

# Jurassic-Cracow Flint in the Linear Pottery Culture in Kuyavia, Chełmno Land and the Lower Vistula Region

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**Abstract:** Jurassic-Cracow flint was one of the most important lithic raw materials in the Linear Pottery Culture (LBK) in Poland. It is registered in numerous assemblages in the Polish Lowland, but its percentages and technological structures vary through time. This paper presents the current state of research on Jurassic-Cracow flint procurement, which is discussed in the broad context of cultural developments of early farming communities in the areas of the Lowland close to the River Vistula.

Keywords: Polish Lowland, Early Neolithic, Neolithic flintworking, Jurassic-Cracow flint, Linear Pottery Culture (LBK)

## Introduction

Studies on the distribution of flint raw materials among Early Neolithic farmers in the Lowland areas of Middle Europe have a comparatively long history, as evidenced by numerous publications. The appeal and potential of this line of research should come as no surprise, bearing in mind the unique character of the Linear Pottery Culture (LBK) and post-LBK settlement, most often defined as 'insular'. In research on these communities, particular cognitive value is attributed to various types of artefacts made of raw materials from outside the local area, whose widespread distribution enables the monitoring of inter-regional contacts, the strength of the bonds between settlement enclaves hundreds of kilometres apart, and their variation over time. In terms of the archaeology of the earliest farming communities in Poland, a particularly important role is played by studies into the distribution of flint raw materials of Lesser Poland. This is a fairly enigmatic group of raw materials, including Jurassic-Cracow flints from the Cracow-Częstochowa Upland (Polish Jura), so-called 'chocolate' flints from the Holy Cross (Świętokrzyskie) Mountain Region (also of Jurassic date) and Cretaceous-Turonian-flints, represented by Świeciechów (grey white-spotted) flint. The characteristics of the ways in which the raw materials were distributed and exploited have been covered many times in the subject literature in Poland.

Often, however, particularly in the case of LBK communities in the Lowland, these sources were discussed together. This is why we felt it right to examine the subject of Jurassic-Cracow flint alone among these communities. Our observations are confined to the area of the Vistulian enclaves of LBK settlements, i.e. Kuyavia, Chełmno Land with a part of the lower Vistula valley. These regions have been relatively well studied so far (Pyzel 2010; Werra 2013). In our paper, we make

extensive use of these published materials (see the list of sites in Tab. 1). We already have a considerable number of sites at our disposal, the exact dating of which within the LBK has been modified with reference to the latest studies (after Pyzel 2010 and Werra 2013). For the same reason, it would seem to be worthwhile to renew research on this subject, although we realise that taking into account, for example, flint assemblages from many of the hitherto unpublished sites from the A1 motorway could influence our interpretations. The aim of this article is not, therefore, so much to exhaust the topic of Jurassic-Cracow flint in the Lowlands, as to sum up the state of research so far and to indicate new directions for research.

## History of research

Jurassic-Cracow flint reached the widest range of distribution in the history of its use in the LBK. This seems to indicate the unique character of the social and cultural bonds which linked the communities of the LBK over extensive areas of Central Europe (Lech 2006: 402). It is this unique character that meant that this raw material has most often been written about from the global perspective (e.g. Lech 1979, 1981, 1987, 2003, 2006) or that of Lesser Poland. Although as yet no mines are known of, their existence is implied and the topic of the extraction and distribution of this raw material in general takes up a considerable amount of space in the literature. The basic question seems to be to establish whether different LBK groups obtained Jurassic-Cracow flint through self-supply or exchange. The majority of researchers lean towards the first interpretation (e.g. Lech 1979, recently also Wilczyński 2014a and 2014b).

Jacek Lech was also concerned with the matter of functional variations among LBK sites, introducing the division into primary and secondary production sites and settlements of users (Lech 1981, 1988, 2003). One of

Table 1. Number of finds of different raw materials from sites analysed in this paper with the percentage of Jurassic-Cracow flint. N. d. – no data.

No.	Site	Phase	Number of flints									% Jurassic-Cracow flint	References	
			Baltic	Pommeranian	Chocolate	Jurassic-Cracow	Volhynian	Świeciechów	obsidian	undefined	total			
1.	Baba 12, Rypin dist.	III	3		3						6	0	Domańska 2004	
2.	Bożejewice 22/23, Mogilno dist.	IIA	6		72	15					54	147	10.2	Kabaciński 2010
3.	Brześć Kujawski 3, Włocławek dist.	IIB	129		53						7	189	0	Grygiel 2004
4.	Brześć Kujawski 4, Włocławek dist.	III	78		242	30		6			20	376	7.98	Grygiel 2004
5.	Chabsko 40, Mogilno dist.	III	137		55	3			1		25	221	1.36	Kabaciński 2010
6.	Grabie 4, Aleksandrów Kujawski dist.	I	31		7	31					6	75	41.33	Domańska 2016
7.	Guźlin 2, Włocławek dist.	IIA	4		9							13	0	Grygiel 2004
7.	Guźlin 2, Włocławek dist.	IIB	7		6							13	0	Grygiel 2004
8.	Kuczkowo 5, Aleksandrów Kujawski dist.	III			37	5						42	11.9	Domańska and Kabaciński 2010
9.	Łąkocin 1, Inowrocław dist.	IIB	4		1						1	6	0	Kabaciński 2010
10.	Ludwinowo 7, Włocławek dist.	IIA	38		51	15					2	106	14.15	Kabaciński 2010
10.	Ludwinowo 7, Włocławek dist.	IIB	11		96	8		1			25	141	5.67	Kabaciński 2010
10.	Ludwinowo 7, Włocławek dist.	III	4		48	6					15	74	8.11	Kabaciński 2010
11.	Miechowice 4, Włocławek dist.	IIA	43	3	182	39					73	340	11.47	Grygiel 2004
11.	Miechowice 4, Włocławek dist.	IIB	34		155	15					74	278	5.4	Grygiel 2004
11.	Miechowice 4, Włocławek dist.	III			4						2	6	0	Grygiel 2004
12.	Miechowice 7, Inowrocław dist.	IIA	4		38	43					5	90	47.78	Domańska 1995; Kabaciński 2010
13.	Olsza 9, Mogilno dist.	III	6		6	1					1	14	7.14	Kabaciński 2010
14.	Piecki 8, Inowrocław dist.	IIA	3		40						1	44	0	Domańska 2004
15.	Przybranowo 3, Aleksandrów Kujawski dist.	III	41	1	169						7	218	0	Domańska 2016
16.	Radziejów 5, Radziejów dist.	III	3		26	22					2	53	41.51	Gabałówna 1963
17.	Roźniaty 2, Inowrocław dist.	IIA	1		6	1					2	10	10	Kabaciński 2010
18.	Rzadkwin 22, Mogilno dist.	III			26	1					2	30	3.33	Kabaciński 2010

