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Wojciech Borkowski, Janusz Budziszewski

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Wojciech Borkowski^a and Janusz Budziszewski^b

The oldest striped flint artifacts should probably be dated to the Middle Palaeolithic. Much more voluminous material is dated to the Upper Palaeolithic (Magdalenian).

In the Funnel Beaker Culture (FBC) inventories striped flint artifacts account for a high percentage of finds only in Małopolska (Little Poland), directly around the exploitation points, the Sandomierz Upland and the Nałęczów Plateau. This percentage clearly depends on the distance from places of exploitation: close to the mines in Magonie — Folwarczysko basin striped flint dominates over the other raw materials.

The next culture utilizing striped flint was the Globular Amphora Culture (GAC). In inventories from the Małopolska Upland there is a high percentage of striped flint, ranging from 30 to 90%. In north-western Poland, striped flint percentages are high (up to 40%) only in grave assemblages, due to the large number of axes. The picture is different if one considers only the square axes. These implements made from striped flint are a regular element of GAC inventories. In all of the Central Małopolska Upland they constitute more than 90% of all artifacts of this category. In grave inventories from north-western Poland axes made from striped flint comprise close to 75% of all the axes. In the Sandomierz Upland the distribution of GAC settlement points betrays an influence of mining and production centers.

The role of striped flint is greater in inventories of the Mierzanowice Culture, especially in its later phase. However, this is true only of the groups inhabiting the Sandomierz Upland.

KEY-WORDS: striped flint, flint economy, distribution of flint, Świętokrzyskie Mountains.

The visually appealing striped flint artifacts captured the attention of prehistorians already a long time ago. As early as in 1917–1918 there were attempts to chart the finds of axes made from this raw material (Wilke 1917; Kossinna 1918). These early works contained many errors, but two years later Stefan Krukowski (1920:189, 199–203) subjected them to careful analysis and, based on his own studies of materials recovered from archaeological sites, defined the basic distinctive features of striped flint and the approximate extent of their occurrence *in situ*. The proposition of hypotheses was followed by field work. In September 1921 Krukowski (archaeologist) and Samsonowicz (geologist) jointly carried out surface surveys which led to the first discoveries of striped flint outcrops and revealed the first prehistoric exploitation point (Krukowski 1921:162–3, fig. 10). Since that time,

^a Państwowe Muzeum Archeologiczne, Warszawa, Poland

^b Instytut Archeologii, Uniwersytet Warszawski, Warszawa, Poland

successive generations of scholars have studied – with various intensity – the occurrence and prehistoric exploitation of striped flint (Budziszewski and Michniak 1983/1989:152–6).

After 75 years of studies, we have a precisely defined stratigraphic position of striped flints and the locations of its outcrops over a distance of many kilometres. Striped flints occur in two beds, 0.7–3.0 meters apart, in powdery and oolitic limestones of the higher Upper Oxfordian (“Astartian”) in Upper Jurassic forms (Budziszewski and Michniak 1983/1989: 158–60; Michniak 1992:174–8). Their outcrops (Fig. 1) are found in three parts of the north-eastern (Mesozoic) border of the Świętokrzyskie Mountains – in the Vistula valley near Zawichost (Tarnobrzeg Province), around the lower course of the Kamienna river between Wojciechówka (Tarnobrzeg Province) and Karolów (Radom Province), and along the upper Iłzanka near Iłża (Radom Province) – and also in the Kuiavian anticlinorium – along the upper Bzura in the Góra Św. Małgorzaty (Płock Province).

Only some of the known outcrops have been subjected to detailed archaeological studies. Explorations so far focused on the southern concentration of outcrops in the Kamienna valley (Magonie-Folwarczysko basin and Stoków anticline) and around Iłża, leading to the discovery of nine striped flint exploitation points around the Kamienna valley and one point on the Iłzanka (Table 1). The various sites differ considerably as to size. The Krzemionki exploitation field, accounting for more than 90% of the total known area of striped flint exploitation, is such a dominant feature that one should not expect any future discoveries to significantly alter the general picture of striped flint use which it has provided. However, the discoveries of new small sites contribute to our knowledge of spatial organization of striped flint mining in microregional scale.

Krzemionki is the only site excavated over many years (Borkowski *et al.* 1989:164–207). The other exploitation fields are known from surface surveys alone, and these provide only information about ground relief, extent of exploitation traces and surface material samples (often very modest).

Mine site explorations were accompanied by studies of striped flint artifacts distribution (most recently Balcer and Kowalski 1978). These were augmented by studies of flint raw material economy in various periods of prehistory (*e.g.*, Cyrek 1983), including those of significance in reconstructions of the history of striped flint use (*e.g.*, Budziszewski 1991). The combined results of these studies make possible a general outline of the history of striped flint utilization.

The oldest striped flint artifacts should probably be dated to the Middle Palaeolithic. Materials recovered from the “Krzemionki” mines complex in 1991 (Migal in press) may suggest that populations of that age ventured to that area. Unfortunately, the next season failed to provide more evidence in support of this hypothesis.

