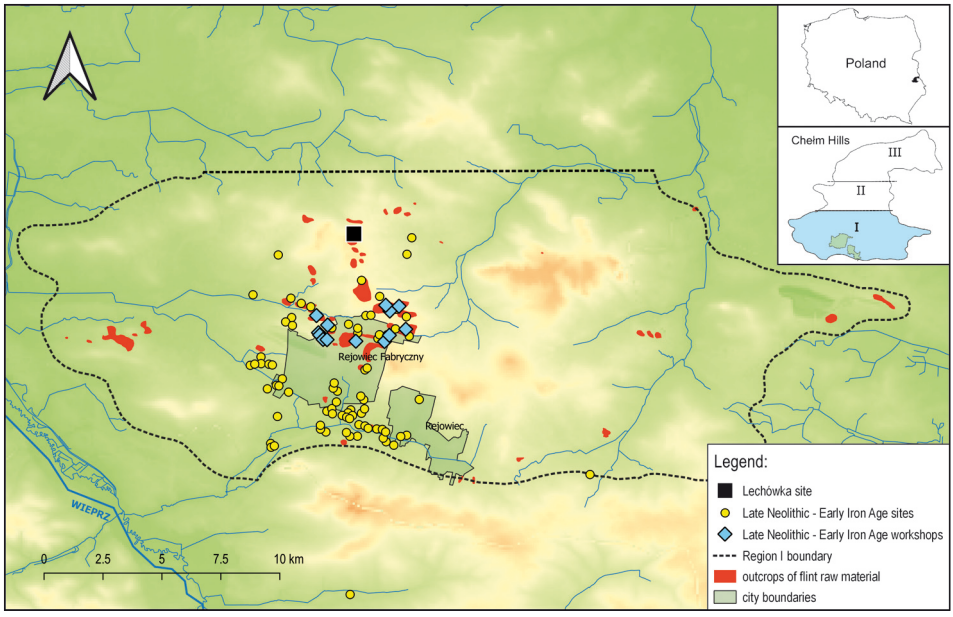

Fig. 7. Distribution of sites dated from the Late Neolithic to the Early Bronze Age within analysed 'Region I'
(acc. to Libera *et al.* 2014; 2016, modified by T. Wiśniewski)

these zones or in their vicinities (Fig. 1). The majority of the sites yielded artefacts made only of the local flint, represented by diverse series of finds that encompass from one to several dozens or even more specimens. The morphological and metric analysis of the features of particular artefacts made it possible to suggest a chronological and cultural classification of 122 sites (*ca.* 53% of the total number). It was impossible to conclusively attribute the remaining 99 sites to particular archaeological cultures. They yielded only sparse and non-diagnostic artefacts.

The earliest chronological horizon is determined by single, strongly aeolised diagnostic forms dated to the Middle Palaeolithic and represented by tools (*e.g.,* side scrapers) as well as by Levallois cores – discovered in Hruszów and Lechówka – attributed to the Mousterian and Micoquian cultural traditions (Libera *et al.* 2014, fig. 4: 1, 2; 2016, fig. 8: 1-6). From a later time – probably Upper Palaeolithic – comes a small number of aeolised cores, flake/blade half-products and tools discovered in Niedziałowice, Chełm, Kamień and Strachosław. Unfortunately, the morphometric qualities of these materials make it impossible to conclusively attribute them to particular cultures, whereas the character and small number of the finds prevent us from determining the functional identification of given sites.

A somewhat larger – although definitely more numerous at particular sites – group of finds represent sites of the Final Palaeolithic. In total, at least eight sites have been discovered in the discussed area (Fig. 6). They mark the first horizon of the most intense use and exploitation of the local flint outcrops and are represented – besides loose finds – by the remains of at least three mine-type workshops and/or near-mine workshops having various areas reaching up to several dozen ares (Rejowiec Fabryczny, Aleksandria Krzywowolska, Pawłów) (Fig. 6). Blade cores discovered at these sites – including double striking platform cores – discarded at various exploitation stages as well as pre-cores and abundant flake/blade debitage suggest technological features typical of the Mazovian cycle (*cf.* Libera and Szeliga 2006). Scarce finds of diagnostic tools – especially tanged points, which include specimens made of imported raw materials (for example, *Chocolate flint*) – correspond to this observation (*cf.* Libera and Szeliga 2006, tabl. V: 7; IX: 5). A completely different cultural tradition (associated with the Final Palaeolithic) is represented by a small number of single platform cores from Hruszów – bearing marks of being exploited with the use of a hard hammerstone in order to obtain irregular blades – and several medium-sized backed blades found in Kobyle and Aleksandria Krzywowolska (Libera and Szeliga 2006, tabl. V: 8). The morphometric and typological features of the above-mentioned artefacts corroborate the assumption that they should be linked with the backed blade complex (Libera *et al.* 2014, 65; 2016, 162).

