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The Relationship between a settlement and flint mines. A preliminary study of the Eneolithic workshop assemblages from Ćmielów (Southern Poland)

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In the northern part of an upland settlement of the Funnel Beaker Culture at Ćmielów in Southern Poland close aggregates of numerous (507–26,132) flint artefacts were found in 16 pits. These aggregates are considered to be workshop assemblages, generated by the refuse thrown out from the neighbouring workshops. In these workshops the flint, extracted in neighbouring mines, was processed. Striped flint from Krzemionki mine was used mostly to make pre-forms of axes, and Świeciechów flint was used to make blade pre-forms.

KEY-WORDS: flint workshops, flint mines, Krzemionki flint, Świeciechów flint

1. INTRODUCTION

The purpose of this paper is to present the general results of the study of the mass flint finds from several pits in the upland settlement of the Funnel Beaker Culture (FBC, in Continental terminology also "TRB") on the Gawroniec hill at Ćmielów. The site, which is one of the most important Neolithic sites in Poland, occupies a hill which is one of several loess promontories at the northern border of the Sandomierz Upland, beyond the Kamienna-river valley. The site is located in the neighbourhood of two flint deposits: 9 km to the south from the mine of striped flint at Krzemionki and 22 km to the west from the mine of grey, white spotted flint at Świeciechów (Fig. 1). The settlement has a total area of 8 hectares. The Gawroniec site was investigated by Zofia Podkowińska in 1947–1961, during six field seasons

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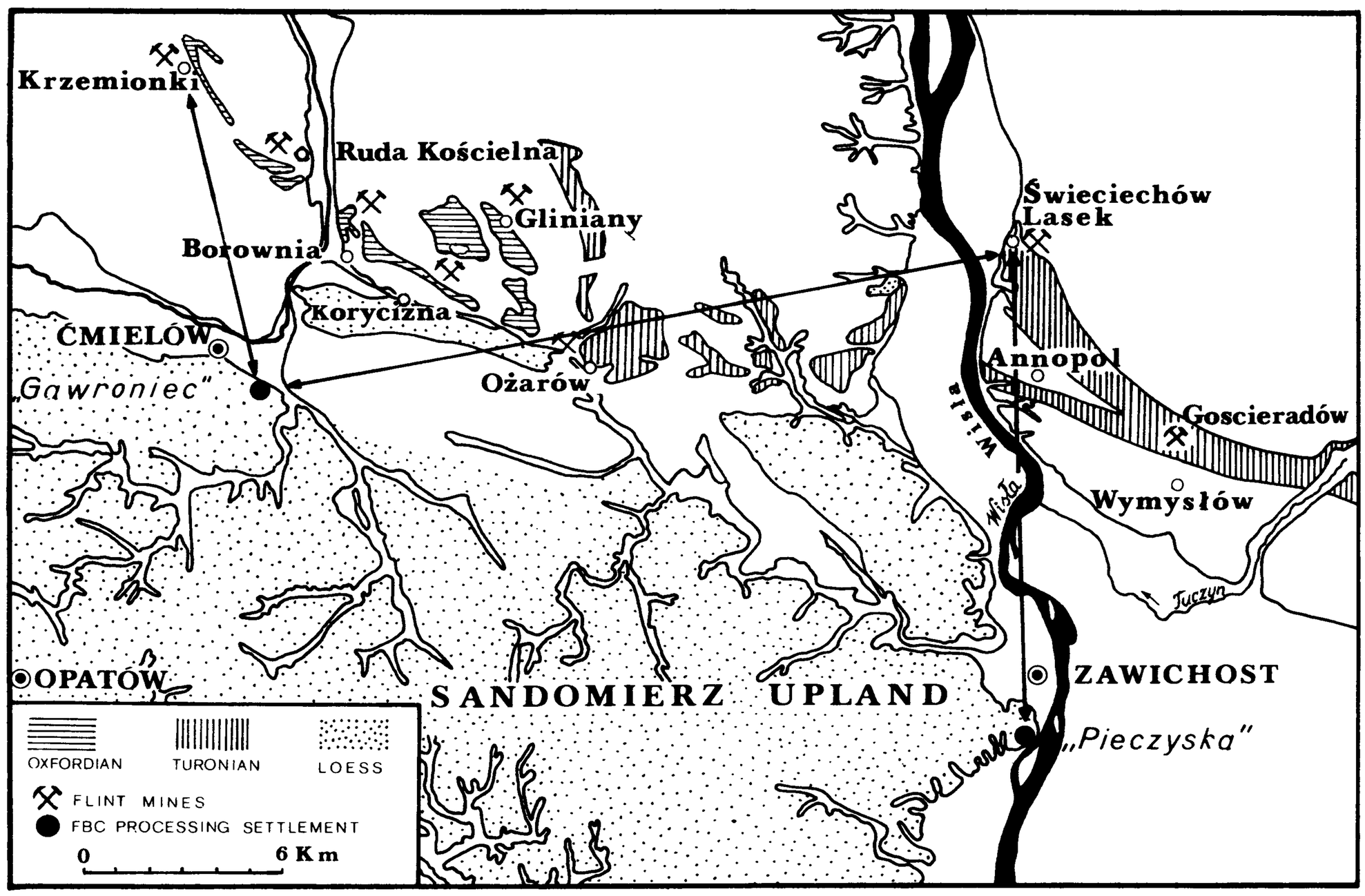

