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ŚWIECIECHÓW FLINT AND THE TRANS-REGIONAL INTERACTIONS OF THE FUNNEL BEAKER POPULATIONS

ABSTRACT

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This paper deals with the distribution of Świeciechów flint and trans-regional interactions of the Funnel Beaker populations in the territory of modern Poland. Analysis of the numerical distribution of artefacts made it possible to draw a conclusion regarding the close connection in the 'flow' of Świeciechów and Volhynian flint. Two 'routes' of transportation of this raw material to Kujawy were identified. The first 'route' is associated with the Vistula river, while the second 'route', to a less extent confirmed by empirical evidence, indicates the raw material flow from the south.

Keywords: Funnel Beaker culture, Świeciechów flint, trans-regional interaction, Kuyavia, Małopolska
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INTRODUCTION

Since Renfrew's (Renfrew *et al.* 1968; Renfrew 1975; 1977) remarkable study on trade and culture process in Anatolia, the spatial distribution of raw materials, such as obsidian and flint, have been actively studied in archaeology and raising discussions on wide-scale

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interactions of ancient populations, their economy and social organization. Considering the multi-linear cultural development, this issue may be solved through related case studies. Hence, one of the most important issues in this set concerns the trans-regional cultural influences following the flow of raw materials over large territories in different continents and periods of time (e.g. Renfrew *et al.* 1968; Renfrew 1975; Hodder 1974; Balcer 1975; Thalmann 2006; Ortega *et al.* 2014; Barrientos *et al.* 2015; Ibáñez *et al.* 2015; Sobkowiak-Tabaka *et al.* 2015).

This paper deals with the spatial distribution of Świeciechów flint and the trans-regional interactions of the Funnel Beaker populations in the territory of modern Poland, c. 4000-2900 BC (Nowak 2009, 347-349; Kruk and Milisauskas 1999, 120). Sources of Świeciechów, banded and chocolate flint are located in the northern and northeastern outskirts of Łysogóry (Balcer 1983, 51). Flint processing of the populations of the Funnel Beaker culture (hereinafter – FBC) in this area included the mine in Świeciechów-Laski located in the eastern bank of the Vistula river (Balcer 1975, 149-152; 1983, 51; 2002; Wiślański 1979, 228). Raw materials from the mine were used for the production of macro-lithic blades and axes at the settlement of Ćmielow (Balcer 2002). It should be noted that besides flint-knapping population of this settlement practiced extensive agriculture (Kruk 1980, 327-329; Kruk and Milisauskas 1999, 147-161; Pelisiak *et al.* 2006, 65). Our paper aims to answer the following questions. Were there any patterns in the macro-regional distribution of Świeciechów flint? How does the amount of Świeciechów flint correlate with the quantity of Volhynian flint in the sites of Funnel Beaker culture? What was the place of Świeciechów flint in the trans-regional cultural influences of the FBC populations?

DATA INPUT AND SYSTEMATIZATION

Since only the comparison of complexes of a similar function is methodologically correct, our sample is deliberately limited to FBC settlements. The analysis considers FBC sites with assemblages of tools containing artefacts made of Świeciechów flint (Fig. 1). We should note that only published materials were used in this study. Special attention is paid to settlements where artefacts made of Świeciechów, Volhynian and other kinds of flint were found. The latter settlements mainly represent the early phase of the FBC (Table 1). It should be noted that certain sites were deliberately not included into the analysis. In some cases, the percentage of the raw material is impossible to estimate (for instance, Kraków-Nowa Huta-Mogila, site 62: Kluzik 2010). Other cases are represented by multi-layered sites (for instance, Radziejów Kujawski, site 4: Pelisiak and Rybicka 2003, 81-113; Pawłosiów, site 52: Dobrzyński and Piątkowska 2014, 257-277).

Only the sites with known relative dates were considered in order to analyze the trends in both space and time. Five of these settlements belong to the early phase of the Eastern group of the FBC; twenty four sites are dated by the classic phase, while two more belong

Table 1. Percentage of Świeciechów and Volhynian flint at the sites included into our sample (after Balcer 1983; 2002; 2002a; Bronicki, Hander 2008; Dobrzyński 2011; 2014; Domańska 1995; 2013; Gumiński 1989; Libera, Zakościelna 2011; Papiernik 2016; Pelisiak 2003; Rybicka 2017; Zawisłak 2013)

N	Site	Phase	Group	Percentage of Volhynian flint	Percentage of Volhynian and Świeciechów flint
1	Grzybów, site 23	Early	Eastern	1	2
2	Jasienica Sufczyńska, site 5	Early	Southeastern	100	100
3	Jezuicka Struga, site 17	Early	Eastern	3.3	6.6
4	Kawczyce	Early	Southeastern	1	2
5	Poczałkowo, site 38	Early	Eastern	2.7	3.9
6	Przybranówek, site 43	Early	Eastern	0.01	0.31
7	Sierakowo, site 8	Early	Eastern	0	8.4
8	Skołoszów, site 31	Early	Southeastern	90	90
9	Smólsk, site 2	Early	Eastern	1.52	1.52
10	Witoldów, site 1	Early	Eastern	1.1	1.1
11	Andrzejów, site 1	Classic	Eastern	0.72	0.86
12	Annopol, site 1	Classic	Eastern	11.3	18.9
13	Białe, site 14	Classic	Eastern	4.9	7.8
14	Ćmielów	Classic	Southeastern	0.02	43.92
15	Dobroń, site 1	Classic	Eastern	1	1.7
16	Gródek nad Bugiem	Classic	Southeastern	78.55	87.39
17	Grójec Wielki, site 1	Classic	Eastern	1	1
18	Huta Nowa, site 1	Classic	Eastern	3.5	7.7
19	Inowrocław-Mątwy, site 5	Classic	Eastern	1.5	4.5
20	Kamień Łukawski	Classic	Southeastern	0.1	79.1
21	Klementowice, site B	Classic	Southeastern	22	47
22	Kraków-Czerwony Prądnik	Classic	Southeastern	1	2
23	Krężnica Jara	Classic?	Southeastern	1	81
24	Nowy Młyn, site 6	Classic	Eastern	7.3	18.95
25	Opatowice, site 33	Classic	Eastern	0.4	1.4
26	Opatowice, site 36	Classic	Eastern	0.5	1.2
27	Opatowice, site 42	Classic	Eastern	2.3	3
28	Oslonki, site 2	Classic	Eastern	2.18	4.28
29	Oslonki, site 7	Classic	Eastern	1.41	1.41
30	Pliszczyn, site 9	Classic?	Eastern	26.4	42.9
31	Ptaszkowice, site 3	Classic	Eastern	0.22	1.08
32	Stefanów, site 3	Classic	Eastern	5.16	8.6
33	Szumów, site 10	Classic?	Southeastern	22	60
34	Szychowice	Classic	Southeastern	98	98.5