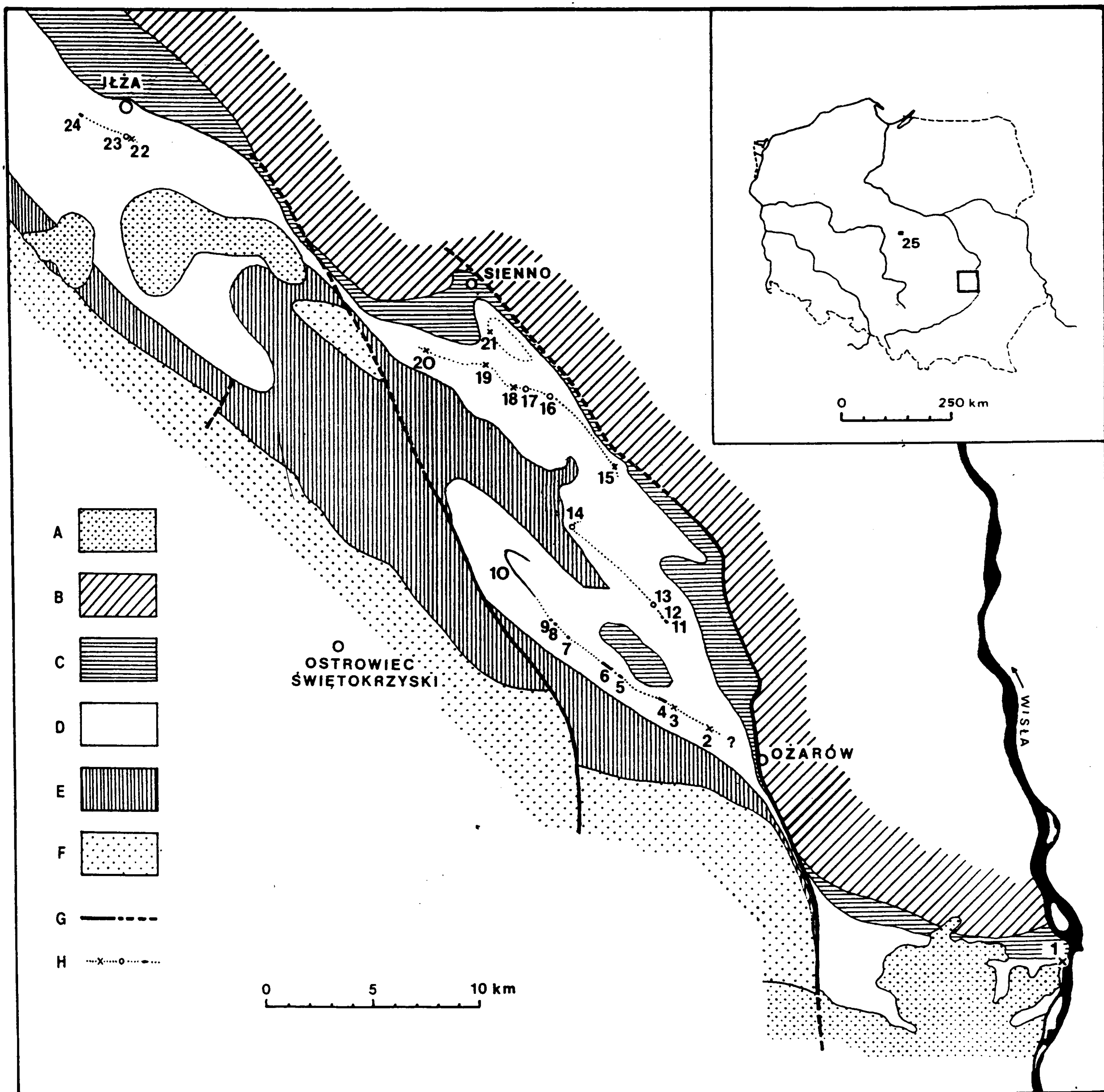


Fig. 1. Appearance of striped flints in the pre-quaternary deposits of the north-east margin of the Świętokrzyskie Mountains: 1 — Zawichost, Tarnobrzeg Province (Budziszewski and Michniak 1983/1989:169-70); 2 — Wojciechówka, Tarnobrzeg Province (Budziszewski and Michniak 1983/1989:169); 3 — Śródborze, Tarnobrzeg Province (Budziszewski and Michniak 1983/1989:168-9); 4 — Exploitation point "Koryczna"; 5 — Exploitation point "Krunio"; 6 — Exploitation point "Borownia"; 7 — Exploitation point "Ostroga"; 8 — Exploitation point "Księża Rola Duża"; 9 — Exploitation point "Księża Rola Mała"; 10 — Exploitation point "Krzemionki"; 11 — Exploitation point "Skalecznica Duża"; 12 — Exploitation point "Skalecznica Mała"; 13 — Teofilów, Tarnobrzeg Province (Budziszewski in press); 14 — Boria, Tarnobrzeg Province (Michniak 1992: fig. 1); 15 — Skarbka Dolna, Kielce Province (Buczek and Peszat 1965); 16 — Wólka Bałtowska, Kielce Province (Pożaryski 1948:18); 17 — Wólka Trzemecka, Kielce Province (Pożaryski 1948:18); 18 — Eugeniów, Radom Province (Pożaryski 1948:18); 19 — Nowy Olechów, Radom Province (Samsonowicz 1923:21-2); 20 — Karolów, Radom Province (Pożaryski 1948:18); 21 — Wodąca, Radom Province (Samsonowicz 1923:21-2); 22 — Błaziny, Radom Province (Karczewski 1960:7-8); 23 — Iłża, Radom Province; 24 — Exploitation point "Dworskie"; 25 — Góra Św. Magorzaty, Płock Province (Książkiewicz and Samsonowicz 1953); A — Miocene; B — Turonian; C — Kimeridgian; D — Upper Oxfordian ("Astartian" and "Rauracian"); E — Middle and Lower Oxfordian; F — Callovian; G — faults known and suspected; H — striped flint outcrop visible in natural exposure or quarry; x — surface concentration of flint natural deposits; o — exploitation points.

Table 1

Locali- zation on Fig. 1.	Site	Locality	Voivodship	Aproksimative size of the site [ha]	Length of outcrop [m]	Surface mining relief	Chronology and production	Base of chronology	Date of discovery and name of researcher	References
4	"Koryczna"	Wojciechówka	Tarnobrzeg	1,7	625	visible	early bronze age bifacial axes	material from surface	Cz.Czerwiński S.Krukowski 1931	Budziszewski, Michniak 1983/1989:166-8
5	"Krunio"	Łysowody	Tarnobrzeg	0,3	210	invisible	early bronze age bifacial axes	material from surface	J.Budziszewski 1983	Budziszewski, Michniak 1983/1989:166-8
6	"Borownia"	Ruda Kościelna	Tarnobrzeg	2,7	700	visible on a part of site	1. early bronze age bifacial axes 2. neolithic square axes	material from surface	S.Krukowski J.Samsonowicz 1921	Budziszewski, Michniak 1983/1989:166-8
7	"Ostroga"	Ruda Kościelna	Tarnobrzeg	0,1	40	visible	1. early bronze age bifacial axes 2. neolithic square axes	material from surface	J.Budziszewski 1982	Budziszewski, Michniak 1983/1989:166-8
8	"Księża Rola Duża"	Ruda Kościelna	Tarnobrzeg	2,1	250	invisible	1. early bronze age bifacial axes 2. neolithic square axes	material from surface	S.Krukowski 1928	Budziszewski, Michniak 1983/1989:166-8
9	"Księża Rola Mała"	Ruda Kościelna	Tarnobrzeg	0,3	70	invisible	1. neolithic square axes 2. early bronze age bifacial axes	material from surface	S.Krukowski 1961	Budziszewski, Michniak 1983/1989:166-8
10	"Krzemionki"	Krzemionki Magonie Stoki Stare	Kielce Tarnobrzeg	328	4100	visible	1. neolithic square axes 2. early bronze age bifacial axes	archaeological excavations	J.Samsonowicz 1922	Borkowski et al. 1989:164-207; Borkowski et al. 1991:607-27
11	"Skatecznica Duża"	Teofilów	Tarnobrzeg	0,8	185	invisible	early bronze age bifacial axes	material from surface	J.Budziszewski 1983	Budziszewski in press
12	"Skatecznica Mała"	Teofilów	Tarnobrzeg	0,1	30	invisible	early bronze age bifacial axes	material from surface	J.Budziszewski 1983	Budziszewski in press
24	"Dworskie"	Kolonia Seredzice	Radom	1,0	195	invisible	1. bronze age bifacial points 2. early bronze age flakes and bifacial axes 3. neolithic square axes	material from surface	J.Budziszewski 1988	unpublished

Much more voluminous material is dated to the Upper Palaeolithic. Two assemblages from the Magdalenian campsite in Mały Antoniów (Radom Province) contain striped flint. About of 15% of artifacts in the collection from site I published by Sawicki are made from striped flint. The author classified this collection as purely Magdalenian. The other (still unpublished) assemblage contains some admixtures of younger materials (remains from the production of square axes), and striped flint comprises not more than 13% of the collection. The flint from both assemblages appears to come from the nearby outcrop in Wólka Bałtowska and Olechów, and it differs from the “Krzemionki” flint by numerous calcium oolites in the siliceous mass. The cortex of the Antoninów flint exhibits a contact with layers of oolite limestone which were not observed in any of the profiles in Magonie-Folwarczysko basin. There are only few known striped flint artifacts from the Late Palaeolithic and Mesolithic (Balcer and Kowalski 1978:133). At that time chocolate flint was definitely the preferred raw material (Szymczak 1992:fig.1; Cyrek 1983).