Fig. 1. Spatial relationship between the Gawroniec settlement and flint mines at Krzemionki and Świeciechów.

(Podkowińska 1950, 1962; Krzak 1963), a total area of 4622 m² was excavated. The main trench (160 x 25 m), was located perpendicular to the axis of the site (Fig. 2).

Various archaeological materials were found there in large quantity in the course of excavation. There are also five ^{14}C dates for pits from this site:

Pit 180 – H566–592 (Sch.1167): 2725 ± 110 bc
Pit 200b – GrN-5087: 4775 ± 40 BP
Pit 192 – GrN-5090: 4720 ± 40 BP
Pit 243 – GrN-5036: 4650 ± 40 BP
Pit 231 – GrN-5088: 4615 ± 40 BP (Bakker, Vogel and Wiślański 1969:12–4).

Because of erosion no traces of ground-level buildings were discovered at Ćmielów. The only features preserved were 328 pits. They are considered to be remains of the lower, underground part of the settlement, primarily connected with its overground buildings (Balcer 1989). These form three clusters separated from each other (north, middle and south).

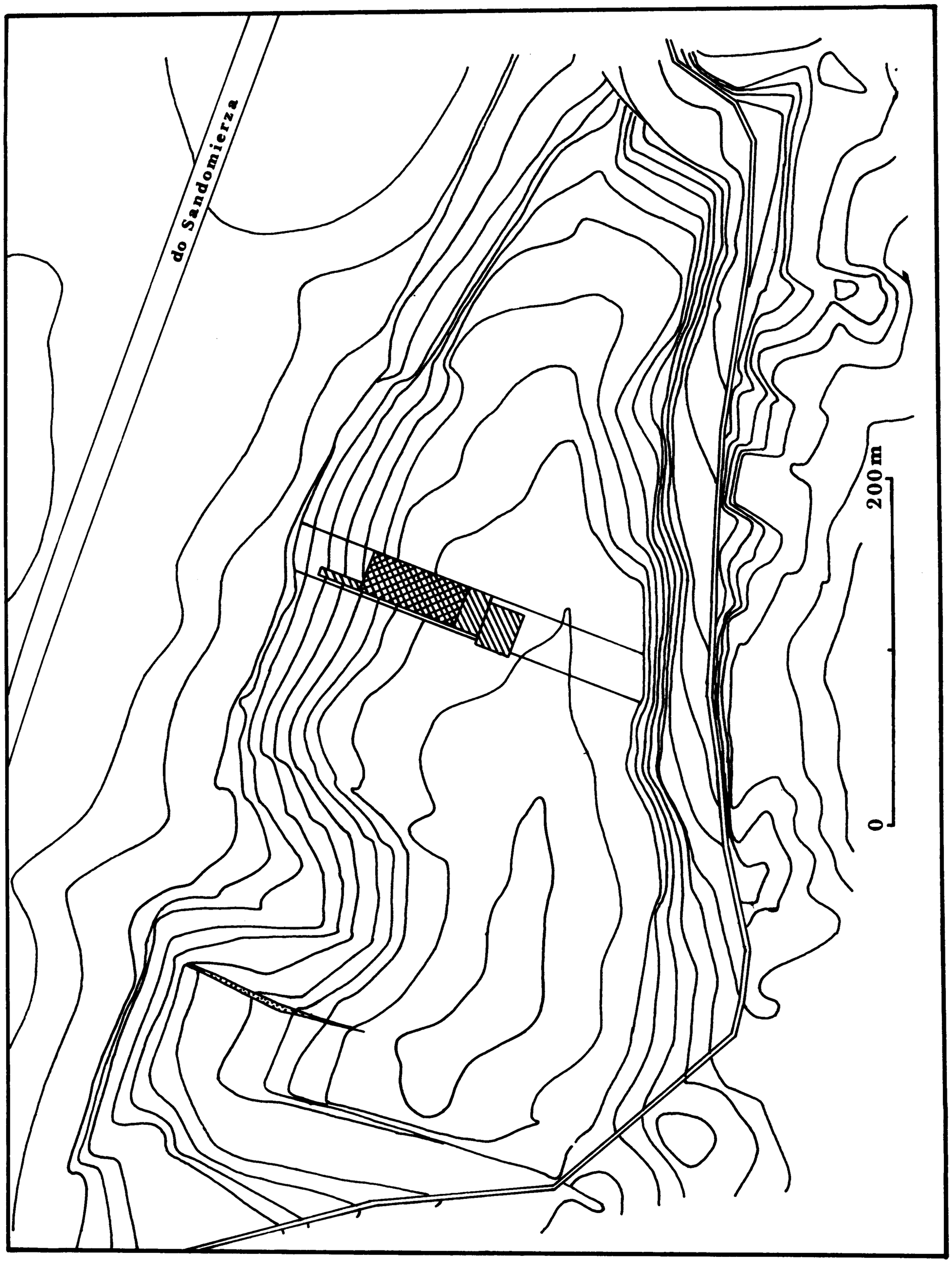

Fig. 2. Ćmielów, Tarnobrzeg Province. Gawroniec hill with excavation trench discussed in the paper. Dense shading indicates part of 1947–48 trench shown in Fig. 3.

2. DISTINCTION OF A FLINT PROCESSING WORKSHOP AREA

In the investigated part of the northern area on the strongly sloping hillside (Fig. 3), 82 pits were discovered. There, concentrations of flint material in workshop (flint) assemblages (WFA) were found in 16 pits (the term "assemblage" is applied here to inventories containing at least 500 flint finds; the term "workshop" applied to an assemblage should be taken to mean "originating from a workshop", but not necessarily referring directly to the places of location of workshops).

In the opinion of the author, the flint artifacts were dumped in the pits after being removed from the processing workshops situated in their neighbourhood (see below). Though they are thus only waste heaps of flints, they offer the only possibility for investigation of the flint processing in the workshops that left no traces on the surface.