19.	Siniarzewo 1, Aleksandrów Kujawski dist.	IIA	5		30	15				3	53	28.3	Domańska and Kabaciński 2010
19.	Siniarzewo 1, Aleksandrów Kujawski dist.	IIB	7		23	8				3	41	19.51	Domańska and Kabaciński 2010
19.	Siniarzewo 1, Aleksandrów Kujawski dist.	III	9		11						20	0	Domańska and Kabaciński 2010
20.	Smólsk 4, Włocławek dist.	IIA	4		3						7	0	Grygiel 2004
20.	Smólsk 4, Włocławek dist.	III	13		115					3	131	0	Grygiel 2004
21.	Strzelce 2, Mogilno dist.	IIA	78		13	2 (?)				17	108	1.85 (?)	Wiślański 1959
22.	Wolica Nowa 1, Środa Wielkopolska dist.	IIA	146		73					4	223	0	Grygiel 2004
23.	Zagajewice 1, Inowrocław dist.	IIB	1		23				1	1	26	0	Grygiel 2004
23.	Zagajewice 1, Inowrocław dist.	III	3		113				3	1	120	0	Grygiel 2004
24.	Żabienko 12, Mogilno dist.	III	14		7	4				3	28	14.29	Kabaciński 2010
25.	Żegotki 2, Mogilno dist.	IIB	8		15						23	0	Kabaciński 2010
26.	Żegotki 18, Mogilno dist.	III	5		11						16	0	Kabaciński 2010
27.	Annowo 31, Grudziądz dist.	IIA			168	4					172	2.33	Małecka-Kukawka 2008
28.	Bocień 5, Toruń dist.	IIA	35		104	2				6	147	1.36	Małecka-Kukawka 2012
28.	Bocień 5, Toruń dist.	III	22		11	1				4	38	2.63	Małecka-Kukawka 2012
29.	Boguszewo 41, Grudziądz dist.	I	25		3	86				21	135	63.7	Małecka-Kukawka 2008
30.	Boguszewo 43a, Grudziądz dist.	I	1	1		29				3	34	85.29	Małecka-Kukawka 2008
31.	Gruta 52, Grudziądz dist.	I			2	32					34	94.12	Małecka-Kukawka 2008
32.	Kornatowo 14, Chełmno dist.	IIB	25		4					4	33	0	Małecka-Kukawka 2008
33.	Linowo 6, Grudziądz dist.	IIA			59	5					64	7.81	Małecka-Kukawka 2008
34.	Lisewo 31, Chełmno dist.	IIA	21		17	4				13	55	7.27	Małecka-Kukawka 1992
35.	Małe Radowiska 17, Wąbrzeźno dist.	III	n. d.	n. d.	n. d.	4	n. d.	n. d.	n. d.	n. d.	82	4.88	Osipowicz <i>et al.</i> 2012
36.	Ryńsk 42, Wąbrzeźno dist.	IIA			39	1					40	2.5	Małecka-Kukawka 2008
37.	Stolno 2, Chełmno dist.	IIA	117		12					144	273	0	Małecka-Kukawka 2008
38.	Wielzijdz 31, Wąbrzeźno dist.	IIB	4		6						10	0	Małecka-Kukawka 2008

39.	Wielkie Radowiska 22, Wąbrzeźno dist.	III			74					74	0	Małecka-Kukawka 2008
40.	Wielkie Radowiska 44, Wąbrzeźno dist.	III			246	13				259	5.02	Małecka-Kukawka 2008
41.	Kościelna Jania 13, Starogard Gdański dist.	IIA	10	10	6	4				30	13.3	Czerniak <i>et al.</i> 2016

the basic criteria for this distinction was the distance from the outcrops. As regards raw materials from Poland, nobody has studied the question as thoroughly as Andreas Zimmermann did for the Rhineland, where he noticed variation even within one microregion, depending on the site's rank and function (Zimmermann 1995). Recent large-scale rescue excavations in Poland raise the hope that such detailed studies could take place in the future, while even now it is possible to investigate, for instance, chronological differentiation within the LBK to a considerably greater degree. Thus, for example, Jarosław Wilczyński suggests for the LBK site at Targowisko 10 and 11, Cracow district, dated to the Zofipole and Music Note phases, that the inhabitants supplied their raw materials themselves (Wilczyński 2014a), while for Brzezcie 17, Cracow district, located nearby and dated to the later Music Note and Żeliezowce phases, specialised flint-workshops were discovered, which testify to the fact that, together with the development of the LBK, an intensification of production took place, specialists appeared and large-scale exchange began (Wilczyński 2014b).

In many of these general considerations of Jurassic-Cracow flint in the LBK, some sites from the Lowlands have been mentioned, but they served mainly as background information and were not the research subject itself (see Lech 1979, 1981, 2003, 2006). Bogdan Balcer in his paper on so-called imported raw materials in the LBK distinguished regions of differing importance for Jurassic-Cracow flint in the flint industry as a whole. In the Lowland Jurassic-Cracow flint can be classified to stage C, and thus as economically irrelevant (Kuyavia), or even totally absent (Pyrzyce district: Balcer 1983).

Jurassic-Cracow flint was also discussed, of course, in a series of publications from the Lowland perspective (e.g. Domańska 1988, 1995; Małecka-Kukawka 1992; Kabaciński 2010). Essentially, however, in the Lowlands this raw material remains in the shadow of the dominant chocolate flint (see, for example, Małecka-Kukawka 2008). They are most often dealt with together as so-called 'imported' raw materials; it has been suggested that their distribution followed the same networks (recently Kabaciński 2010: 182). Lech was always of a different opinion, and according to

him Jurassic-Cracow flint in the Lowland is rather an example of exchange and not independent distribution, and then connected with 'other purposes of ritual and social exchange' (Lech 1987). The subject of this raw material in the Lowlands was nevertheless practically only dealt with separately from that of chocolate flint in the context of the origin of the LBK and the possible routes of the influx of migration (e.g. Domańska 1988, 1995, see also Gronenborn 1997: 137).

#### **The specificity of research on Jurassic-Cracow flint in the Lowland inventories – verification of sources**

The attempt to characterise the place and role of Jurassic-Cracow flint in flint production as a whole in the LBK should be preceded by a few remarks. These remarks concern the state of sources and publications which document the presence of this raw material in the LBK inventories. Attention is drawn primarily by the unique position of flint artefacts in the publication of the results of find processing, where they are most often presented – which is understandable in a certain sense – as a secondary category of artefacts with regard to pottery. As a consequence, analysis of this group of artefacts is often in the form of annexes, or they are completely overlooked as a unique category, attracting the attention only of flint specialists.

At the same time, a certain paradox can be perceived in the fact that flint artefacts of so-called imported raw materials draw particular attention in the relevant papers. Indeed, they have gained the reputation of being material relics of interregional social relations (as expressed earlier). Unfortunately, studies of these raw materials (including Jurassic-Cracow flint) are most often confined to ascertaining their inclusion in the inventory, using simple quantitative indicators to do so, and then creating a 'superstructure' with frequently repeated terms, such as procurement, distribution and exchange.