Table 1 cont.

N	Site	Phase	Group	Percentage of Volhynian flint	Percentage of Volhynian and Świeciechów flint
35	Tarkowo, site 23	Classic	Eastern	2	2
36	Tarkowo, site 50	Classic	Eastern	2	2.5
37	Wilkostowo 23/24	Classic	Eastern	8.6	9.6
38	Zawarża	Classic	Southeastern	15	17.5
39	Zawichost	Classic	Southeastern	0.41	96.48
40	Książnice Wielkie	Late	Southeastern	2.14	3.74
41	Raciborowice Kolonia, site 3	Late?	Southeastern	56.8	56.8
42	Stefanów, site 4	FBC-Baden	Eastern	0	5

to the late phase of the Southeastern group of the FBC (Książnice Wielkie: Burchard *et al.* 1991, 99) and the FBC-Baden horizon in Central Poland (Stefanów, site 4: Rybicka and Gowin 1994). It should be noted that the relative dates of one early site (Począkowo, site 38: Rzepecki 2004) and three classic phase settlements (Krężnica Jara: Rybicka 2017, 105; Szumów, site 10: Zawisłak 2013, 227-250; Zawichost: Balcer 1983, 148) are questionable. All these sites belong to the Eastern and Southeastern group of the FBC and occupy several micro-regions. More specifically, the settlements included into our study form eight clusters in space (Fig. 1). These are:

- Kujawy (Inowrocław-Mątwy, site 5, Nowy Młyn, site 6, Opatowice, site 42, Osłonki, site 2, Tarkowo, site 50 and Wilkostowo 23/24);
- Gostynin Lakeland (Anopol, site 1, Białe, site 14, Huta Nowa, site 1 and Stefanów, site 3);
- Grabia basin (Andrzejów, site 1, Dobroń, site 1 and Ptazkowice, site 3);
- two settlement clusters in Western Little Poland (Kraków-Nowa Huta-Mogiła, site 49, Książnice Wielkie; and Zawarża; Ćmielów, Kamień Łukawski and Zawichost),
- three settlement clusters in Lublin area (Klementowice, site B and Szumów, site 10; Krężnica Jara and Pliszczyn, site 9; Gródek nad Bugiem and Szychowice, site 1).

However, some areas of the FBC, including the territory between Lublin area and the Gostynin Lakeland, are not represented in the analysis due to the sampling criteria discussed above.

Let us consider the distribution of the percentage of Świeciechów flint in the overall flint assemblages of the analyzed sites. This parameter represents the 'importance' of tools made of Świeciechów flint in flint processing. According to the general trends in distribution of raw materials, the values of the chosen parameter should decrease with the increase of distance from the source following the power-law function (Renfrew 1975). Meanwhile

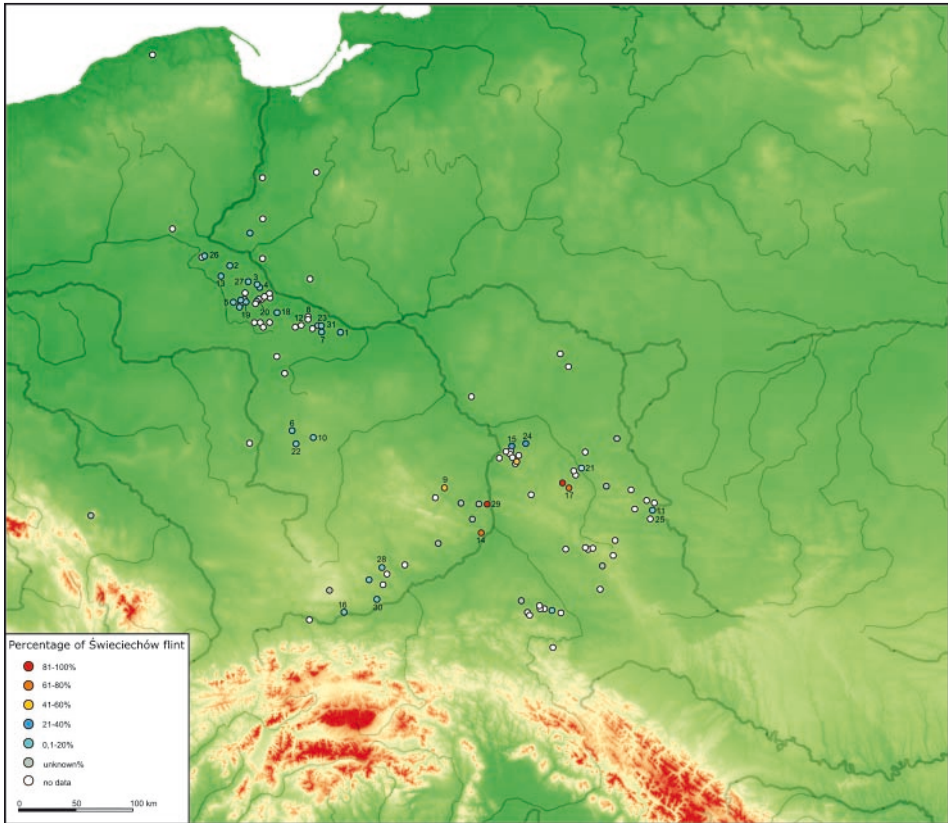


Fig. 1. Location of sites included into the sample: site numbers correspond to Table 1 (after Balcer 1983; 2002; 2002a; Bronicki and Hander 2008; Dobrzyński 2011; 2014; Domańska 1995; 2013; Gumiński 1989; Libera and Zakościelna 2011; Papiernik 2016; Pelisiak 2003; Rybicka 2017; Zawiślak 2013)