Sixty one pits from the northern zone were separated from each other; the rest of them occurred in complexes of 2–4 pits joined in horizontal units (Table 1). No flint artifacts were found in 7 pits and only small quantities of them occurred in 15 pits. The rest (39 pits) contained usually 1–500 flint finds. More abundant deposits (500–26,000 flint artefacts) were noted in 21 pits. In five pits, the flints (500–1700 pieces) were dispersed in the fillings without any concentration, so they do not correspond to close WFA. The accumulations of flints in 16 pits can be considered as workshop assemblages (Table 1). They are known only from the northern area and not outside it. This is good reason to qualify this zone as a flint processing workshops area.

3. LOCATION OF FLINT ASSEMBLAGES

3.1. DESCRIPTION OF PITS CONTAINING THE FLINT ASSEMBLAGES (Table 1)

Ten pits with flint assemblages occurred separately, six of them were linked to other pits. An analysis of pit characteristics shows that the flint assemblages occurred in morphologically different fillings of ordinary pits known from the Gawroniec settlement. Except for feature 45 (Fig. 4b), there is no pit of complex construction (Balcer 1989:356).

During the excavations the concentrations of flints in the pits were marked on section drawings, more rarely on plans; for the Pits 49 and 53 only verbal descriptions were made.

3.2. STRATIGRAPHIC SITUATION AND SPATIAL DISTRIBUTION OF THE FLINT ASSEMBLAGES

Fifteen features contained only one flint assemblage; only one pit (106) however contained two assemblages of flints of different dimensions, deposited at different