Although the research potential of imported materials is undeniable, the way in which flintworking is characterised and analysed may leave a feeling of unfinished business. The evident latitude in the classification and presentation of flint inventories

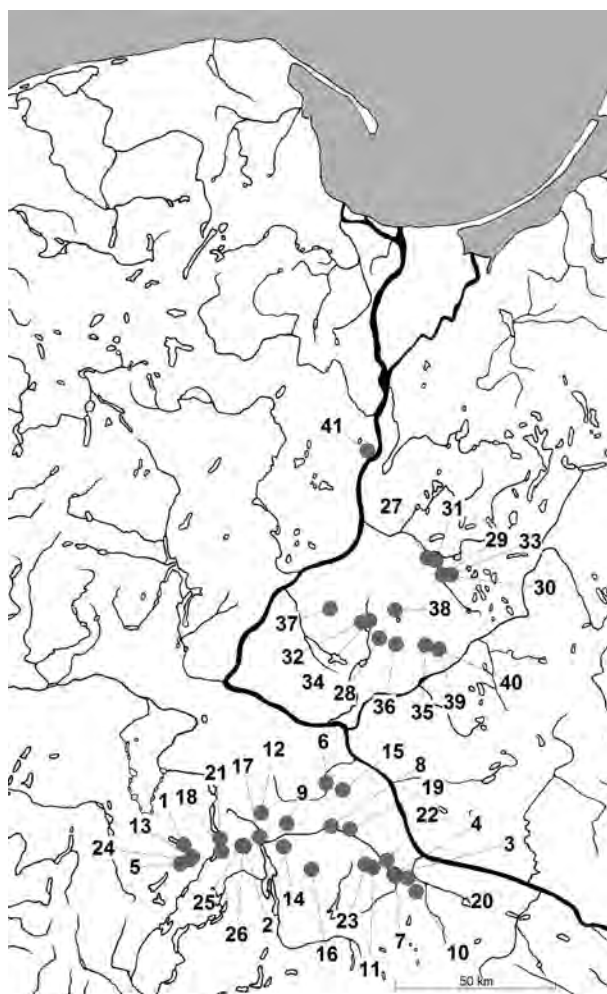


Fig. 1. Map of sites analysed in this paper. Number of sites according to Table 1. Drawn: J. Pyzel.

and the lack of a standardised system therefore result in difficulties in conducting comparative studies. The present paper, too, has many deficiencies for the above reasons.

A separate issue is that of the method for measuring and determining the proportion of non-local raw materials in flint inventories of the LBK in the Lowland. Most often the measure of the proportion of imported flints is the nominal number of artefacts. It is usually shown as a percentage against the assemblage as a whole. Such a perspective is not, unfortunately, the right way to evaluate the proportions of an individual raw material within the general raw material composition of the analysed inventory. The shortcomings emerge, in particular, in comparative analyses confronting very small assemblages (with a few elements) and rich assemblages (with several hundred artefacts). Then the percentage of non-local raw material reduced to the role of indicators of the percentage composition could

in fact give a false picture when evaluating the quantity of 'imported' Jurrasic-Cracow flint.

In order to estimate the quantity of raw material imported to a site, it could be useful to weigh the non-local materials; however, in the case of the assemblages examined in the present paper, source work does not provide information about their mass.

## Presentation of the data

### General remarks

In the present paper, we look at flint inventories of altogether 41 sites: 26 from Kuyavia, 14 from Chełmno Land and one from Pomerania (Tab. 1 and Fig. 1). All of these sites are classified to separate LBK phases, divided into LBK I, LBK IIA, LBK IIB and LBK III (description of phases presented by Pyzel 2010). At seven sites there are materials from several phases: at four settlements there are two phases and at three as many as three phases. Each phase was examined separately and as a minimum we assumed the presence of a total of five flint finds. In total this gave us 51 sites/phases and 4768 flints (see Tab. 1).

We deliberately did not include so-called Podgaj-type sites (recently Rzepecki 2013) in the work because of their suggested distinctness in flint industries; we were trying to find the norm, not deviations from it. We assume that most of the sites analysed in this paper represent quite ordinary LBK villages.

Analysis of the proportion of Jurrasic-Cracow flint was conducted separately for each phase.

Thus from phase I we have four sites, in all of which Jurrasic-Cracow flint is present, with an average share of 64%.

There are 18 sites dated to phase IIA, at 13 of which (72%) there is Jurrasic-Cracow flint in different quantities, from 1-2% (Ryńsk 42, Wąbrzeźno district, Bocięń 5, Toruń district, probably Strzelce 2, Mogilno district) to 48% (Miechowice 7, Inowrocław district), with an average (for all sites) of 8%.

In phase IIB Jurrasic-Cracow flint is only present at three sites out of ten (30%). All of these sites are multi-phase sites with evidence of previous settlement. In all, the average share of Jurrasic-Cracow flint is 4% for all sites of this phase, from 5% in Miechowice 4, Włocławek district, to 19% in Siniarzewo 1, Aleksandrów Kujawski district.

In phase III Jurrasic-Cracow flint is present at 11 out of 19 sites from this phase (58%). On average it constitutes

Table 2. Group of products made of Jurassic-Cracow flint from selected sites.

A – products of blade/flake core exploitation; core procurement products; products of cresting and rejuvenation flakes; B – products of splintered technique; C – unidentified products, wastes, chunks; D – conventional tools.

Chronology	Sites	Groups of products				sum
		A	B	C	D	
Phase I	Boguszewo 41, Grudziądz dist.	70			16	86
	Boguszewo 43a, Grudziądz dist.	23			6	29
	Grabie 4, Aleksandrów Kujawski dist.	11	1		19	31
	Gruła 52, Grudziądz dist.	27			5	32
Phase IIA	Annowo 31, Grudziądz dist.	1			3	4
	Bożejewice 22/23, Mogilno dist.	6	1	1	7	15
	Kościelna Jania 5, Starogard Gdański dist.	4				4
	Ludwinowo 7, Włocławek dist.	3	4	6	2	15
	Miechowice 4, Włocławek dist.	15	8		5	28
	Miechowice 7, Inowrocław dist.	26	6		11	43
	Rożniaty 2, Inowrocław dist.				1	1
	Ryńsk 42, Wąbrzeźno dist.	1				1
Siniarzewo 1, Aleksandrów Kujawski dist.	8	1		6	15	
Phase IIB	Miechowice 4, Włocławek dist.	4	1		6	11
Phase III	Bocień 5, Toruń dist.	1				1
	Brześć Kujawski 4, Włocławek dist.	24	2		4	30
	Chabsko 40, Mogilno dist.	1		2		3
	Kuczkowo 5, Aleksandrów Kujawski dist.	5				5
	Małe Radowiska 17, Wąbrzeźno dist.	3			1	4
	Olsza 9, Mogilno dist.	1				1
	Rzadkwin 22, Mogilno dist.	1				1
	Wielkie Radowiska 24, Wąbrzeźno dist.	10			3	13
	Żabienko 12, Mogilno dist.		3	1		4

5%, from 1.36% in Chabsko 40, Mogilno district, to 41.5% in Radziejów 5, Radziejów district.

#### **Presentation of flint material from separate phases**

Unfortunately, not all of the sites presented above can be subjected to a more detailed characterisation, meaning that the analysis of the technological profile and the tool structure is of necessity limited to 377 artefacts from 23 inventories.<sup>1</sup> Similar considerations determined the necessity of adopting a very general manner of presentation of the flint products taken together.

<sup>1</sup> This limitation results from the very varied state of the presentation of flint products in source publications, which made it impossible to identify them in more detail. This refers to the following inventories: Lisewo 31, Chełmno district, Linowo 6, Grudziądz district, Radziejów 5 and some of the artefacts made of Jurassic-Cracow flint from Ludwinowo 7, Włocławek district, Siniarzewo 1 and Bocień 5 (in total about 30 unidentified artefacts not included in this characterisation).