Also in Early Neolithic assemblages striped flint artifacts are practically never to be found. Exceptions to this rule are the assemblages from Opatów (Tarnobrzeg Province) and Ćmielów, site 2 (Tarnobrzeg Province) containing a minimal presence of this raw material (Balcer 1983:82). This is reflected to some extent in the artifacts found in the immediate vicinity of the exploitation field at “Krzemionki”, the Kał Cebuli camp site (Zalewski in press) as well as in isolated finds from the field itself (Balcer and Kowalski 1978:132–3) and possibly also in the dating of a fire layer from this site (Borkowski and Zalewski 1992:162–5).

In the Funnel Beaker Culture (FBC) flint inventories, striped flint artifacts account for a high percentage of finds, but only in Małopolska (Little Poland), practically directly around the exploitation points, the Sandomierz Upland and the Nałęczów Plateau (Fig. 2). This percentage clearly depends on the distance from places of exploitation: close to the mines in Magonie-Folwarczysko basin, Borownia and Ruda Kościelna striped flint dominates over the other raw materials (Borkowski *et al.* 1991:623). The exception here is the site in Stryczowice (Kielce Province). The striped flint content in inventories more than 15 kilometers from the outcrops drops visibly. Striped flint is entirely absent in Biedrzychów (Tarnobrzeg Province) – a site close to the Świeciechów deposit – and just barely present in Zawichost, site “Pieczyska” (Tarnobrzeg Province) and Kamień Łukawski (Tarnobrzeg Province) (Balcer 1983:132). Surprisingly large amounts of striped flint reached Klementowice (Lublin Province) (Balcer 1975:tab. 28), but none was exported up the Vistula river to the Nida River Basin and the loess areas near Cracow (Kruk and Milisauskas 1989). It is also practically nonexistent in Kuiavia (Balcer 1983:124, 154). We are not taking into account here isolated finds of flint axes, given the doubts that are being expressed about the validity of assigning isolated finds of this type to the Funnel Beaker culture (Borkowski and Migal, in press).

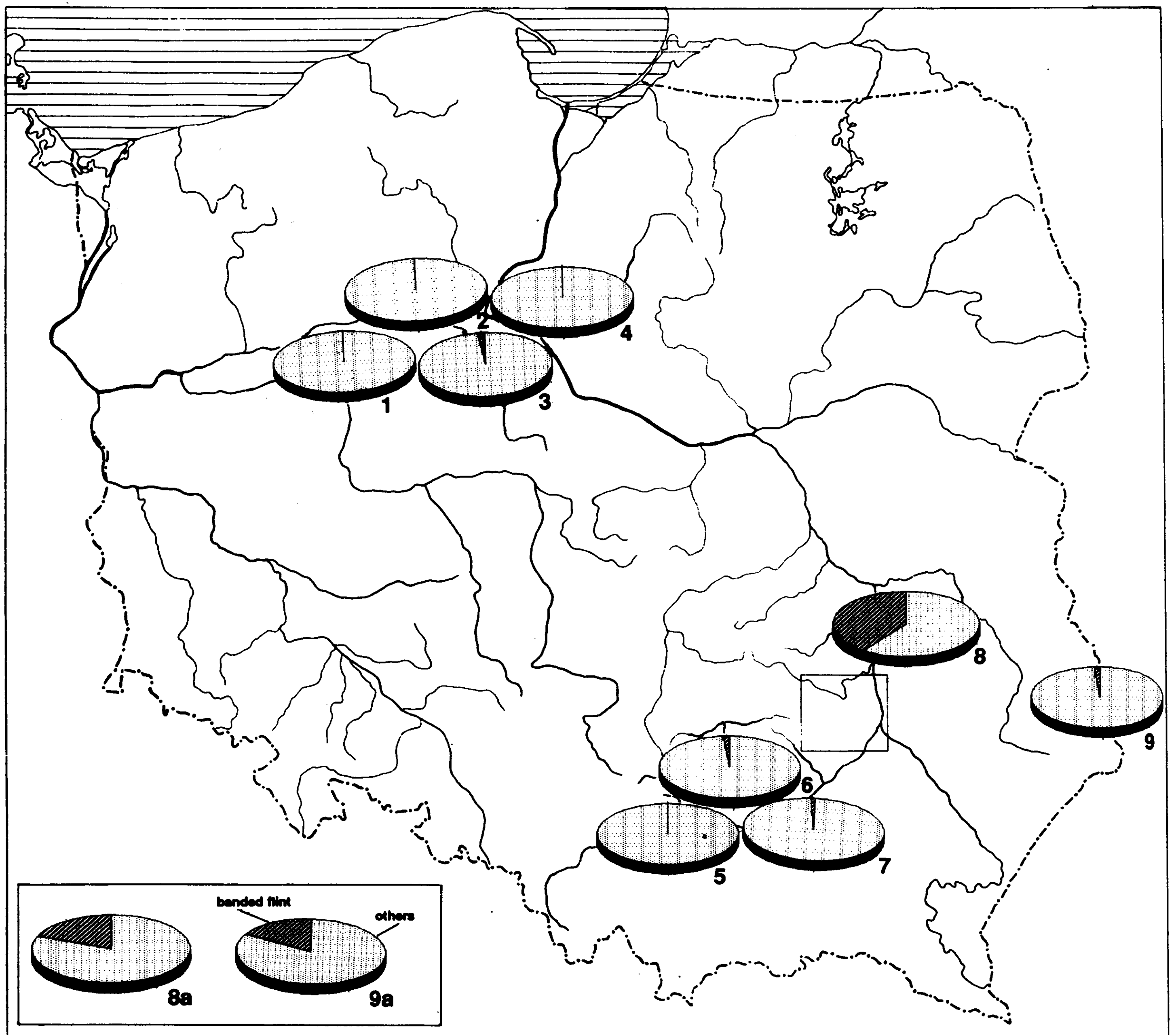


Fig. 2. Percent of striped flint materials in collections from FBC sites: 1 — Leśniczówka; 2 — Sarnowo; 3 — Mątwy; 4 — Sierakowo; 5 — Zawrza; 6 — Bronocice; 7 — Książnice Wielkie; 8 — Klementowice; 9 — Gródek Nadbużny; “a” — percent in axes collection.