Another groups of finds are artefacts attributed to the Mesolithic and/or Early Neolithic represented mainly by blade cores, blades and a small number of microliths discovered at six sites concentrated mainly in the vicinities of Rejowiec Fabryczny (Libera *et al.* 2014, fig. 5: 4, 5). Unfortunately, the character of these finds makes it impossible to propose conclusive and detailed cultural and functional classifications of particular sites.

There is an analogous problem with sites generally attributed to the Neolithic which yielded only a few non-diagnostic artefacts (*e.g.*, cores and fragments of tetrahedral axes or chisels) only sporadically accompanied by non-characteristic pottery (Libera *et al.* 2016, 165).

The latest – and at the same time the most numerous – group of finds are remains of settlement activity generally dated from the Late Neolithic to the Early Iron Age (92 sites). An especially important group among them are the remains of 14 workshops associated with the production of small and very small dihedral axes (Libera *et al.* 2014, fig. 6: 1). They are concentrated in a relatively small area in the vicinities of Rejowiec Fabryczny (Fig. 7). The surfaces of these sites yielded large groups of artefacts – represented by axe half-products (from several to several dozen specimens) (Libera *et al.* 2016, fig. 11, 12; 13: 2, 3) and great amounts of production debris from different stages of tool production (*e.g.*, diagnostic plunging flakes). The production character of the products together with lack of pottery make it impossible to perform chronological and cultural classifications of particular workshops. Still, the morphometric features of the finds allow us to narrow down the most plausible period of their functioning to the Late Neolithic and/or an unspecified phase of the Bronze Age (*cf.* Bargieł and Libera 2002, 28; Libera 2003, fig. 3; Libera *et al.* 2014, 67; 2016, 165). Undoubtedly, sites that yielded flakes, para-blades and cores processed with a hard hammerstone, as well as characteristic tools – *e.g.*, backed knives, side-scrapers, denticulate and notch tools, perforators with tips retouched from both edges and a small number of bifacial forms – are linked with this period and with later times (Early Iron Age; Libera *et al.* 2016, 165, fig. 14: 7). The technological and typological features of a considerable part of the artefacts appear to find analogies in the canon of the final stage of flint knapping tradition, including the so-called Kosin industry of the Tarnobrzeg Lusatian culture (Libera 2004; 2005; Libera and Zakościelna 2019, tab. 1), although they are often similar to older assemblages attributed to the Late Neolithic and Early Bronze Age. This fact makes it impossible to perform a detailed chronological and cultural classification of the discussed group of finds/sites, including the selection of assemblages linked with the Lusatian culture from the Late Bronze Age and Early Iron Age. The same applies to the functional classifications of particular sites, although in this case it appears that relatively few sites are linked with workshops, whereas the majority are the remains of strictly settlement activity performed by the local communities of the Lusatian culture.

DISCUSSION

Model of erratic flints deposition in the Chełm Hills

The universal model of Pleistocene ice-sheet advances across the Polish territories supposes that they were mainly supplied by bedrock deposits as a result of cyclic regelation processes linked with the incorporation of materials into the ice bed (Brodzikowski and

Van Loon 1991). They were transported and successively deposited in a form of basal tills, which compose the essential part of modern moraine plateaus (Kasprzak 2003). In marginal zones, in compressive ice conditions (with sliding surfaces tilted upwards), mineral materials were transported from the subglacial to the supraglacial position. Here, the material released from the sliding surfaces underwent fluvial redeposition (often also in the form of mass flow) at the ice front or in crevasses. Diverse lithogenetic glacigenic forms were formed this way – *e.g.*, accumulation terminal moraines or kames, which are mainly composed of glacifluvial and diamicton deposits (Zieliński 1992; Terpiłowski 2008).