The aim is to cancel out, as it were, the differences between individual publications, and particularly any divergence manifest in the application of various systems for the classification of flint artefacts. It is not, however, our aim to negate perspectives adopted in the past or to propose a new method for grouping and describing flint finds. In order better to depict the technological specificity of flint artefacts made of Jurassic-Cracow flint, and to avoid errors which would certainly be revealed by a more detailed correlation of different classification systems present in source work, we propose treating them in four groups:

- A. Products of blade/flake core exploitation; core procurement products; products of cresting and rejuvenation flakes (e.g. groups: I, II, III, V after Domańska and Kabaciński 2010).
- B. Products of the splintered technique (e.g. group IV after Domańska and Kabaciński 2010).

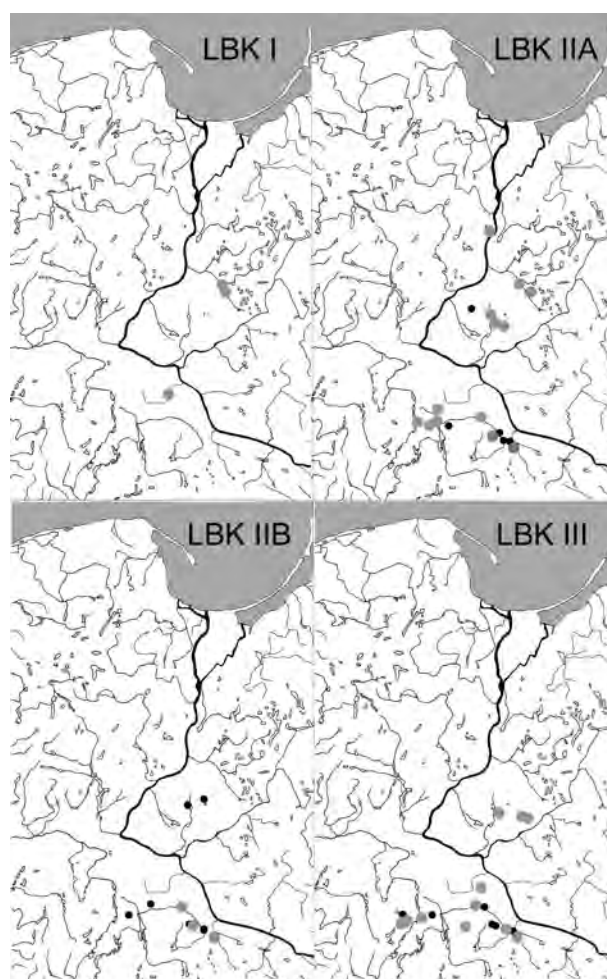


Fig. 2. LBK sites from individual phases analysed in this paper. Grey dot – sites with Jurassic-Cracow flint; black dot – other sites. Drawn: J. Pyzel.

- C. Unidentified products, wastes, chunks (e.g. group VI after Domańska and Kabaciński 2010).
- D. Conventional tools (e.g. group VII after Domańska and Kabaciński 2010).

In total, in the group of 377 artefacts made of Jurassic-Cracow flint recorded at all of the sites discussed here, products classified as group A are dominant in terms of quantity (Tab. 2). This group consists of 245 products of classical blade/flake exploitation: blanks, cores, procurement wastes and so-called ‘technical flakes and blades’ (crested blades, core tablets, rejuvenation flakes). Together they make up 65% of the whole assemblage. The second in terms of numbers is group D (over 25%). So-called conventional tools, which are classified in this group, form a collection comprising 95 artefacts.

In comparison, group B is very modest, comprising products of the splintered technique (about 7%).

In the whole assemblage, only 10 unidentified products were found (group C – 2.7%).

Because such a curtailed assemblage does not allow detailed comparative analysis of sources to be carried out, we propose only a general outline of the specificity of Jurassic-Cracow flint inventories in individual phases of the LBK settlement in Lowland areas of interest to us.

#### LBK I

Despite the fact that this phase is only represented by the inventory from four sites, products of Jurassic-Cracow flint are the most strongly represented in it. Also from the overall perspective of the database of LBK flints in the Lowland, they constitute almost half (over 47%) of the analysed inventory of 377 artefacts, standing out against the background of the following phases of this culture. In the whole assemblage of phase I, containing 178 artefacts of Jurassic-Cracow flint, only relics classified into two groups are in fact visible. Almost three-quarters of the assemblage (74%) is composed of products of blade/flake core exploitation (131 items). The remaining part consists of conventional tools, totalling 46 items (26%). It is worth remarking that in the light of available sources there is no sign in this phase of products of the splintered technique, or of morphologically and technologically unidentified products.

#### LBK II

The sources for the research on the role of the Jurassic-Cracow flint in the second phase of the LBK settlement in the Lowland are 137 artefacts from nine inventories from phase IIA and one from phase IIB. Due to the strong disproportion in favour of this chronological group, which is representative of flintworking, sites from phase IIA will be discussed in more detail.

Although as many as 126 artefacts come from phase IIA (constituting over 33% of the total inventory), their considerably smaller quantity at individual sites compared to LBK I is clearly visible. Apart from the inventory from Miechowice 4 including 43 artefacts of Jurassic-Cracow flint, at other sites this material is not as numerous as in the oldest phase. At some sites, indeed, there are only traces (4 pieces only both in Annowo, Grudziadz district, and Kościelna Jania, Starogard Gdański district, and single finds in Rożniaty, Inowrocław district and Ryńsk).

In addition, the ‘internal’ structure of the assemblage of Jurassic-Cracow flints from this phase differs from that of LBK I. There is a distinct alteration of the technological profile, in which artefacts of group A are reduced to about 51% (64 items) in favour of products of

the splintered technique, which constitute 16% of the whole assemblage in this phase.

It is also worth noting that, despite the changes emerging in Jurrasic-Cracow flintworking technology, the profile of the tool group remains relatively homogeneous. Naturally, along with the general decline in the quantity of Jurrasic-Cracow flints on the LBK IIA sites, the actual quantity of tools also decreases (35 items), and yet their percentage in this phase is almost identical to that in the overall inventory of LBK I, fluctuating around 28%. In addition the internal structure of the tool group does not display significant differences; all types of conventional tools are present with end-scrapers and truncations being quantitatively dominant.

### LBK III

Finds of Jurrasic-Cracow flint from the youngest LBK phase in the Lowland constitute the smallest assemblage in comparison with the previous phases. It consists of 62 products, which constitutes over 16% of the total Jurrasic-Cracow flint inventory.

As in previous periods, also in LBK III, Jurrasic-Cracow flint is most numerous connected to blade/flake core exploitation (46 items Group A, i.e. 74%). This represents a slight increase in comparison with the earlier period, which in turn correlates with the decline in the share of products of the splintered technique (c. 8% – 5 items). The most significant difference emerges in this phase in the quantity of tools (group D – 8 items). Compared with the previous phases, where the presence of tools was fairly clearly visible, the share of Jurrasic-Cracow flint in LBK III seems to have a diminished role. Apart from the fact that its share falls to the level of 13%, of no less significance is the distinct disturbance of the existing internal structure of the conventional tool group. Of particular note is the absence of the classical typological core group of end-scrapers and truncations. Apart from a single end/scrapper from Wielkie Radowiska, Wąbrzeźno district, none of the other tools represents classical forms of typological tools. In the place of such forms as trapezes, borers and side-scrapers present in older phases, only amorphous tool types, such as retouched blades and retouched flakes (2 items), but especially unidentified ones (3 items), occur in LBK III.