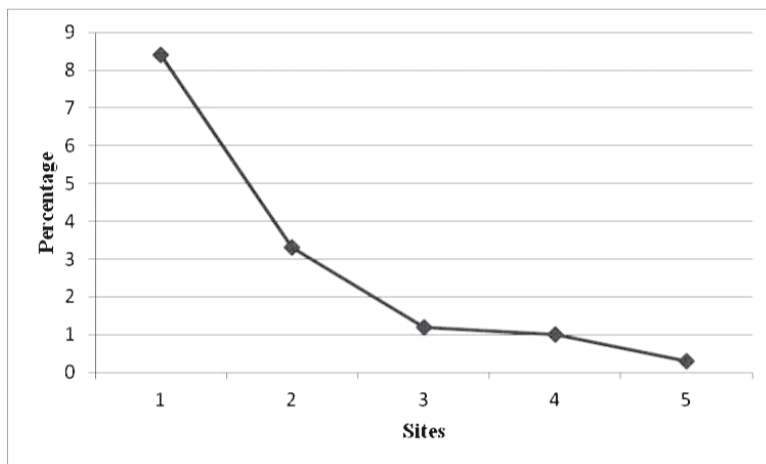


Fig. 2. Distribution of the percentage of Świeciechów flint in the early phase FBC site. 1 – Sierakowo, site 8; 2 – Jezuicka Struga, site 17; 3 – Początkowo, site 38; 4 – Grzybów, site 23; 5 – Przybranówek, site 43

different underlying processes may be resulted in the same distributions (Hodder 1974; Hodder and Orton 1976). Deviations from this trend require additional explanations.

Early sites of the Eastern group of the FBC may be divided into two groups according to the relative amount of Świeciechów flint in their assemblages. The first group is represented by the settlement of Sierakowo, site 8 in Kujawy with 8.4% of Świeciechów flint in its assemblage, while the second group includes four sites located in Kujawy and Gostynin Lakeland with 0.3-3.3% of Świeciechów flint in the related collections (Grzybów, site 23, Je-zuicka Struga, site 17, Poczalkowo, site 38 and Przybranówek, site 43; Fig. 2). The latter settlements belong to the Eastern group of the FBC (Prinke 1988; Rzepecki 2004; Rybicka 2004). Ceramic assemblages from these sites are not characterized by influences from the Southeastern group of the FBC and Tripolye (Rybicka 2017, 110-116), while the 'genetic' link between pottery from Sierakowo, site 8 and Poczalkowo, site 38 raises discussions (Rzepecki 2004, 47-48). Some of the ornamentation details noted in ceramic assemblages of these sites were used over long time. The latter makes their relative dating questionable, while the related absolute dates were not obtained (Włodarczyk 2006, 50; Rybicka 2011, 231-237).

Classic phase and late FBC sites are divided into three groups according to the chosen parameter (Fig. 3a). Sites of the first (Kamień Łukawski, Krężnica Jara and Zawichost) and the second group (Ćmielów and Szumów, site 10) are characterized by, respectively, 79-96% and 38-44% of Świeciechów flint in their assemblages. All these sites belong to the Southeastern group of the FBC. These settlements are noted in the micro-region, which has a source of raw material, or in the closest micro-regions (Fig. 1). The third group includes six subgroups with the following relative number of tools made of Świeciechów flint (3, b):

A: 25% (Klementowice, site B);

B: 16.5% (Pliszczyn, site 9);

C: 7.6-11.7% (Annopol, site 1, Gródek nad Bugiem and Nowy Młyn, site 6);

D: 5% (Stefanów, site 4);

E: 1.6-3.4% (Inowrocław-Mątwy, site 1, Książnice Wielkie, Osłonki, site 2, Stefanów, site 3 and Zawarża);

F: 0.1-1% (Andrzejów, site 1, Dobroń, site 1, Opatowice, site 42, Ptaszkowice, site 3, Tarkowo, site 50 and Wilkostowo 23/24).

All these settlements belong to the Eastern and Southeastern group of the FBC, excluding Stefanów, site 4 located in Gostynin Lakeland (Rybicka 2004) and Książnice Wielkie located in Little Poland (Burchard 1981). Most of sites located in Niż are characterized by ceramic styles which are to a different extent influenced by the traditions of the Southeastern group (Inowrocław-Mątwy, site 1: Kośko 1988; Tarkowo, site 50: Prinke 1987; Stefanów, site 3: Rybicka 2004; Wilkostowo, site 23/24: Rzepecki 2014) and Tripolye pottery styles (e.g. Annopol, site 1: Papiernik and Rybicka 2002; Rybicka 2017; Dobroń, site 1: Pelisiak 2003; Huta Nowa, site 1: Rybicka 2004; Nowy Młyn, site 6: Grygiel 2016; Opatowice, site 42: Kośko and Szmyt 2015; Rybicka 2017).