The sedimentary succession of the glacigenic series from the site in Lechówka corresponds to this deposition model. The kame in Lechówka was formed as a result of the redeposition of supraglacial mineral materials from the ice of the ice sheet. Based on the morphological and geological conditions and reconstructed sedimentary environments, we can state (Fig. 5: A-B):

1) The place of the sediment deposition was a crevasse. It was formed as a result of ice tension above an elevation of the Upper Cretaceous bedrock during the advance of the Odranian ice sheet (Fig. 5: A ; *cf.* Godlewska and Terpiłowski 2012).

2) The sediments were redeposited from tilted upwards sliding surfaces during the progressive areal decline of stagnant ice sheet. The compression of ice was caused by the ice-oriented slopes of an elevation of the Upper Cretaceous bedrock (Fig. 5: B; *cf.* Terpiłowski 2008).

3) The sediment deposition occurred in the form of a glacigenic fan from sheet flows and mass flows. Coarse-clastic sediment fractions – including, to a lesser degree, flint nodules – were deposited during the two final phases (Fig. 5: B, unit b and c): (a) in the cycles of sandy-gravelly deposition from sheet flows during increased ablation of ice, and next (b) in the cycles of diamicton mass flows during the general reduction of ice ablation.

In the light of the suggested model of glacigenic deposition, the flints from Lechówka are redeposited allochthonous rocks representing so-called erratic flints. This raises the question of where they had come from. Their origin cannot be linked with the thick series dated to the Upper Maastrichtian – admittedly widespread across the Chełm Hills but extremely poor in this raw material. It is also very unlikely that it was transported from remote regions – from the Baltic Basin – area of the alimentation of the Scandinavian ice sheets. *Wallstein* type flints – representing lower stratigraphic units of the Upper Cretaceous and considered as indicative of this region – have diagnostic features differing from those of Rejowiec flint (Czubla 2015). The features and frequency of raw material occurring in Lechówka are generally similar to those present in chronologically and genetically diverse glacial sediments from Poland – their proportion in coarse-clastic fraction >20 mm in tills, flow diamictons and glacifluvial sediments does not exceed several percent (Górska-Zabielska 2008, Czubla 2015). They are believed to be local rocks, transported at short distances and subjected to repeated redeposition during successive Pleistocene glaciations. Where in this case can we find the original source of the Rejowiec

flint from the site in Lechówka? We suspect that in an extreme case the source of the flints might have been series of older glacigenic sediments (glacial or glacifluvial) from before the advance of the Odranian ice sheet, i.e. dated to the Sanian glaciation, that filled the Pawłów Basin or the Wieprz River valley near Trawniki and Łęczna or a bit further towards the north – the Bug river valley in the vicinity of Włodawa or Brest.

Archaeology of flint use vs. geological context

Despite clear evidence of early settlement in the discussed 'Region I' of the Rejowiec flint outcrops, as well as its long-lasting and multicultural character, data obtained so far allow us to distinguish two distinct horizons of their exploitation that generally correspond to the Final Palaeolithic and – generally – to a period encompassed between the Late Neolithic and the Early Iron Age. This fact concurs previous observations made in other areas of the Chełm Hills (Libera *et. al.* 2014; 2016). The scope of the presently available data does not allow us to rule out the possibility that the local deposits were also intensely exploited in this region during other periods of human presence confirmed by the sources. Currently, this assumption cannot be definitely corroborated due to the lack of a satisfying number of workshop sites with diagnostic artefacts.

The earlier horizon (Final Palaeolithic) is represented by the remains of workshops, which were most probably sited near seasonal settlements of migrating hunting groups, and by single diagnostic artefacts (*e.g.*, tanged points) probably lost/left during hunting expeditions (Fig. 6). This functional diversity corresponds to data obtained from other regions located within flint deposit zones or in their nearest vicinities, *e.g.*, by the upper Warta River (Ginter 1967), in Załęcze Meander (Zakole Załęczańskie) of the Warta River valley (Cyrek 1996), in the valley of the lower Narew River (Więckowska 1985) or across the territories of north-eastern Poland and the adjacent parts of Lithuania and Belarus (Szymczak 1992), constituting a direct reflection of the raw material economy model greatly determined by a considerable mobility of hunting groups associated with the tanged point and backed blade cultures.