It may be understood that this difference is decisive not only in the decline in the nominal quantity of the tools themselves, but also in the distinct change in the role of Jurrasic-Cracow flint in the latest stage of the LBK in the Lowland.

### Function and purpose of Jurrasic-Cracow flint materials at Lowland LBK sites

Significant data on the role of Jurrasic-Cracow flint artefacts at Lowland LBK sites can be supplied by the results of traceology. Analyses aimed at determining the function and purpose of flint in LBK societies were also conducted in the case of inventories from Kuyavia and Chełmno Land (Winiarska-Kabacińska 2003; Małecka-Kukawka 1992, 2001). It should be noted that there are glaring disproportions between the intensity and degree of advance in the research of the two regions.

Particularly effective are papers by Jolanta Małecka-Kukawka, who analysed flint inventories of the following LBK sites from Chełmno Land: Boguszewo 41, Boguszewo 43a (Grudziądz district), Annowo 7, Gruta 52 (Grudziądz district), Wielkie Radowiska 22 and 24 and Bocień 5 (Małecka-Kukawka 2001: 32, 2012). These are supplemented by the later papers of Grzegorz Osipowicz on the flint assemblage from Małe Radowiska 17, Wąbrzeźno district (Osipowicz *et al.* 2012).

In the context of the subject discussed here, it is notable that in this research particular emphasis is placed on the presence of imported finds made of Lesser Poland raw materials, with Jurrasic-Cracow flint playing a vital role (Małecka-Kukawka 2001: 159). In order to assess the role and specificity of this raw material, a series of questions was posed, covering such issues as the way tools made of Jurrasic-Cracow flint were used and whether they had any particular use that diverged from that of analogical forms of local flints.

As a result of the research conducted on a sample numbering 165 pieces of Jurrasic-Cracow flint, 86 types of functional application were identified, which gives a fairly high rate of using a single tool (Małecka-Kukawka 2001: 162). Such a result indicates the considerable significance of imported raw materials in the context of technologically specialised economic activity.

The functional characteristics of Jurrasic-Cracow flint artefacts from Chełmno Land are particularly interesting. Małecka-Kukawka distinguishes the following functional tools: hide scrapers (18), hide burins (1), wood scrapers (16), wood burins (9), wood chisels (1), whittles (1), bone/antler scrapers (1), bone/antler burins (3), cereal sickle inserts (8), cereal sickle inserts/grass knives (1), and meat knives (23). Two areas of application of products of Jurrasic-Cracow flint clearly emerge: for processing animal products (meat, hide, bone/antler: 46 items) and for wood-working (27 items). Jurrasic-Cracow flint artefacts together with another imported raw material – chocolate flint – are the dominant raw material group in the category of tools also connected with cereal harvesting; against this



Table 3. Percentage of tools in Jurrasic-Cracow flint inventories from selected sites.

Sites	Tools (%)	Others (%)	Total
Grabie 4, Aleksandrów Kujawski dist.	61	39	31
Gruta 52, Grudziądz dist.	16	84	32
Boguszewo 41, Grudziądz dist.	19	81	86
Boguszewo 43a, Grudziądz dist.	21	79	29
Ryńsk 42, Wąbrzeźno dist.	0	100	1
Annowo 31, Grudziądz dist.	75	25	4
Bożejewice 22/23, Mogilno dist.	47	53	15
Rożniaty 2, Inowrocław dist.	100	0	1
Ludwinowo 7, Włocławek dist.	13	87	15
Siniarzewo 1, Aleksandrów Kujawski dist.	40	60	15
Miechowice 4, Włocławek dist.	18	82	28
Miechowice 7, Inowrocław dist.	26	74	43
Kościelna Jania 5, Starogard Gdański dist.	0	100	4
Miechowice 4, Włocławek dist.	55	45	11
Chabsko 40, Mogilno dist.	0	100	3
Bocień 5, Toruń dist.	0	100	1
Rzadkwin 22, Mogilno dist.	0	100	1
Małe Radowiska 17, Wąbrzeźno dist.	25	75	4
Wielkie Radowiska 24, Wąbrzeźno dist.	23	77	13
Olsza 9, Mogilno dist.	0	100	1
Brześć Kujawski 4, Włocławek dist.	13	87	30
Kuczkowo 5, Aleksandrów Kujawski dist.	0	100	5
Żabienko 12, Mogilno dist.	0	100	4

background local Baltic erratic flints were of marginal importance.

It is also worth emphasising that in the light of traceological analysis, the dominant functional category here, i.e. meat knives (as many as 93 items altogether), is composed solely of raw, unretouched blades made exclusively of Lesser Poland raw materials, with a complete lack of analogical tools of local Baltic erratic flints. According to the author of this research, these observations provide grounds for claiming that in the LBK tradition there were rigorous rules for the production and use of meat knives (Małecka-Kukawka 2001: 168). Perhaps this conclusion should be perceived as the key to understanding the 'Jurrasic-Cracow flint phenomenon' in the Lowland LBK inventories.

Against the background of the microwear analysis in Chełmno Land outlined above, the results of analogical studies on Kuyavian assemblages are considerably more modest. Among LBK sites from the Brześć Kujawski, Włocławek district, and Osłonki region only two Jurrasic-Cracow flint artefacts have been analysed: a borer from Brześć Kujawski 4 and a borer combined with an end-scraper from Miechowice 4, Włocławek

district. No traces of use were identified on the first specimen, while the second is connected with wood working (Grygiel 2004).

In conclusion, the state of traceological studies on LBK inventories enables the position of artefacts of imported raw materials in the overall economic activity undertaken within LBK settlements to be approximately determined.

### Discussion

The analysis of the percentage share and the technological structure of Jurrasic-Cracow flint artefacts at LBK Lowland sites, despite all of the limitations presented in this work, demonstrated clear tendencies and significant chronological differences within this culture. It is worth presenting them again here in the wider context of the development of the local Lowland LBK communities.

The first issue is that of the origin of these communities. Although their general southern, Lesser Poland provenance seems indisputable with regard to all cultural traits, it is, nonetheless, flint materials from

Table 4. Tool types made of Jurassic-Cracow flint from selected sites.