A problem in its own right is the use of striped flint in the production of square axes. There is no doubt that striped axes made their appearance together with the FBC, and that striped flint was the raw material used most frequently to make them. On the other hand a look at the raw materials used in making tools of this category shows that the use of striped flint in axe production is more diversified than in the production of tools in general. There are sites where the proportion of this flint in the axe category is exactly the same as in the flint inventory as a whole (this being true of Ćmielów, site “Gawroniec” and Zawichost, site “Pieczyska”, despite earlier doubts — Krukowski 1939:84–97; Balcer 1983:182). There also exist inventories in which the percentage of striped flint in the group of axes decreases or increases. Given the

smaller range of raw materials used to make axes, there is a more powerful link between Świeciechów flint and this tool group. In Klementowice there is slightly less striped flint than the general raw materials list would suggest, but in Gródek Nadbużny (Zamość Province) and Kamień Łukawski there is more. Thus, although axe production was the leading form of striped flint use, even in this tool group the material was not always dominant (Fig. 3).

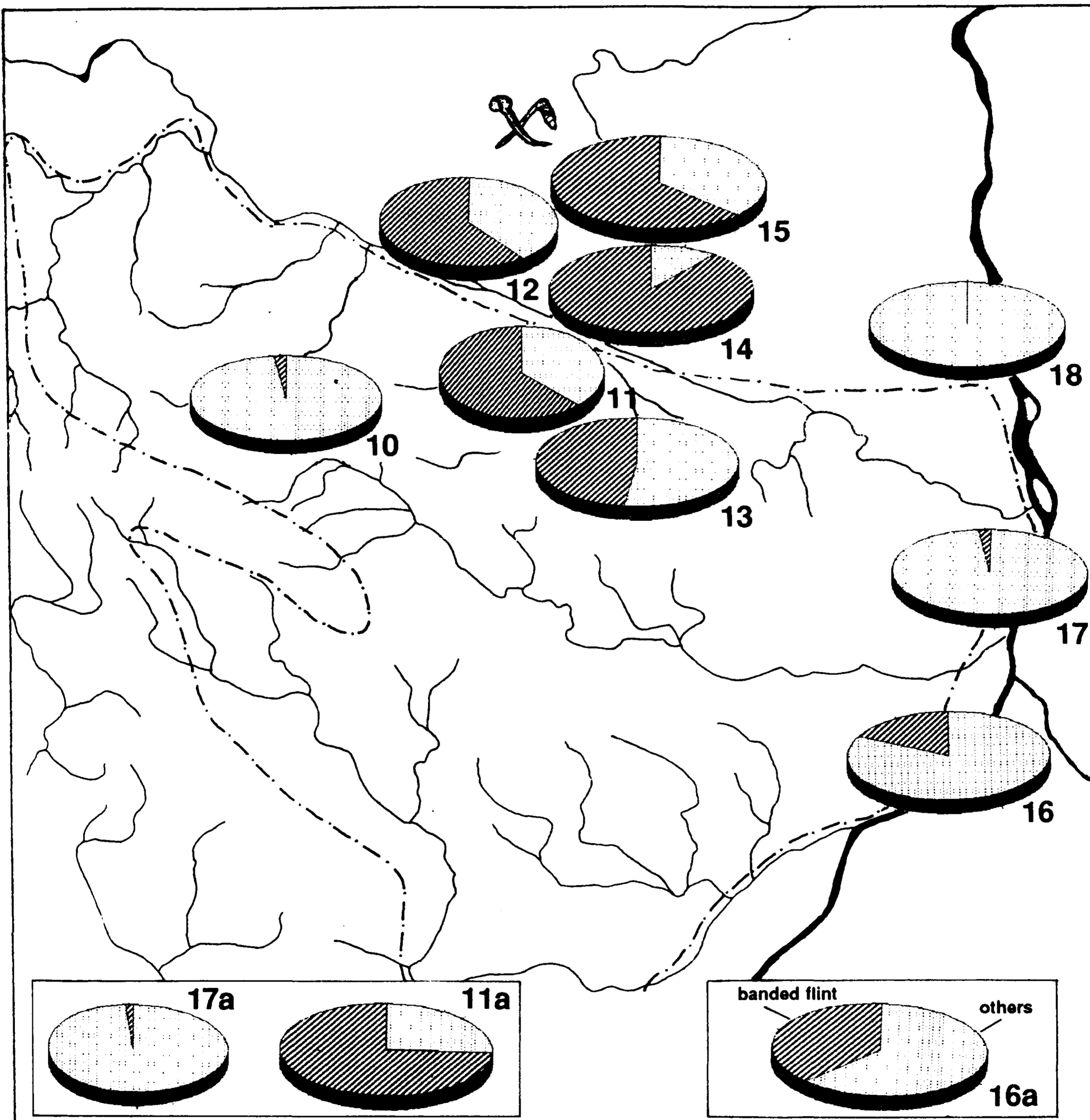


Fig. 3. Percent of striped flint materials in collections from FBC sites from Sandomierz Upland: 10 — Stryczowice; 11 — Ćmielów; 12 — Podgrodzie; 13-14 — Borownia; 15 — Skala; 16 — Grójec; 17 — Zawichost; 18 — Biedrzychów; "a" — percent in axes collection.

Looking at the FBC settlement network in the Sandomierz loess area, one does not see a tendency of the settlement points to concentrate on the edge of this area, close to exploitation points (Kowalewska-Marszałek 1993: fig. 56). It follows from this that there are no grounds for the claim that striped flint outcrops modified the FBC settlement network in the Sandomierz Upland (Fig. 4).