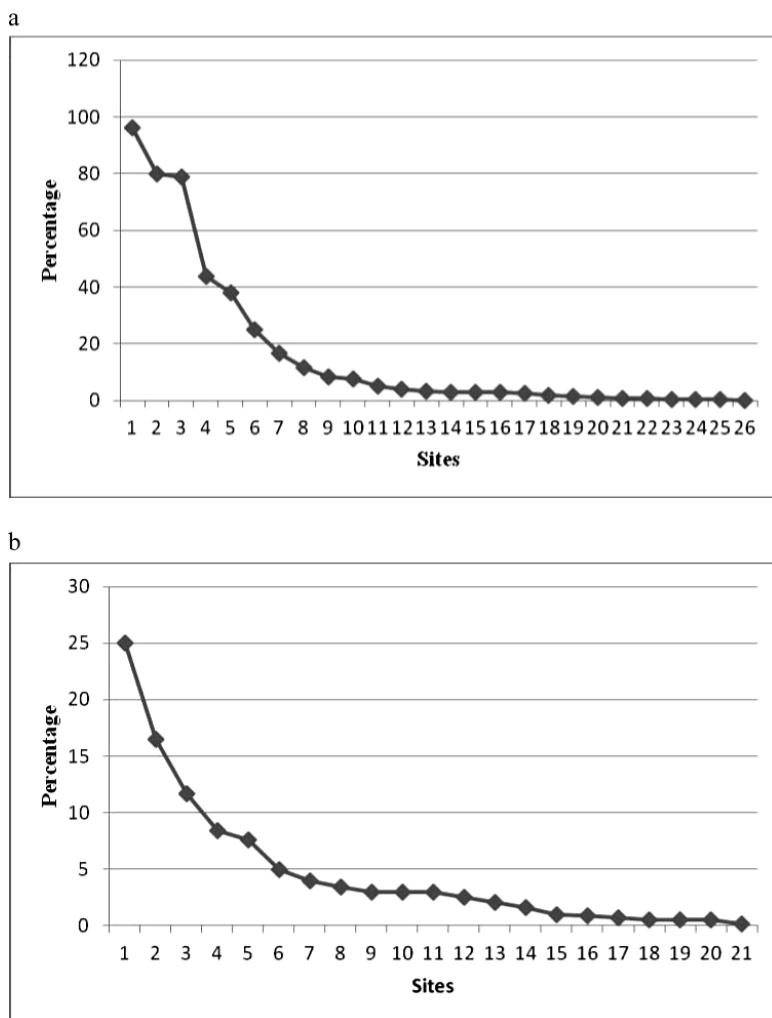


Fig. 3. Distribution of the percentage of Świeciechów flint in the classic phase and late phase FBC sites: a – all sites; 1 – Zawichost; 2 – Krężnica Jara; 3 – Kamień Łukawski; 4 – Ćmielów; 5 – Szumów, site 10; 6 – Klementowice, site B; 7 – Pliszczyn, site 9; 8 – Nowy Młyn, site 6; 9 – Gródek nad Bugiem; 10 – An-nopol, site 1; 11 – Stefanów, site 4; 12 – Huta Nowa, site 1; 13 – Stefanów, site 3; 14 – Inowrocław-Mątwy, site 5; 15 – Białe, site 14; 16 – Kraków-Nowa Huta-Mogiła, site 49; 17 – Zawarża; 18 – Ostonki, site 2; 19 – Książnice Wielkie; 20 – Wilkostowo 23/24; 21 – Ptaszkowice, site 3; 22 – Dobroń, site 1; 23 – Tar-kowo, site 50; 24 – Opatowice, stan. 42; 25 – Szychowice; 26 – Andrzejów, site 1; b – sites with the percentage of Świeciechów flint below 25%; 1 – Klementowice, site B; 2 – Pliszczyn, site 9; 3 – Nowy Młyn, site 6; 4 – Gródek nad Bugiem; 5 – Annpol, site 1; 6 – Stefanów, site 4; 7 – Huta Nowa, site 1; 8 – Ste-fanów, site 3; 9 – Inowrocław-Mątwy, site 5; 10 – Białe, site 14; 11 – Kraków-Nowa Huta-Mogiła, site 49; 12 – Zawarża; 13 – Ostonki, site 2; 14 – Książnice Wielkie; 15 – Wilkostowo 23/24; 16 – Ptaszkowice, site 3; 17 – Dobroń, site 1; 18 – Tarkowo, site 50; 19 – Opatowice, stan. 42; 20 – Szychowice; 21 – Andrzejów, site 1

The settlement of the Southeastern group of the FBC at Gródek nad Bugiem is characterized by the significant impact of Tripolye CII pottery stylistics (Kruk and Milisauskas 1981, 98; 1983; Gumiński 1989, 98-99; Rybicka 2017, 103-104, 106-107). Notable Tripolye influences were noted in Pliszczyn, site 9 (Chmielewski 2015a, fig. 15: 5; 2015b, 221). Some influences from the latter cultural complex were also identified in Ćmielow (Rybicka 2017, 114).

Sites of the subgroups A and B are located in micro-regions, which are close to the source of raw material. Settlements of the subgroups C, D and E are located in the large territory from Kujawy to Hrubieszowska valley. The sites of the subgroup F are located in Kujawy and Grabia basin. The latter distribution contradicts the general assumption considering the distance-decay in spatial distribution of raw materials and, hence, allows the hypothesis on alternative raw materials used and different 'routes' from the source of raw materials to Kujawy. Let us consider these assumptions more precisely, taking into account the Volhynian flint found at the sites included into our sample.

ALTERNATIVE RAW MATERIALS AND TRANSPORTATION 'ROUTES'

The importance of Volhynian flint in trans-regional interactions of the FBC has been actively discussed for almost forty years (Balcer 1981; 1983; Koško 1981; Lech and Młynarczyk 1981; Papiernik and Rybicka 2002; Libera and Zakościelna 2011; Dobrzyński 2014). Moreover, tools made of this raw material, when compared to the imports and imitations of Tripolye pottery, raised a number of discussions on the character of the interactions between the populations of the two cultural units. According to Balcer (1981), intensiveness and directions of interactions between the FBC and Tripolye populations are better identified by the finds of Volhynian flint. Koško (1981) interpreted the Volhynian flint in assemblages of Kujawian settlements within the context of direct migration of Tripolye groups from Volhyn. Later on, he also argued that artefacts made of this raw material found in Niż could also feature in the interactions between local FBC groups with the population of the FBC settlements in Volhyn (Koško 1988). The other important issue concerns the utilization of Świeciechów flint by the easternmost FBC population groups (Rybicka 2017).