Chronology	Sites	end-scrapers	truncations	ret. blades	ret. flakes	trapezes	borers	side-scrapers	others
Phase I	Boguszewo 41, Grudziądz dist.	4	4	3		1	4		
	Boguszewo 43a, Grudziądz dist.	3	3						
	Grabie 4, Aleksandrów Kujawski dist.	5	5	5	4				
	Gruta 52, Grudziądz dist.	3							2
Phase IIA	Annowo 31, Grudziądz dist.		2					1	
	Bożejewice 22/23, Mogilno dist.	4	1	1					1
	Ludwinowo 7, Włocławek dist.			1		1			
	Miechowice 4, Włocławek dist.	1		2			1	1	
	Miechowice 7, Inowrocław dist.	6	2						3
	Rożniaty 2, Inowrocław dist.	1							
Siniarzewo 1, Aleksandrów Kujawski dist.	2	1	1	2					
Phase IIB	Miechowice 4, Włocławek dist.	2	1	2	1				
Phase III	Brześć Kujawski 4, Włocławek dist.	1		1	2				
	Małe Radowiska 17, Wąbrzeźno dist.			1					
	Wielkie Radowiska 24, Wąbrzeźno dist.								3
	<b>SUM</b>	<b>32</b>	<b>19</b>	<b>17</b>	<b>9</b>	<b>2</b>	<b>5</b>	<b>2</b>	<b>9</b>

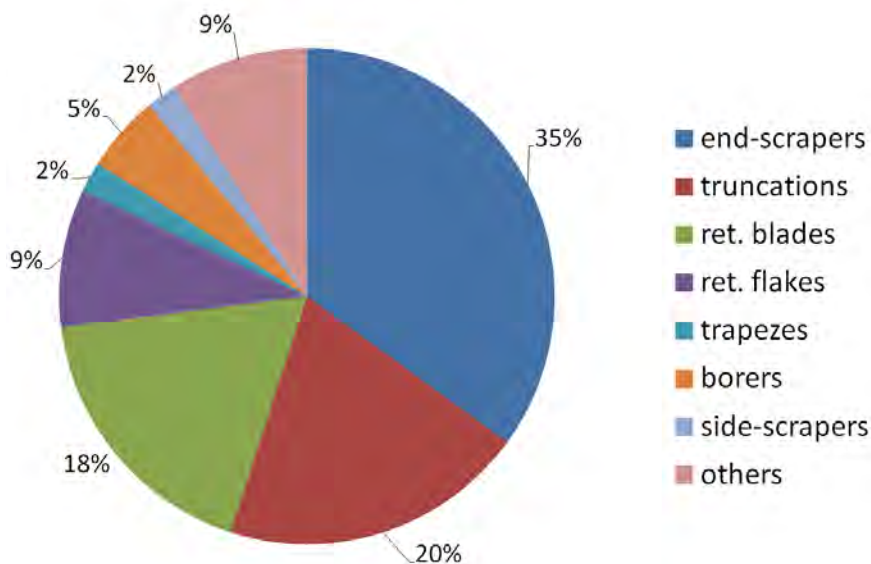


Fig. 3. Percentage of tool types made of Jurassic-Cracow flint from sites presented in Table 4.  
Drawn: M. Wąs.

Kuyavia and Chełmno Land that show the strength of that connection clearly. This is evidenced not only by the high percentage share of Jurassic-Cracow flint in Lowland LBK I; it was also the most important raw material for the Lesser Poland LBK communities. It should also be noted that at Lowland LBK I sites there

are no clear indications of the adaptation of local flint sources for the production of conventional-type tools using blade technology. Perhaps local raw materials (especially Pomeranian flint, the so-called ‘swallow-eggs’) could not be exploited intensively for at least four reasons (of equivalent status or not):

- insufficient knowledge of local raw materials and places where they occurred in great quantities;
- inappropriate technical properties and parameters of the local raw material to fulfil production needs, and particularly the production of blades and blade tools (e.g. truncations, sickle inserts, etc.);
- insufficient knowledge and know-how of processing local raw-materials (erratic Baltic flint and pebble-shaped Pomeranian flint) using blade technology;
- the considerable 'cultural' significance of products made of 'southern' raw materials.

Although there are distinct differences in quantities among LBK I sites, and also in proportions among individual technological groups within particular inventories (e.g. Boguszewo 41, Grudziądz district and Grabie 4, Aleksandrów Kujawski district), a general tendency is visible nevertheless. The most significant attribute of the specificity of this phase must be the lack of splintered pieces and splintered flakes in the group of Jurrasic-Cracow flints. Assuming that this reduction method is the most typical for local flintworking (based mainly on Baltic erratic flint), one can conclude that in this phase Jurrasic-Cracow flint was not exploited in this way. On the other hand, there is an absence of clear indications that would enable researchers to state unequivocally that Jurrasic-Cracow flint was reduced using blade core methods within LBK sites in the study area. It cannot, in fact, be excluded that products of classical blade/flake exploitation could have appeared 'ready-made' in the form of imports. This idea fits in well with the relatively numerous group of tools in which the forms making up the core of tools in the LBK – end-scrapers and truncations – are particularly visible (Tabs. 3 and 4; Fig. 3). It should be clearly emphasised that the question of the functioning of local flintworking requires further research, and in particular the identification of products typical for flint-workshops.

Lowland LBK I flint inventories seem to confirm the preconceived idea of the origins of the LBK in the Lowland as being the consequence of demographic migration. Newcomers slowly adapted to the new terrain and, with time, the links to the old region weakened. This is the context in which we should view the raw material structure of flint assemblages of LBK IIA, which, on the basis of pottery analysis, can be regarded as a direct continuation of LBK I and represents the same foremost, original, migration wave and its implications in the Lowland (Pyzel 2014).

Gradually, a local specificity in flintworking begins to emerge in this phase, which can be seen in the example of products of the splintered technique in LBK II. Although in total there are only 20 artefacts (splintered

pieces and splintered flakes), their presence should not be trivialised. In a sense, they can be interpreted as an effect of the change in the position of imported flint in LBK flintworking as a whole in the Lowland. It cannot be excluded that behaviours connected with the origins of local flintworking in the LBK in Kuyavia and Chełmno Land are apparent here, which gradually developed 'technologically' independently from settlement and production centres in the south. Although the above thesis is as yet poorly supported by the sources, this line of interpretation seems to be worth studying further. The growing role of chocolate flint should also be seen in this context, its significance in the Lesser Poland LBK communities being much smaller than that of Jurrasic-Cracow flint, and it being a raw material typical for the Lowland communities. That is also why these raw materials should not be treated together. From the time when LBK communities in Kuyavia and Chełmno Land became more autonomous, Jurrasic-Cracow flint played a marginal role in their flintworking. It is nevertheless interesting that it did not disappear completely; quite the contrary – after a certain regress in LBK IIB – in LBK III it occurs sparsely, but at the majority (60%) of sites throughout the Lowland. In part this increased presence can be explained by changes in the production of this flint in Lesser Poland, which is reflected in the intensification of large-scale exchange over time. The percentage of this raw material increases in many regions in later phases, e.g. in Lower Silesia (Furmanek and Masojć 2016), Moravia (Mateiciucová 2008; Kuča *et al.* 2009) or Bohemia (Lech 1989). It is interesting that such interregional contacts, mirrored by the presence of specific flint raw material, are not reflected in other kinds of material culture, for example pottery. Each region maintains its specific features and identity, including the Lowland communities, and this distinguishes the later developments from the beginning of the settlement there, with still existing strong genetic connections with the south.

However, for the regions mentioned above, Jurrasic-Cracow flint had more or less a basic technological function and its supply was an economic necessity. It was definitely not the case in LBK III in the Lowland, where only single artefacts reached the local settlements. At this point, a change in the tools' structure should be pointed out, as it may be evidence of a distinct shift in the role of Jurrasic-Cracow flint in the latest stage of the LBK in the Lowland.