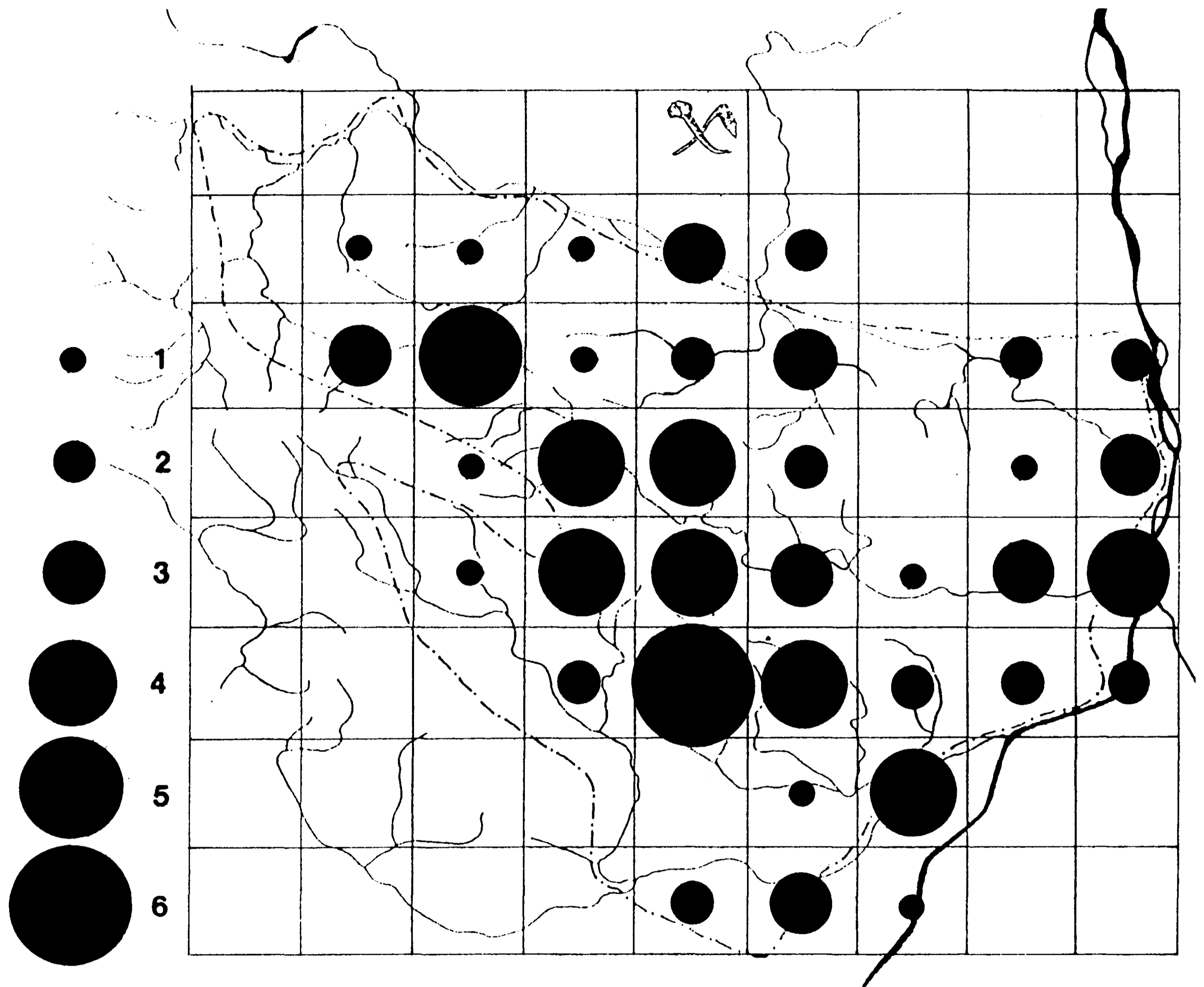


Fig. 4. Concentration of FBC sites on the Sandomierz Upland (division of the territory by 36 km² squares): 1 — 5 sites; 2 — 5–10 sites; 3 — 11–20 sites; 4 — 21–30 sites; 5 — 31–40 sites; 6 — 40 sites (Kowalewska-Marszałek 1993:fig. 56).

So far none of the explored mines from the Krzemionki exploitation field yielded dates or materials allowing to link the site with the FBC. The distribution of ceramics on the site surface suggests that the FBC people exploited the outer part of the outcrop. It is likely that the deposit in this area was exploited using the simplest pit mines.

It may be that the scant materials of Neolithic form discovered on the “Dworskie” exploitation field in Kolonia Seredzice (unfinished square axes, blade cores) are linked to the FBC.

To sum up, one should agree with Balcer that even in the Małopolska FBC group striped flint was of local significance, its use being confined to the immediate vicinity of exploitation points (Balcer 1983:179). Noteworthy here is the settlement microregion connected with Krzemionki, with its central site “Gawroniec” in Ćmielów. Materials recovered from Klementowice and the “Dworskie” exploitation point suggest that other microregional dependences of this kind also existed at the time. The presented picture of striped flint economy fits well in the model of raw material economy of Małopolska FBC communities described by Milisauskas and Kruk (1989:431–3).

The next culture utilizing striped flint was the Globular Amphora Culture (GAC). In flint inventories from the Małopolska Upland there is a high percentage of striped flint, ranging from 30 to 90%. Generally speaking, in the central Małopolska Upland area this figure is about 48%, and in the Nałęczów Plateau – almost 40% (Balcer 1983:208; Budziszewski 1990:214–8).

In north-western Poland, striped flint percentages are high (up to 40%) only in grave assemblages, this being due to the large number of axes in such collections (Balcer 1983:208; Wiślański 1969:37–40). In settlement materials from Kujawy (Kuiavia) striped flint is practically not to be seen (Olszewski 1990:198). It is thus to be assumed that, like in the case of the FBC, in the flint inventory of the GAC striped flint is of local significance, its use being confined to the vicinity of outcrops of this raw material (Fig. 5).

The picture is different if one considers only the square axes. These implements made from striped flint are a regular element of GAC inventories. In sites closest to striped flint outcrops – Kosowice (Kielce Province), Mierzanowice, site 4 (Tarnobrzeg Province) – they sometimes comprise almost 100% of the assemblage (Budziszewski 1990:214; Balcer 1983:208), while elsewhere they clearly dominate. In all of the Central Małopolska Upland they constitute more than 90% of all artifacts of this category (Budziszewski 1990:216). An almost identical percentage of striped flint axes (87.1%) is noted in the Nałęczów Upland (Budziszewski 1990:218). In both cases there is a very strong correlation between raw material kind and artifact category (square axes and chisels). The preference for this raw material spread far beyond the closest vicinity of the outcrops. In grave inventories from north-western Poland axes made from striped flint comprise close to 75% of all the axes (Wiślański 1969: 37–40). In Kuiavia this percentage is lower but still stands at almost 60% (Balcer 1983:224–6). This strong raw material preference is also reflected in the range of isolated finds of square axes (Balcer and Kowalski 1978: fig. 7). In this case we may assume the correct cultural interpretation of isolated finds (*cf.* Borkowski and Migal in press) (Fig. 6).