Considering the significant role of Volhynian flint in the subsistence strategies of the FBC populations, we could question the distribution of Świeciechów flint in its possible relation to the distribution of Volhynian flint. Figure 4 shows the general comparison of the two kinds of raw material identified for the settlements of our sample, while Figure 5 represents the related correlations for the early and classic phase sites in Kujawy. According to the ratio of two raw materials, the settlements are combined into three groups.

I. Sites with the ratio of Volhynian to Świeciechów flint of 8.6 – 9.3 (Gródek nad Bugiem and Wilkostowo 23/24).

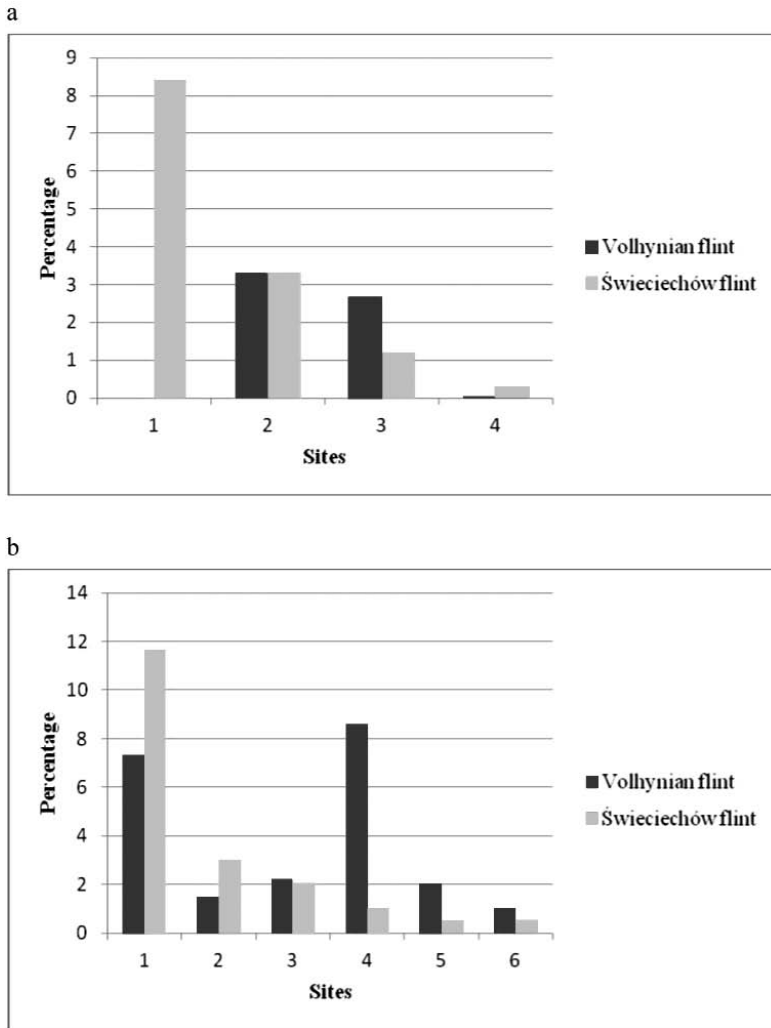


Fig. 4. Distribution of Świeciechów and Volhynian flint in Kujawy: a – early phase sites, 1 – Sierakowo, site 8; 2 – Jezuicka Struga, site 17; 3 – Poczalkowo, site 38; 4 – Grzybów, site 23; b – classic phase sites, 1 – Nowy Młyn, site 6; 2 – Inowrocław-Mątwy, site 5; 3 – Osłonki, site 2; 4 – Wilkostowo 23/24; 5 – Tarkowo, site 50; 6 – Opatowice, site 42

II. Sites with the ratio of Volhynian to Świeciechów flint of 4 – 6 (Andrzejów, site 1, Tarkowo, site 50 and Zawarża).

III. Sites with the ratio of Volhynian to Świeciechów flint of 0 – 2.3. Settlements of this are divided into three sub-groups:

IIIa. Sites with the ratio of Volhynian to Świeciechów flint of 2 – 2.3 (Początkowo, site 38 and Opatowice, site 42).

IIIb. Sites with the ratio of Volhynian to Świeciechów flint of 0.5 – 1.6 (Annopol, site 1, Dobroń, site 1, Grzybów, site 23, Inowrocław-Mątwy, site 5, Jezuicka Struga, site 17, Klementowice, site B, Książnice Wielkie, Nowy Młyn, site 6, Osłonki, site 2, Pliszczyn, site 9, Stefanów, site 3 and Szumów, site 10).

IIIc. Sites with the ratio of Volhynian to Świeciechów flint of 0 – 0.3 (Ćmielów, Kamień Łukawski, Krężnica Jara, Przybranówek, site 43, Ptaszkowice, site 3, Sierakowo, site 8, Stefanów, site 4 and Zawichost).

Settlements of the group I, Gródek nad Bugiem and Wilkostowo 23/24, within the context of Balcer's (1983, 181, 183) idea, probably, represent the starting and one of the ending points of the flow of this raw material from Volhyn to Kujawy (Balcer 1981; 1983). The settlements of Zawarża and Andrzejów, site 1 belonging to the group II clearly show the preference in choice for Volhynian flint, despite the source of Świeciechów flint being located relatively close by. Meanwhile, Świeciechów flint is also noted in the assemblages of settlements left by populations who 'preferred' Volhynian flint. It should be underlined that the relatively low relative number of both kinds of raw material in Andrzejów, site 1 should be taken into account (see below). Most probably, Tarkowo, site 50 belonging to the group II in its comparison to Wilkostowo 23/24, represents local specific in the regional network in Kujawy.