Also the contemporaneity of the latest phases in different regions may turn out to be only apparent. Thus the disappearance of the LBK and the beginning of the Stroke Band Pottery Culture in Bohemia, Lower Silesia and Moravia can be dated even as early as 5100 cal BC (Kulczycka-Leciejewiczowa 1997: 145), which is contemporaneous only with the beginnings of LBK

III in the Lowland! In addition, in Bohemia, Moravia and Lower Silesia the share of Jurassic-Cracow flint declines just before the end of the LBK (Lech 1987), so even earlier. In the Lowland it is present until the very end of this culture, for example at Wielkie Radowiska 24, Wąbrzeźno district dated to 4900–4850 cal BC (Pyzel 2010: 96 and tab. 23, further references therein). Additionally, it is also present, albeit to a slightly lesser extent, at some sites of the subsequent post-LBK phase I in Kuyavia (Kabaciński 2010: 185 and fig. 59). Although this matter requires further detailed study, a cautious hypothesis may be formulated that connections of the Jurassic-Cracow flint, could have survived the demise of the LBK. This is interesting in the context of the discussions as to the continuation of, or the hiatus in, the post-LBK settlement of the Lowland.

In the subject literature generally, the dominant hypothesis is that of the collapse of communication networks organising flint supply, even in the scenario of an undoubted cultural continuation (e.g. Lower Silesia; Furmanek and Masojć 2016) at the end of the LBK. The example of Jurassic-Cracow flint in the Lowland shows, nevertheless, that every type of raw material should be examined separately. Above all, Jurassic-Cracow flint and chocolate flint must not be analysed together – they were raw materials with a different economic and social significance. Jurassic-Cracow flint definitely did not play any important technological or economic function in the late flintworking of the Lowland LBK. Maybe its meaning was much more of a semiotic nature. In the time when the LBK world began to collapse the Lowland communities might have referred to some material signs to emphasise their ancestry and identity. Jurassic-Cracow flint could probably have acted from the beginning as an ‘allocative resource’ (*in sensu* Giddens; see also the role of Szentgál radiolarite in Mateiciucová 2010) and this could have been mobilised at a time when the continuity became endangered.

Unfortunately, we do not know exactly what the contacts between the Lowland communities and Lesser Poland were like because the end of the LBK there has not been well investigated. We do not know how to date the Żeliezovce phase (e.g. Dębiec and Dzbyński 2007; Czekaj-Zastawny 2014: 93–105; Valde-Nowak 2014: 32), and the beginnings of Malice culture are equally enigmatic. It is also not known who supplied the latest LBK and earliest post-LBK communities from the Lowland with Jurassic-Cracow flint.

Although research on the distribution of raw flint materials has a long tradition in Polish archaeology of the Neolithic, it should be developed further as an area of unusual cognitive potential. At the same time, we should highlight the need for a change in the direction of archaeological investigations and for the formulation

of new research problems, whose character should be correlated with the growing state of sources in recent years and with the scope of knowledge about the earliest Neolithic settlement on the Lowland.

Based in part on the results obtained in this paper and the shortcomings that became apparent during the research, we propose that the questions of the spread and use of non-local raw materials by LBK communities on the Lowland (e.g. Kuyavia) should be tackled as far as possible taking into account the divergences among the individual species of flint (both petrographic and geological, as well as their ‘technological’ properties). We are convinced that the convention of treating several species together as a group of so-called Lesser Poland flints blurs the outwardly discrete differences between the various raw materials, making it difficult (or even impossible) to observe and perceive significant differences in the ways they ‘functioned’ and to identify their real role as so-called exotic raw materials among the early farming communities of the Lowland. This is all the more important as studies on the distribution of raw materials among prehistoric communities act as markers of wider phenomena of a ‘culture-forming’ nature, and of course archaeology aspires to identify them, particularly in such an ‘attractive’ period of prehistory as the beginning of the Neolithic.

*Translated by Hazel Pearson*

## References

- Balcer, B. 1983. *Wytwórczość narzędzi krzemienych w neolicie ziem Polski*. Wrocław, Warszawa, Kraków, Gdańsk, Łódź.
- Czekaj-Zastawny, A. 2014. *Brzezcie 17: Osada kultury ceramiki wstęgowej rytej*. Kraków. *Via archaeologica. Źródła z badań wykopaliskowych na trasie autostrady A4 w Małopolsce*.
- Czerniak, L., Pyzel, J. and Wąs, M. 2016. The beginning of the Neolithic in Eastern Pomerania. Settlement of the Linear Band Pottery Culture at Kościelna Jania, Comm. Smętowo Graniczne, site 13, *Sprawozdania Archeologiczne* 68: 193–222.
- Dębiec, M. and Dzbyński, A. 2007. Die ersten Radiokarbon-darierungen aus der Siedlung der Linearbandkeramischen Kultur in Zwięczyca, Gm. Boguchwała. *Sprawozdania Archeologiczne* 59: 53–62.
- Domańska, L. 1988. Recepcja małopolskich surowców krzemienych wśród kujawskich społeczeństw cyklu wstęgowego. In A. Cofta-Broniewska (ed.), *Kontakty pradziejowych społeczeństw Kujaw z innymi ludami Europy*: 81–91. Inowrocław.
- Domańska, L. 1995. *Geneza krzemieniarstwa kultury pucharów lejkatych na Kujawach*. Łódź.
- Domańska, L. 2004. Materiały krzemienne z badań wykopaliskowych na trasie gazociągu Mogilno-Włocławek i Mogilno-Wydartowo. In J. Bednarczyk