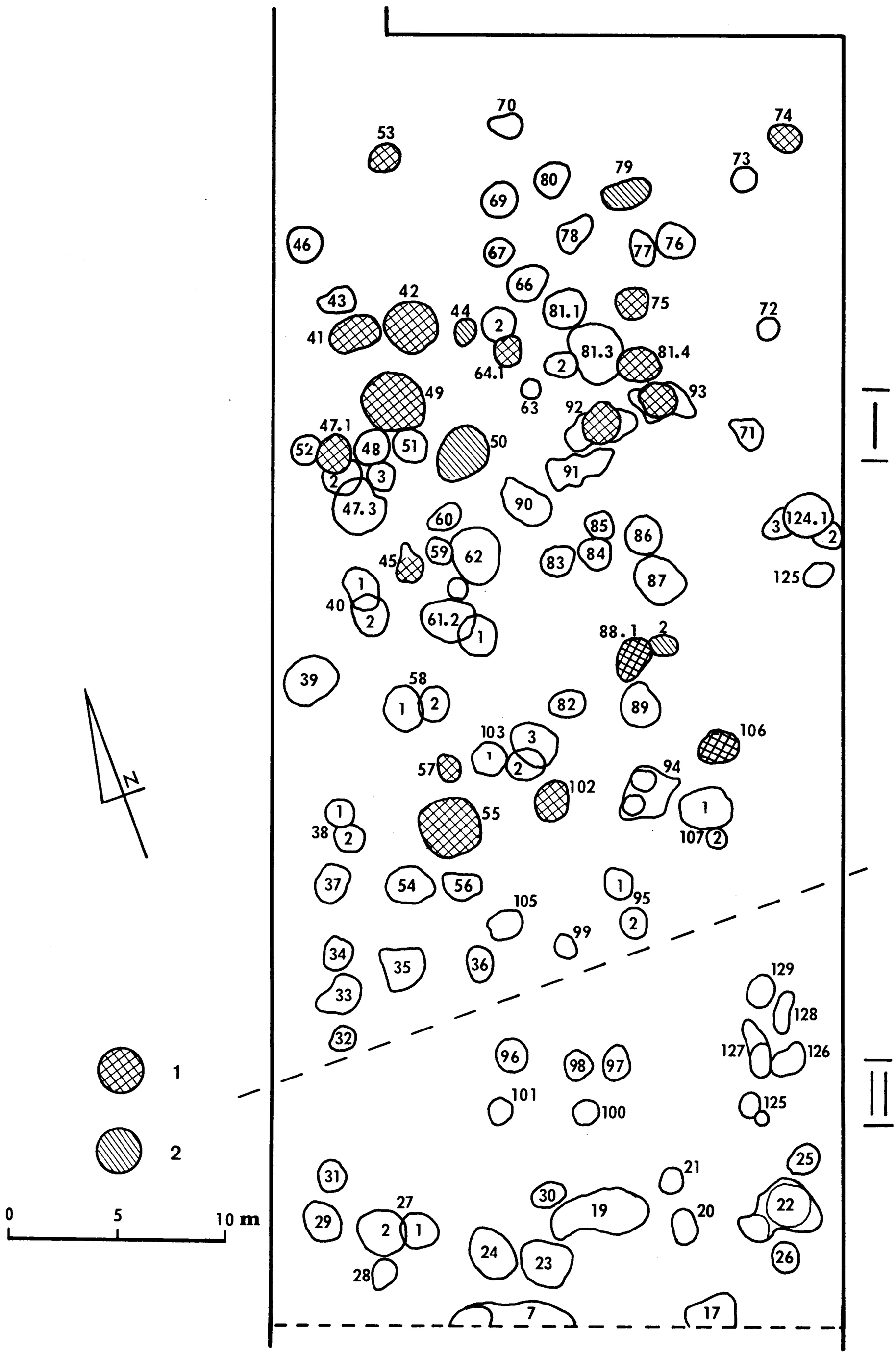

Fig. 3. Ćmielów, Tarnobrzeg Province. Gawroniec site. Part of 1947–48 trench: 1 — pits with clusters of flints; 2 — pits with many flints dispersed in the filling.

Table 1. Ćmielów, Tarnobrzeg Province. Main attributes of pits with workshop type flint assemblages.

	Pit No	Horizontal connections	Outline	Section	Dimensions (cm)			Internal features	Flint concentrations				Figure
					Length or diameter	Width	Depth		Number of flints	Dimensions (cm)			
										len./dia.	width	thick	
1	41	Co	Ov	Bo/Cy	220	100	90	Ni, Sh	1636	60	–	25	4e
2	42	Co	Ro	Fu-Tr	130	110	92	–	3662	115	–	20	4a
3	45	Se	8	Bo-Pe	165	112	134	SEt	5750	170	30	30	4b
4	47.1	Co	Ro	Tr?	110	?	118	–	1346	80	36	24	5e
5	49	Co	Ro	Cy	270	240	136	Ni, Ov	619	?	?	?	–
6	53	Se	Ro	Tr?	150	146	60	–	618	?	70	10	–