Settlements of the subgroup IIIa, Początkowo, site 38 and Opatowice, site 42 could mark the alternative route of the Świeciechów flint to Kujawy. Most probably, the ratio of Volhynian to Świeciechów flint at the sites of the subgroup IIIB is caused by different factors. Meanwhile, we could underline the notable location of settlements Klementowice, site B and Szumów, site 10 in approximately equal distance from sources of the raw material and representing different 'preferences' in terms of the choice of flint. In respect to the latter claim, we should note that the majority of axes found in the Southeastern group of the FBC were made of Świeciechów flint (Balcer 1983, 145; 2002a, fig. 1, 8; Dobrzyński 2011, 74; Sałaciński 2013, 264; Chmielewski 2015c, fig. 40, 4). Banded flint and, to a less extent, Volhynian flint was also used in the production of axes, for instance in Ćmielów (respectively, Balcer 1983, 145, fig. 23, 6; 2002, 127, 147). Macroolithic blades were made of raw materials of all three kinds (Volhynian flint: Balcer 2002a, fig. 3; Bronicki and Hander 2008, fig. 21, 3-10; Dobrzyński 2011, fig. 8, 3, 4, 5, 7; Chmielewski 2015c, fig. 38; Świeciechów flint: Dobrzyński 2011, 73, fig. 8, 1, 2, 6, 8; Sałaciński 2013, 269; Chmielewski 2015c, fig. 37; 39).

The location of settlements belonging to subgroup IIIc represents several patterns. Some sites of this group, including Zawichost, Kamień Łukawski and Ćmielów, are obviously located close to the source of Świeciechów flint. Moreover, Ćmielów and Zawichost are often considered as a 'settlement of producers' (Balcer 1983, 182; 2002). Przybranówek, site 43 is dated to the time when East-West connections were not yet well-established.

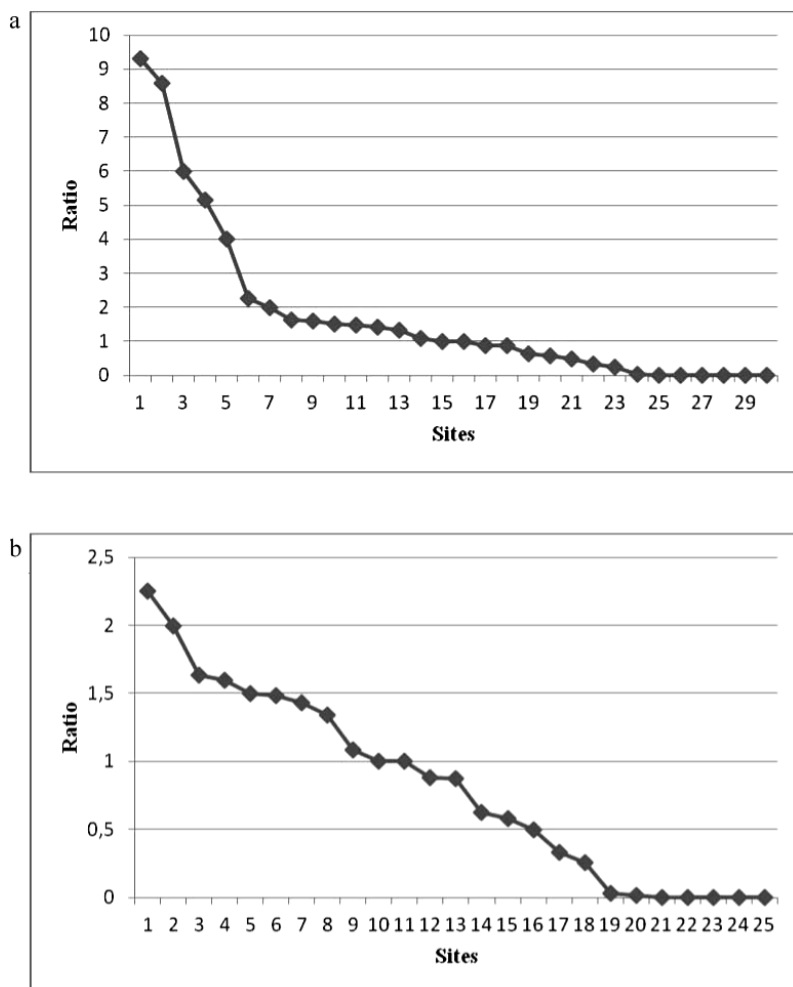


Fig. 5. Ratio of Świeciechów and Volhynian flint: a – all sites, (note that the value 196 obtained for Szychów is not represented in graphs), 1 – Gródek nad Bugiem; 2 – Wilkostowo 23/24; 3 – Zawarża; 4 – Andrzejów, site 1; 5 – Tarkowo, site 50; 6 – Początkowo, site 38; 7 – Opatowice, site 42; 8 – Białe, site 14; 9 – Pliszczyn, site 9; 10 – Stefanów, site 3; 11 – Annopol, site 1; 12 – Dobroń, site 1; 13 – Książnice Wielkie; 14 – Osłonki, site 2; 15 – Jezuicka Struga, site 17; 16 – Grzybów, site 23; 17 – Klementowice, site B; 18 – Huta Nowa, site 1; 19 – Nowy Młyn, site 6; 20 – Szumów, site 10; 21 – Inowrocław-Mątwy, site 5; 22 – Kraków–Nowa Huta-Mogiła, site 49; 23 – Ptaszkowice, site 3; 24 – Przybranówek, site 43; 25 – Krężnica Jara; 26 – Zawichost; 27 – Kamień Łukawski; 28 – Ćmielów; 29 – Stefanów, site 4; 30 – Sierakowo, stan. 8; b – settlements with the ratio of Świeciechów and Volhynian flint below 2.5; 1 – Początkowo, site 38; 2 – Opatowice, site 42; 3 – Białe, site 14; 4 – Pliszczyn, site 9; 5 – Stefanów, site 3; 6 – Annopol, site 1; 7 – Dobroń, site 1; 8 – Książnice Wielkie; 9 – Osłonki, site 2; 10 – Jezuicka Struga, site 17; 11 – Grzybów, site 23; 12 – Klementowice, site B; 13 – Huta Nowa, site 1; 14 – Nowy Młyn, site 6; 15 – Szumów, site 10; 16 – Inowrocław-Mątwy, site 5; 17 – Kraków–Nowa Huta-Mogiła, site 49; 18 – Ptaszkowice, site 3; 19 – Przybranówek, site 43; 20 – Krężnica Jara; 21 – Zawichost; 22 – Kamień Łukawski; 23 – Ćmielów; 24 – Stefanów, site 4; 25 – Sierakowo, stan. 8