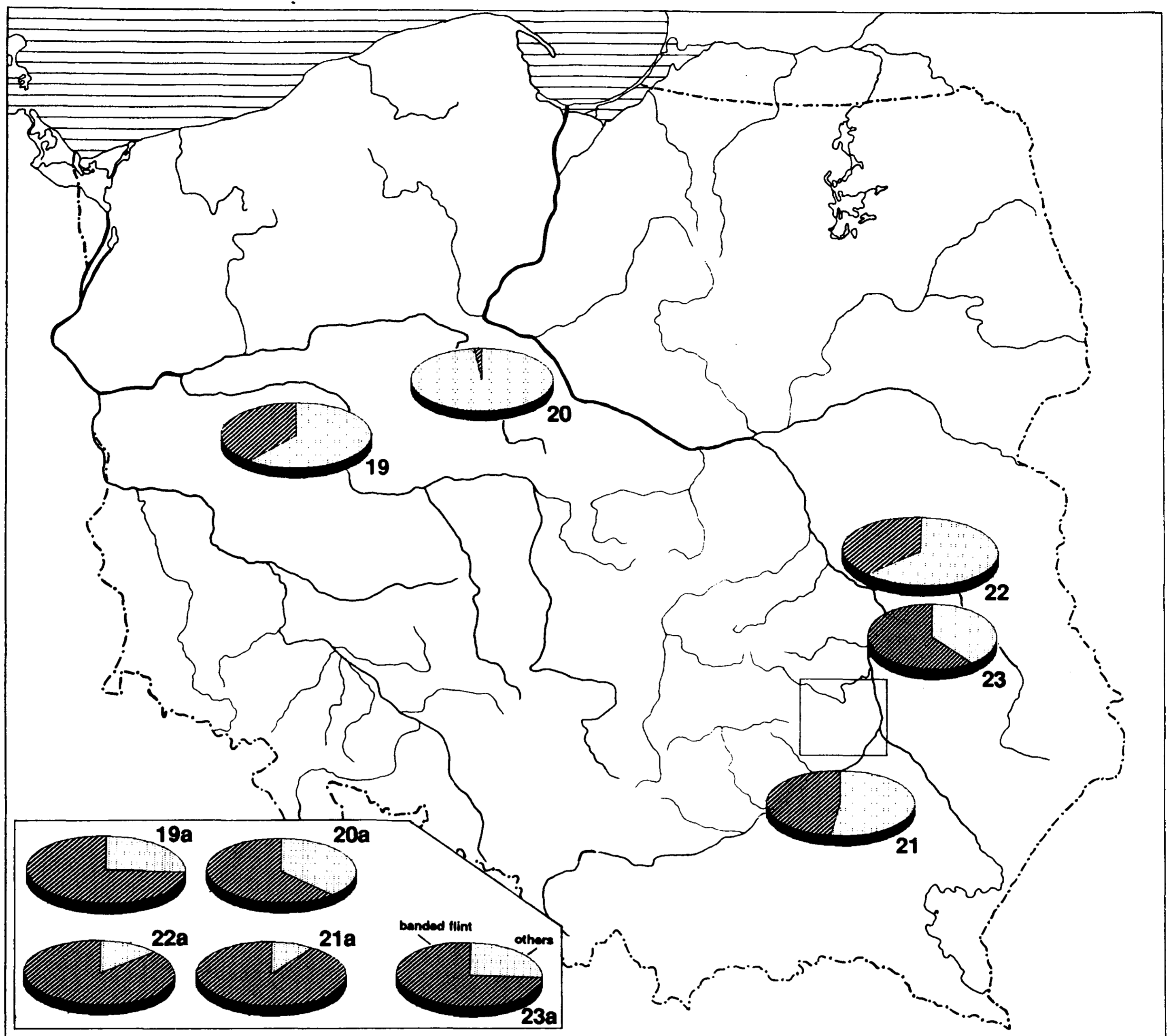


Fig. 5. Percent of striped flint materials in collections from GAC sites: 19 — Northwest Poland; 20 — Kujawy (Kuiavia); 21 — Małopolska Upland; 22 — Klementowice; 23 — Nałęczów Upland; “a” — percent in axes collection.

To sum up, it appears that there clearly was in the GAC culture a twofold demand for striped flint: firstly, as the basic raw material for tool production in the immediate vicinity of outcrops and as a principal material in the Małopolska Upland, and, secondly, as the basic raw material in the production of square axes and chisels in the western zone of the south-eastern groups of the GAC. This kind of demand is what clearly distinguishes GAC and FBC assemblages, even right next to the mines.

In the Sandomierz Upland the distribution of GAC settlement points betrays the influence of mining and production centers. Leaving aside the settlements right on the exploitation field (Migal and Jaworowska 1992:37–58), we see a distinct

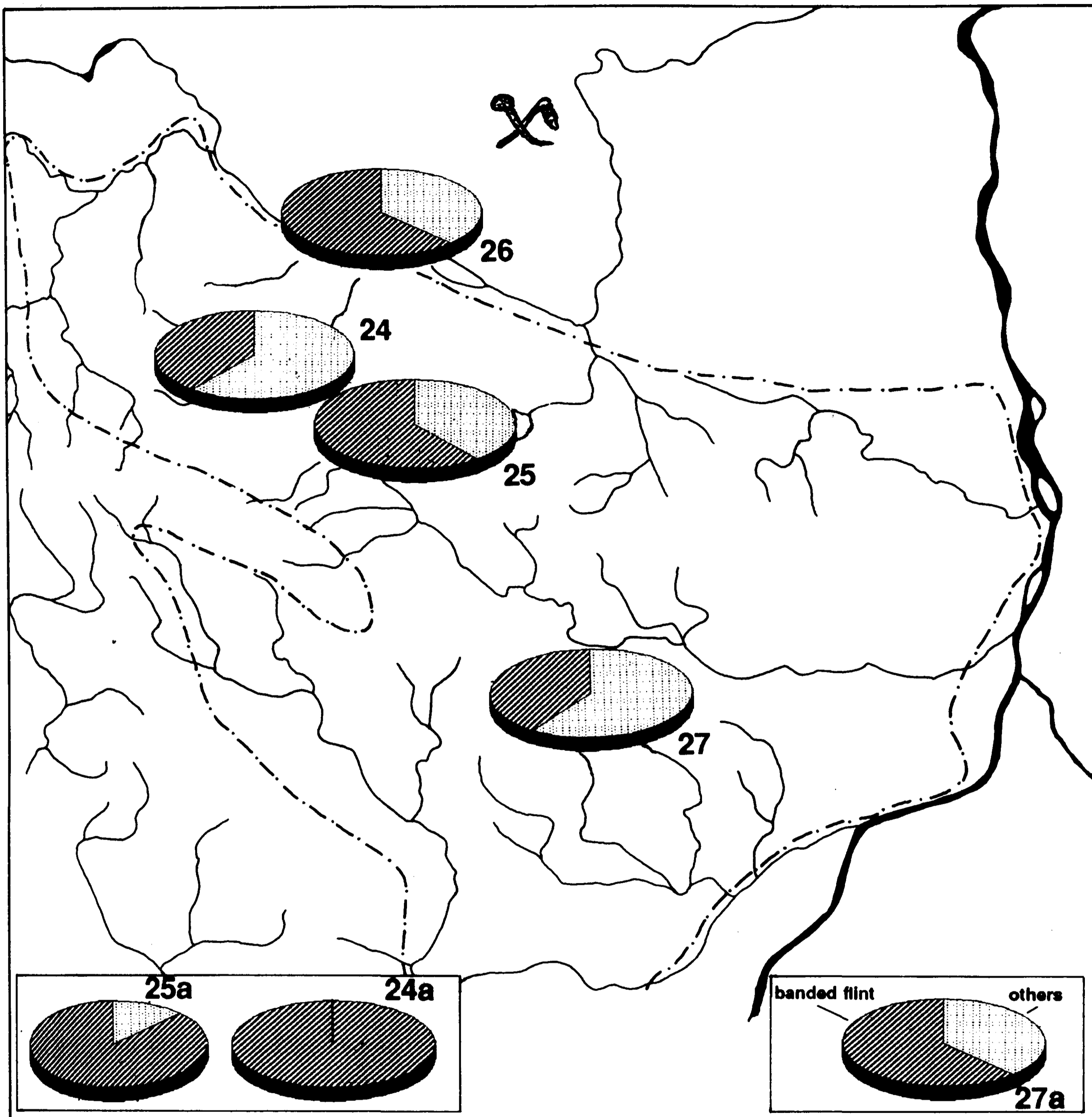


Fig. 6. Percent of striped flint materials in collections from FBC sites from Sandomierz Upland: 24 — Mierzanowice; 25 — Kosowice; 26 — Ostrowiec Świętokrzyski; 27 — Sandomierz Upland; “a” — percent in axes collection.

concentration of GAC settlements on the edge of the loess area alongside the exploitation points (Kowalewska-Marszałek 1993: fig. 57). The production-related materials recovered from these sites confirm that they were involved in raw material processing (Borkowski *et al.* 1991: 625–6). Although the size and structure of these settlements do not depart from the prevailing GAC model, the accumulations and concentration of production waste there leave no room for doubt as to their links with the striped flint outcrops area (Fig. 7).