During the later horizon (Late Neolithic until the Early Iron Age), the distribution of the workshops was clearly concentrated in the central part of the analysed territory, in a relatively small area (*ca.* 6 sq. km; Fig. 7). This fact indicates a limitation of the zone where the local materials were exploited and processed to the richest part of their outcrops. It also suggests that the workshops were established in direct proximity to settlements, which were usually located within the valleys of the nearby watercourses. The structure of finds made within the workshops indicates that they were highly specialized (production of small dihedral axes), which has analogies in deposits of other flint materials exploited from the Late Neolithic to the Early Bronze Age (Grużdź and Budziszewski 2014; Zakościelna 2019; Grużdź 2020). It should be stressed that in the context of the current

state of archaeological prospection the question of the local production of bifacial tools other than axes (like sickles, projectile points) remains unanswered.

The considerable accessibility of flints to different cultures from the Final Palaeolithic to the Early Iron Age contradicts the original conditions of their deposition documented by the example of the site in Lechówka. A small number of flint clasts occur here in a thick series of glacifluvial and mass-flow sediments (Fig. 4, units b, c). The post-deposition indicators of transformations taking place in the upper, subsurface part (Fig. 4, unit c) appear to explain this contradiction. They allow us to suspect that the considerable concentration of the flints and, as a result, their considerable accessibility for groups representing different cultures should be linked with their 'upfreezing' in periglacial conditions that occurred mainly during successive glacial cycles (from the Odranian to the Vistulian glaciation) (Fig. 5: C). The great accumulation of Rejowiec flint on the land surface is thus the result of swelling and dynamic cryoturbation – accompanying the processes of freezing and thawing of the ground – that caused a gradual movement of flint nodules to the surface and their progressive frost disintegration (gelifraction).

CONCLUSIONS

1) The majority of sedimentological premises associate Rejowiec flint with lithostratigraphic units of the Upper Cretaceous lower than the Maastrichtian. They also indicate their relatively close source area linked with the northern foreland of the Chełm Hills. Glacial transport – whose origin, time and dynamics were probably diverse – occurred in stages, maybe during different advance phases of the Odranian glaciation. The boldest assumption associates the origin of Rejowiec flint with the earlier glacial cycle (Sanian glaciation) and their redeposition from the land surface to ice crevasses during the Odranian glaciation.

2) The wide distribution of flints in 'Region I' (Rejowiec region) is a result of post-deposition processes occurring in the periglacial environment of successive glacial cycles (Odranian, Wartanian and Vistulian glaciations). Their considerable concentration near the ground surface was caused by frost processes taking place in the active layer of permafrost and was linked with their 'upfreezing' that is gradual movement to the surface accompanied by a progressive frost destruction.

3) Despite the still unsatisfactory state of research and necessity to continue the work, it appears that 'Region I' is the area of the greatest flint accumulations in the entire territory of the Chełm Hills. At the same time, from among three selected zones (see: Libera and Szeliga 2006; Libera *et al.* 2014; 2016), the greatest accumulation of archaeological sites has been discovered in the above-discussed area.

4) This fact allows us to consider the analysed territory as crucial in the perspective of research on using and processing local Rejowiec flint, whose presence in this area was one

of the most important factors determining local settlement processes in prehistory. The outstanding technological features of this raw material and the adequate size of its concretions made it possible to fulfil various requirements of flint-knappers from the Middle Palaeolithic to the Early Iron Age.

5) The current state of research indicates that Rejowiec flint was the most intensely exploited and processed in the Final Palaeolithic and from the Late Neolithic to the Early Iron Age. Finds made in the discussed region allow us to suspect that it was a place where functioned dynamic local centres of mining, processing and (possibly) distribution of the local materials.

6) The clear dispersion of Final Palaeolithic workshops (Fig. 6) was probably caused by the considerable mobility of hunting groups operating across this territory and, as a result, their seasonal visits (during hunting) in areas located within the ranges of the outcrops and in their vicinities.

7) The greatest accumulation of workshops dated from the Late Neolithic to the Early Iron Age clearly corresponds to the distribution of settlements in river valleys (workshops located near settlements) (Fig. 7), indirectly suggesting the long-lived and continuous character of their activity (parallel to that of the settlements).

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