Settlements in Kujawy, including the early phase Sierakowo, site 8 and FBC-Baden Stefanów, site 4, represent two chronologically different processes. The first settlement may indicate the earliest development of the FBC in the micro-region, when the intra- and inter-regional networks were weakly developed. The second site probably marks the dramatic shift in networks in the last phase of the FBC and FBC – Baden horizon. It should be noted that the mean and median values identify the increase of importance of Volhynian flint comparing to Świeciechów flint increasing from, respectively, 1.4 to 16.8% and from 1 to 6.4% for the whole sample from the early to the classic phase of the FBC. The settlement of Krężnica Jara, considering the later trend, may represent the colonization process of the micro-region from the neighboring settlement cluster in the West.

Correlations of two kinds of flint observed for the early and classic phase sites in Kujawy shows the increase of importance of Volhynian flint in the classic phase compared to its relative number in early phase. The observed patterns allow the question of the distribution of these raw materials in their close connection, however this does not mean their simultaneous transportation. This issue may be considered through the analysis of the relative number of Volhynian and Świeciechów flints. The related patterns are represented in figure 6. It should be noted that the summarized frequencies of these two kinds of raw material were multiplied by 10 to avoid negative values on a logarithmic scale.

The distribution of the early phase imported flints in Kujawy is close to the expected pattern with the exception of Przybranówek, site 43 (Fig. 6a). The latter divergent value is hard to explain. It may be caused by chronological factors and, hence, represent the changes in the importance of different kinds of flint over time, or may indicate the specifics of local networks in Kujawy. Three other settlements form the chain Sierakowo, site 8 – Jezuička Struga, site 17 – Poczalkowo, site 38. This chain represents the flow of raw materials from the south and their latter distribution through the regional networks.

The distribution of Volhynian and Świeciechów flint among the classic phase settlements clearly shows the two patterns of the raw material flow into this area. This is represented in the graph as two power law functions with different values of the scaling ratio (Fig. 6b). The first pattern represented by the sites Nowy Młyn, site 6 – Wilkostowo 23/24 – Inowrocław-Mątwy, site 5 identifies the chain along Vistula river. The second pattern represented by the settlements Osłonki, site 2, Opatowice, site 42 and Tarkowo, site 50 may be interpreted within the regional network of the distribution of raw materials from the Vistula river 'route'. Absolute dates and stylistics of ceramic complexes allow the dating of Wilkostowo, site 23/24 and Nowy Młyn, site 6 in the range of 3600 – 3400 BC, while Huta Nowa, site 1 are dated to the later time period, c. 3350 – 3100 BC (Rzepecki 2014, 257; Koško and Szmyt 2015; Grygiel 1979; 2016, 873-877; Rybicka 2017, 141-142). According to Grygiel (2016, 466-474), materials from Osłonki, site 2 are chronologically different and belong to the two time ranges, 3600 – 3400 and 3400 – 3000 BC.

The identified patterns allow several assumptions regarding the following patterns in the distribution of Świeciechów flint in the other micro-regions to be made. Settlements

Klementowice, site B and Szumów, site 10 in Lublin area, with their relative number Volhynian and Świeciechów flints, probably indicate the 'route' of transportation of both kinds of raw material further from the southeast to the northwest (cf. Balcer 1983, 181; Papiernik and Rybicka 2002, 164). This settlement cluster is notably located at the 'crossroads' of the river network, which could enable the easiest access to Świeciechów and Volhynian flint.