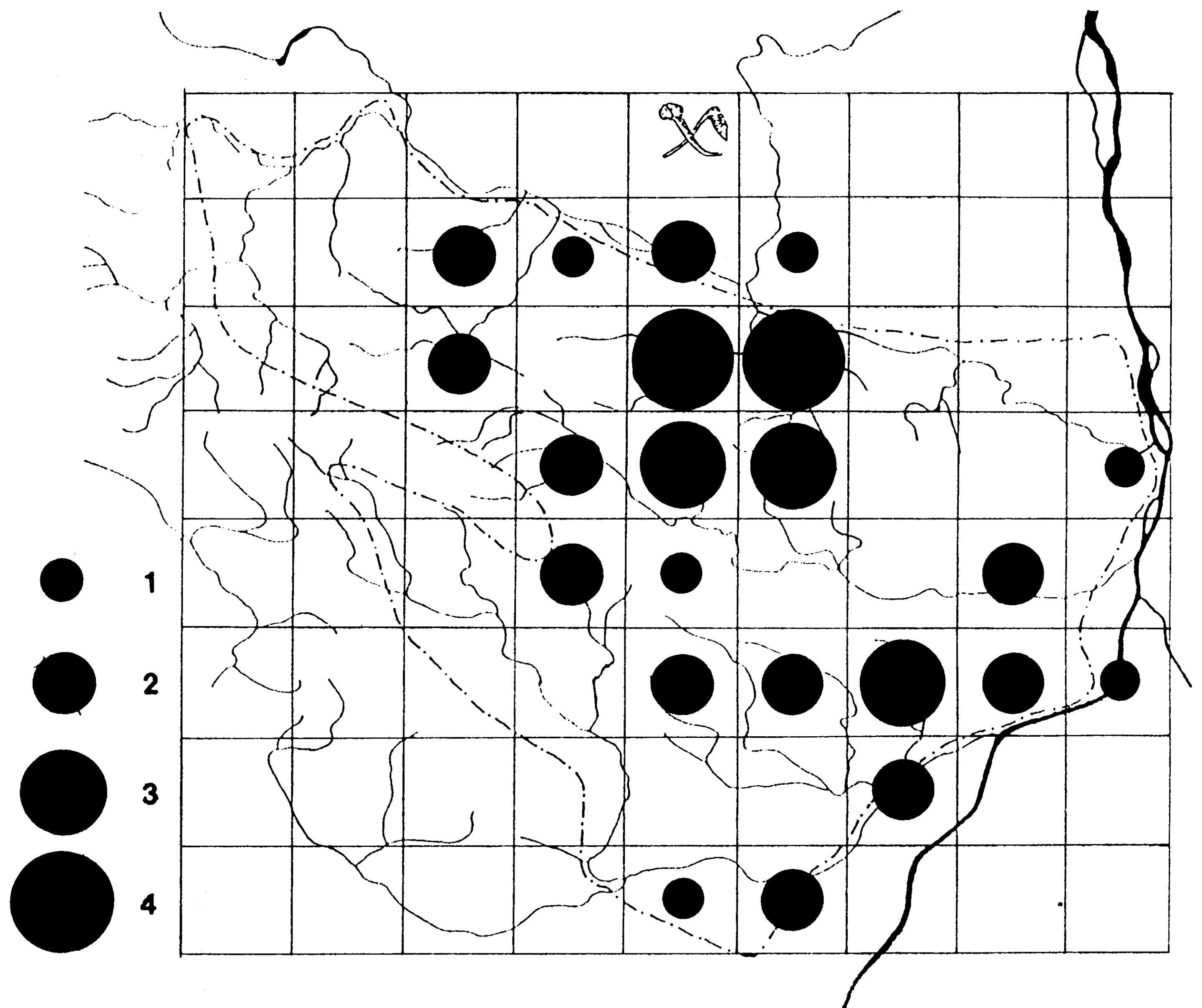


Fig. 7. Concentration of GAC sites on Sandomierz Upland (division of the territory by 36 km² squares):
 1 — 1 site; 2 — 2–5 sites; 3 — 6–10 sites; 4 — > 10 sites (Kowalewska-Marszałek 1993: fig. 57).

All the chamber mines from “Krzemionki” exploitation field are probably connected with the GAC. The pottery recovered from the camp next to mine 7/610 leaves no doubt about this (Migal and Jaworowska, 1992:52–6). Globular Amphora ceramics was also present in another chamber mine in the same segment of the mining field and was discovered also in a flint workshop (Borkowski *et al.* 1991:203). The ¹⁴C dates obtained in Krzemionki indicate that several types of mining units (chamber, pillar and niche mines) could have operated simultaneously (Table 2). It seems that the series of dates from Krzemionki are closest to dates from GAC graves from the Sandomierz Upland (Ścibior 1992:53, 69) (Table 3); in this case the date distributions are in very good accord. One of the dates from grave VIII in Sandomierz is in fact identical with a date from the feature beneath the tip of mine 7/610. Among other things, the grave contained a chisel made from striped flint (Kokowski and Ścibior 1990:40).

Table 2

Dated feature	Sample No.	¹⁴ C BP date with deviation	Dating range at 68.3% probability with dates marking maxima (so called BC calibrated datings)
Mine 7/610	Gd2670	4610 ±90	3510 - (3364) - 3109
	Gd4142	4510 ±70	3352 - (3318, 3231, 3181, 3159, 3139) - 3045
	Gd2661	4510 ±70	3352 - (3318, 3231, 3181, 3159, 3139) - 3045
	Gd4400	4400 ±60	3255 - (3034) - 2922
	Gd4428	4380 ±90	3290 - (3028, 2985, 2930) - 2913
Tip 7/610	Gd4422	4480 ±110	3360 - (3295, 3242, 3104) - 2928
	Gd6040	4370 ±110	3296 - (3023, 2994, 2928) - 2900
	Gd6039	4350 ±90	3261 - (3013, 3007, 2924) - 2889
Mine 4/606	Gd4430	4570 ±110	3499 - (3348) - 3100
Mines 1,2,3	Gd2498	4640 ±120	3616 - (3373) - 3142
	Gd4035	4380 ±160	3340 - (3028, 2985, 2930) - 2786
	Gd4032	3990 ±150	2865 - (2559, 2544, 2495) - 2310
	Gd4043	2190 ±130	400 - (348, 316, 207) - 100
	Gd4034	2150 ±160	390 - (192) - AD 10
Mine 9/160	Gd6038	4750 ±110	3681 - (3611, 3582, 3523) - 3370
	Gd6028	4540 ±80	3369 - (3338, 3213, 3203) - 3098
	Gd4425	6090 ±110	5220 - (5046, 5019, 5004) - 4863
	Gd6037	5890 ±110	4933 - (4784) - 4680
Mine 8/669	Gd4429	4660 ±110	3619 - (3493, 3480, 3377) - 3340
	Gd2672	4510 ±70	3352 - (3318, 3231, 3181, 3159, 3139) - 3045
	Gd6048	4500 ±80	3352 - (3302, 3235, 3177, 3163, 3134, 3112, 3110) - 3039
	Gd2669	4440 ±90	3335 - (3094, 3059, 3045) - 2924
	Gd4438	5840 ±140	4900 - (4772, 4759, 4728) - 4535