- and A. Koško (eds), *Od długiego domu najstarszych rolników do dworu staropolskiego: Wyniki badań archeologicznych na trasach gazociągów Mogilno-Włocławek i Mogilno-Wydartowo*: 503–513. Poznań.
- Domańska, L. 2016. *Change and continuity. Traditions of the flint technology as seen from the Tążyca Valley perspective, Kuyavia*. Łódź.
- Domańska, L. and Kabaciński, J. 2010. Wczesnoneolityczne materiały krzemienne ze stanowisk Kuczkowo 1 oraz Siniarzewo 1, woj. kujawsko-pomorskie. *Fontes Archaeologici Posnanienses* 46: 137–181.
- Furmanek, M. and Masojć, M. 2016. The use of erratic stone by the communities of Linear Pottery culture in view of the excavations in Kostomłoty, site 27, province of Lower Silesia. *Archeologia Polona* 54: 181–200.
- Gabałówna, L. 1963. Ślady osadnictwa kultur z cyklu wstęgowych w Radziejowie Kujawskim. *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi, Seria Archeologiczna* 9: 25–95.
- Gronenborn, D. 1997. *Silexartefakte der ältestbandkeramischen Kultur*. Bonn.
- Grygiel, R. 2004. *Neolit i początki epoki brązu w rejonie Brześcia Kujawskiego i Osłonek I. Wczesny neolit. Kultura ceramiki wstęgowej rytej*. Łódź.
- Kabaciński, J. 2010. *Przemiany wytwórczości krzemieniarskiej społeczności kultur wstęgowych strefy wielkodolinnej Niżu Polskiego*. Poznań.
- Kuča, M., Přichystal, A., Schenk, Z., Škrdla, P. and Vokáč, M. 2009. Lithic raw material procurement in the Moravian Neolithic: the search for extra-regional networks. *Documenta Praehistorica* 36: 313–326.
- Kulczycka-Leciejewiczowa, A. 1997. *Strachów: Osiedla neolitycznych rolników na Śląsku*. Wrocław.
- Lech, J. 1979. Krzemieniarstwo w kulturze społeczności ceramiki wstęgowej rytej w Polsce. Próba zarysu. In W. Wojciechowski (ed.), *Początki neolityzacji Polski południowo-zachodniej*: 121–136. Wrocław.
- Lech, J. 1981. *Górnictwo krzemienia społeczności wczesnorolniczych na Wyżynie Krakowskiej: Koniec VI tysiąclecia-1 połowa IV tysiąclecia p.n.e.* Wrocław-Warszawa-Kraków-Gdańsk-Łódź, Zakład Narodowy im. Ossolińskich.
- Lech, J. 1987. Danubian raw material distribution patterns in eastern central Europe. In G. Gale de Sieveking and M. H. Newcomer (eds), *The human uses of flint and chert: Proceedings of the Fourth International Flint Symposium held at Brighton Polytechnic 10-15 April 1983*: 241–248. Cambridge.
- Lech, J. 1988. Rewolucji neolitycznej i krzemieniarstwie: Część I. Wokół metody. *Archeologia Polski* 33(2): 273–345.
- Lech, J. 1989. A Danubian Raw Material Exchange Network: A Case Study from Byłany. In J. Rulf (ed.), *Byłany Seminar 1987: Collected Papers*: 111–120. Praha.
- Lech, J. 2003. Mining and siliceous rock supply to the Danubian early farming communities (LBK) in eastern central Europe: a second approach. In L. Burnez-Lanotte (ed.), *Production and Management of Lithic Materials in the European Linearbandkeramik: Actes du XIVème Congrès UISPP, Université de Liège, Belgique, 2-8 septembre 2001*: 19–30. Oxford, Archaeopress. British Archaeological Reports International Series 1200.
- Lech, J. 2006. Wczesny i środkowy neolit Jury Ojcowskiej. In J. Lech and J. Partyka (eds), *Jura Ojcowska w pradziejach i w początkach państwa polskiego*: 387–438. Ojców.
- Małecka-Kukawka, J. 1992. *Krzemieniarstwo społeczności wczesnorolniczych ziemi chełmińskiej (2 połowa VI-V tysiąclecie p.n.e.)*. Toruń.
- Małecka-Kukawka, J. 2001. *Między formą a funkcją: Traseologia neolitycznych zabytków krzemiennych z ziemi chełmińskiej*. Toruń.
- Małecka-Kukawka, J. 2008. O mezolocie, neolocie i krzemieniu czekoladowym. In W. Borkowski, J. Libera, B. Sałacińska and S. Sałaciński (eds), *Krzemień czekoladowy w pradziejach. Materiały z konferencji w Orońsku, 08-10.10.2003*: 185–202. Warszawa-Lublin. Studia nad gospodarką surowcami krzemiennymi w pradziejach 7.
- Małecka-Kukawka, J. 2012. Traseologia w badaniach krzemieniarstwa najstarszych społeczności rolniczych na Niżu Polskim. Materiały krzemienne kultury ceramiki wstęgowej rytej ze stanowiska 5 w Bocieniu, gm. Chełmża, woj. kujawsko-pomorskie. *Acta Universitatis Nicolai Copernici Archeologia* 32: 113–160.
- Mateiciucová, I. 2008. *Talking stones. The chipped stone industry in Lower Austria and Moravia and the beginnings of the Neolithic in Central Europe (LBK), 5700-4900 BC*. Brno.
- Mateiciucová, I. 2010. The beginnings of the Neolithic and raw material distribution networks in eastern Central Europe: symbolic dimensions of the distribution of Szentgál radiolarite. In D. Gronenborn and J. Petrasch (eds), *Die Neolithisierung Mitteleuropas. The Spread of the Neolithic to Central Europe Internationale Tagung, Mainz 24. bis 26. Juni 2005*. Mainz: 273–300.
- Osipowicz, G., Balonis-Chyb, A., Pomianowska, H. and Wałaszewska, M. 2012. Materials of Linear Band Pottery Culture from site 17 in Małe Radowiska, Wąbrzeźno Comm., Kujawsko-Pomorskie Voivodeship. *Sprawozdania Archeologiczne* 64: 215–67.
- Pyzel, J. 2010. *Historia osadnictwa społeczności kultury ceramiki wstęgowej rytej na Kujawach*. Gdańsk.
- Pyzel, J. 2014. Findet sich im Norden Polens die älteste Bandkeramik? Probleme der Periodisierung der polnischen Linearbandkeramik. In T. Link and D. Schimmelpfennig (eds), *No future? Brüche und Ende*

- kultureller Erscheinungen. Fallbeispiele aus dem 6.–2. Jahrtausend v. Chr.*: 83–93. Kerpen-Loogh.
- Rzepecki, S. 2013. Beside the mainstream. Some reflections on the LBK in Kujavia. *Sprawozdania Archeologiczne* 65: 79–130.
- Valde-Nowak, P. 2014. Long Houses on the hilltop – Camps in the Mountains: Some Aspects of the Neolithic in the Dunajec Project. In T. L. Kienlin, P. Valde-Nowak, M. Korczyńska, K. Cappenberg and J. Ociepka (eds), *Settlement Communication and Exchange around the Western Carpathians: International workshop held at the Institute of archaeology, Jagiellonian University, Kraków October 27–28, 2012*: 27–49. Oxford.
- Werra, D. 2013. *Społeczności kultury ceramiki wstęgowej rytej na ziemi chełmińskiej*. Unpublished PhD Thesis, Nicolaus Copernicus University, Toruń.
- Wilczyński, J. 2014a. Krzemienny oraz obsydianowy inwentarz kultury ceramiki wstęgowej rytej ze stanowiska Brzezie 17, gm. Kłaj. In A. Czekaj-Zastawny (ed.), *Brzezie 17: Osada kultury ceramiki wstęgowej rytej*: 499–546. Kraków.
- Wilczyński, J. 2014b. Neolityczne materiały krzemienne z wielokulturowego stanowiska 10, 11 w Targowisku, pow. wielicki. In A. Zastawny (ed.), *Targowisko, stan. 10, 11. Osadnictwo z epoki kamienia*: 459–534. Kraków.
- Winiarska-Kabacińska, M. 2003. *Analiza funkcjonalna wybranych zabytków krzemiennych kultury ceramiki wstęgowej rytej z terenu Kujaw*, Unpublished manuscript at Muzeum Archeologiczne i Etnograficzne, Łódź.
- Wiślański, T. 1959. Wyniki prac wykopaliskowych w Strzelcach, w pow. mogileńskim, w latach 1952 i 1954. *Fontes Archaeologici Posnanienses* 10: 1–95.
- Zimmermann, A. 1995. *Austauschsysteme von Silexartefakten in der Bandkeramik Mitteleuropas*. Bonn.