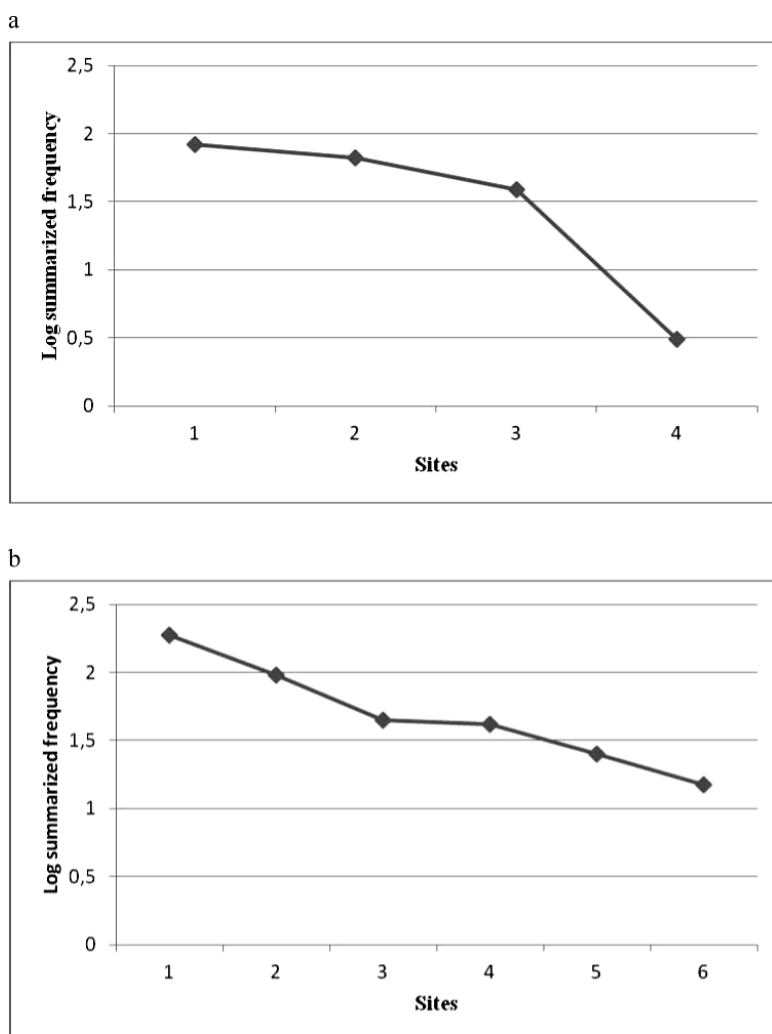


Fig. 6. Distribution of summarized percentage of Volhynian and Świeciechów flint in Kujawy: a – early phase sites, 1 – Sierakowo, site 8; 2 – Jezuicka Struga, site 17; 3 – Początkowo, site 38; 4 – Grzybów, site 23; b – classic phase sites, 1 – Nowy Młyn, site 6; 2 – Wilkostowo 23/24; 3 – Inowrocław-Mątwy, site 5; 4 – Ostonki, site 2; 5 – Tarkowo, site 50; 6 – Opatowice, site 42

The high frequencies of Świeciechów flint noted for the settlement Krężnica Jara probably marks the direct migration of the population group, which used the source of raw material in the neighboring micro-region located to the West, when the stable access to Volhynian flint was not yet accessed. In this respect it is hard to interpret the relative number of Świeciechów flints identified in Pliszczyn, site 9 (Chmielewski 2015b, 120-121). Considering the location of this site, the related value of 16.5% of Świeciechów corresponding to 26.5% of Volhynian flint, most probably indicates the involvement of the settlement in the 'route' of the latter kind of raw material to the northwest.

The relatively high number of Świeciechów flints in the assemblage of Gródek nad Bugiem, which also includes 78.5% of Volhynian flint (Balcer 1983, 132), may represent the colonization process of the related micro-region from the neighboring settlement cluster in the West, while the inventory made of the first kind of these raw materials may represent the assemblage brought by the 'colonists' to the new area. If this assumption is correct, it also indicates the diffusion of the FBC population to the micro-region from the West. It should be noted that, according to Gumiński (1989, 115-139), inhabitants of Gródek nad Bugiem tools, blades and not polished axes made of Świeciechów flint were imported to this settlement. Balcer (1983, 150) noted that the majority of axes there were made of Świeciechów flint.

Settlements Dobroń, site 1, Ptaszkowice, site 3 and Andrzejów, site 1 located in the Grabia basin are characterized by relatively low frequencies of both kinds of raw material due to the peripheral location of this settlement cluster in the territory of the Western group (Pelisiak 2003). On the one hand, this confirms our assumptions considering the transportation 'route' along the Vistula river. On the other hand, this leaves the question of the particular 'route' from the south to Kujawy open. Most probably, further research in the micro-regions that were not considered in our study will solve this issue.

CONCLUSION AND DISCUSSION

Thus, the distribution of Świeciechów flint at the FBC sites is characterized by several important patterns. The low frequencies of this kind of raw material which characterize the early phase settlements increase in the classic phase. The percentage of the related finds seems to decrease from the classic phase of the FBC to its late phase and FBC-Baden horizon, but this conclusion may reflect the bias of our sample.

Over the course of the early and classic phase of the FBC, the flow of Świeciechów flint through the trans-regional networks was closely connected to the import of Volhynian flint, while an increasing number of both kinds of raw material probably represents stable access to the sources obtained by the FBC population and the development of transportation networks. It should, however, be noted that different forms of raw materials flow and their different social context may underline the expected and observed pattern of the decrease of flint with the increase of distance to its source.

The chain of settlements along the Vistula river is clearly identified as the transportation 'route' of Volhynian and Świeciechów flint from the southeast to the northwest, which functioned at least during the early and classic phase of the FBC. However, the issue of raw material flow through the micro-regional networks (Kabaciński, Sobkowiak-Tabaka 2005; Adamczak et al. 2017) requires additional attention. The alternative, southern 'route' of the raw material flow to Kujawy during the early phase is assumed, but not confirmed by the archaeological evidence as yet. This 'route', if this is the case, probably lost its importance in the classic phase.

The relative number of Volhynian and Świeciechów flint in assemblages of the analyzed settlements, especially taking into account the size of our sample, may represent different processes and be explained in different ways. We suggest the following interpretation of the values and trends.

Two main 'routes' of Świeciechów and Volhynian flint transportation in the territory of modern Poland, south-north and southeast-northwest, were already established in the early phase of the FBC and further developed in its classic phase. Stable access to Volhynian flint, which was achieved in the classic phase caused the 'preference' for this kind of raw material in the majority of micro-regions. It is not excluded that the factor of this raw material impacted the direction of territorial expansion of the FBC populations, including the colonization of Hrubieszowska valley. The low percentages of Świeciechów flint represent the raw materials brought by the 'colonizers', while the high relative number of Volhynian flints represent the re-orientation to a raw material of higher quality. Further colonization of the areas along the southeast-northwest 'route', probably followed the same principle. Therefore, the relative numbers of Volhynian and Świeciechów flints could be used as a chronological marker, at the same time reflecting two different spatial processes. Sites with a high frequency of Świeciechów flint in these micro-regions are considered as earlier settlements related to the colonization of micro-regions in the west – east direction. Sites with a high frequency of Volhynian flint are somewhat later and represent the diffusion of the FBC populations within these micro-regions.

On the one hand, the shift in preferences from Świeciechów to Volhynian flint left certain micro-regions, the settlements in the Grabia basin for instance, with a limited number of imported flints. On the other hand, this also increased the importance of southeast-northwest transportation 'route' and framed the direction of significant mutual influences between the FBC and Tripolye populations.

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