Table 3

Site	Sample No.	¹⁴ C BP date with deviation	Dating range at 68.3% probability with dates marking maxima (so called BC calibrated datings)
Klementowice grave 7	KN-I.225	4300 ± 40	3022 - (2915) - 2789
Sandomierz site 12 (Salve Regina)		4390 ± 100	3302 - (3031, 2966, 2940) - 2910
Sandomierz site 78 grave VIII	Gd-2452	4370 ± 70	3095 - (3023, 2994, 2928) - 2914

One may thus speak of a specialized use of striped raw material in the production of square axes and chisels. It is most probable that the scant materials connected with square axes production from the other striped flint exploitation points in the Magonie-Folwarczysko basin are also connected with the activity of GAC groups.

Inventories of the next archaeological unit, the so called Złota Culture, do not contain striped flint (Balcer 1983:233-4). Also the Corded Ware assemblages contain practically no traces of this raw material (Balcer 1983:227). The cemetery of this latter culture in Mierzanowice yielded just over 1 of striped flint finds. In Żerniki Górne

(Kielce Province), further away from the outcrops region, striped flint constituted less than 1 of the assemblage (Budziszewski 1986: tables 23–38). As a rule the Corded Ware people from the central Małopolska Upland made their square axes from Świeciechów flint, and we know only incidental specimens made from striped flint.

The striped raw material again reappears in large quantities in the Early Bronze Age inventories.

Almost three-quarters of Bell Beaker flint artifacts from the Sandomierz Upland are made from striped flint. However, this raw material was of local significance only, and is not to be found in the not too distant Miechów loess area. Unlike in the Małopolska flint industry of the Late Neolithic, the Bell Beaker tool makers had no raw material preferences in the various artifact categories. The flints used most often were also used in the most diverse manner.

The materials from Beradz (Tarnobrzeg Province) and “Grodzisko II” in Złota (Tarnobrzeg Province) carry evident traces of reutilization of older forms. This suggests that the Bell Beaker people obtained their flint by digging up Neolithic mine workshops. Traces of this activity were discovered in features connected with the chamber mines in Krzemionki – 7/610 tip workshop (Migal 1991). An analysis of the technological cycle of this reutilization demonstrated that the final product were cordiform arrowheads. This justifies the inclusion of the workshops in the Bell Beaker Culture, in whose inventories there is a high percentage of striped flint arrowheads.

The role of striped flint is greater in inventories of the Mierzanowice Culture, especially in its younger phase. However, this is true only of the groups inhabiting the Sandomierz Upland. Settlements of this culture – Boria, site “Wyrzykowszczyzna” (Tarnobrzeg Province), Stoki Duże (Tarnobrzeg Province) – appear in the immediate vicinity of exploitation points along the Kamienna river (Budziszewski in press). Already in the Nida Basin this raw material accounts for just a few percent of assemblages (Budziszewski 1991: tab. 2).

In those times striped flint was used mainly in the production of bifacial axes – more than 60% of these implements found in the Sandomierz Upland are made from this raw material (Budziszewski 1991: tab. 3). It is worth noting that the Mierzanowice people subjected to specialized use not only the raw material as such but also the individual parts of nodules. Axes were made from the striped parts, while the non-striped core was utilized to make mining tools – hoes (Michniak and Budziszewski 1986).

The Early Bronze Age people were not involved in a major way in the exploitation of the Krzemionki deposit in Jurassic rocks. These people mostly mined the raw material from mine tips. Recent studies of workshop materials connected with chamber mine features reveal that mine tips and workshops were subjected to secondary exploitation with the reutilisation of production waste materials (Migal 1991). An analysis of the technological cycle of this reutilisation demonstrated that the

final product of the I-10/1441 workshop were bifacial axes. So, the I-10/1441 tip-workshop was certainly dug up and made by the Mierzanowice people. Traces of similar activity are contained in workshop materials recovered from the vicinity of mine 4/606 (Żurowski 1962:90) and mines 6/668 and 8/669 (Bąbel 1982:37; Sałaciński 1988:104–5).

The amount of Early Bronze Age ceramics found on the “Krzemionki” site surface is similar to amounts of pottery left by GAC and FBC Neolithic cultures. This is evidence of a surprisingly intense reutilization of the Krzemionki field surface. Considering the size of this field the role of mining there in the raw material economy of, say, the Mierzanowice Culture, cannot be ignored.

Budiszewski attempted to determine the chronology and cultural affiliation of the various exploitation fields, and his studies indicate that most of them belong to the Mierzanowice Culture of the Early Bronze Age (Tab. 1). This suggests a spatial organization of mining that was different than in earlier times. If we moreover note that nearly all the mining tools dated to the Early Bronze Age are hoes/diggers serving to break up mine tips or dig in weathered clay rubble, it may well be that in some cases we are also seeing traces of secondary exploitation of Neolithic workshops. This is particularly true of exploitation fields with distinct surface relief (such as Borownia).

Materials from the “Dworskie” exploitation point in Iłża suggest that in the Early Bronze Age striped flint from the northern part of the outcrop was used differently than in the Sandomierz Upland. Aside from bifacial axes production, it seems that flake core exploitation played a much greater role, this being reminiscent of the way chocolate flint was used in that time.

Also different was the subsequent history of striped flint use in the two regions. So far we know no traces of later use of this raw material in the Kamienna area. In the “Dworskie” exploitation field in Iłża there dominate remains from the production of small bifacial points, probably dating to the Bronze Age.

Summing up our analysis of striped flint users, we cannot propose any revolutionary conclusions. The above observations largely confirm the earlier findings (Balcer and Kowalski 1978). Striped flint was used by tool makers since the Palaeolithic through the Bronze Age. The heyday of this raw material was in the Middle and Late Neolithic when it was mined and processed on a mass scale and distributed over very large distances. The picture that emerges is in agreement with the situation documented in the “Krzemionki” exploitation field which was by far the most important source of striped flint.

The results of recent studies described above suggest that the history of striped flint use in the various microregions can be considerably different from the general standard. These observations ought to suggest the direction of further research.

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