7	55	Se	Ro	Fu-Cy	240	?	186	Sh, He, Ni	1620	125	?	30	4d
8	57	Se	Ro	Fu-Tr	124	122	185	–	5189	100	90	30	4c
9	64.1	Co	Ro	Cy	120	?	82	–	507	50	–	15	4f
10	74	Se	Ro	Cy	135	?	57	Sh	2549	125-40	100-40	20-38	4h
11	75	Se	Ro	Cy	136	134	134	–	826	80	50	25	4g
12	88.1	Co	Ov	Pe	185	110	142	Ni	897	125	–	10-15	5b
13	92	Se	Ov	Cy	160	?	124	–	970	150	–	20	–
14	93	Se	Ov	Tr	200	140	128	–	2758	152	120	30	5d
15	102	Se	Ov	Bo-Pe	260	204	181	Ni	26132	225	–	50	5a
16	106	Se	Ov	Pe	240	135	165	Ni	3802	?	90	18	5c
										?	?	5	

Key: Co — connected with other pit; Se — separated; Ov — oval; Ro — round; 8 — eight-shaped; Bo — bowl-like; Cy — cylindrical; Fu — funnel-like; Tr — trapezoidal; Pe — pear-shaped; Ni — niche; SEt — step-entrance; Ov — remains of oven; Sh — shelves or steps near the bottom; He — hearth

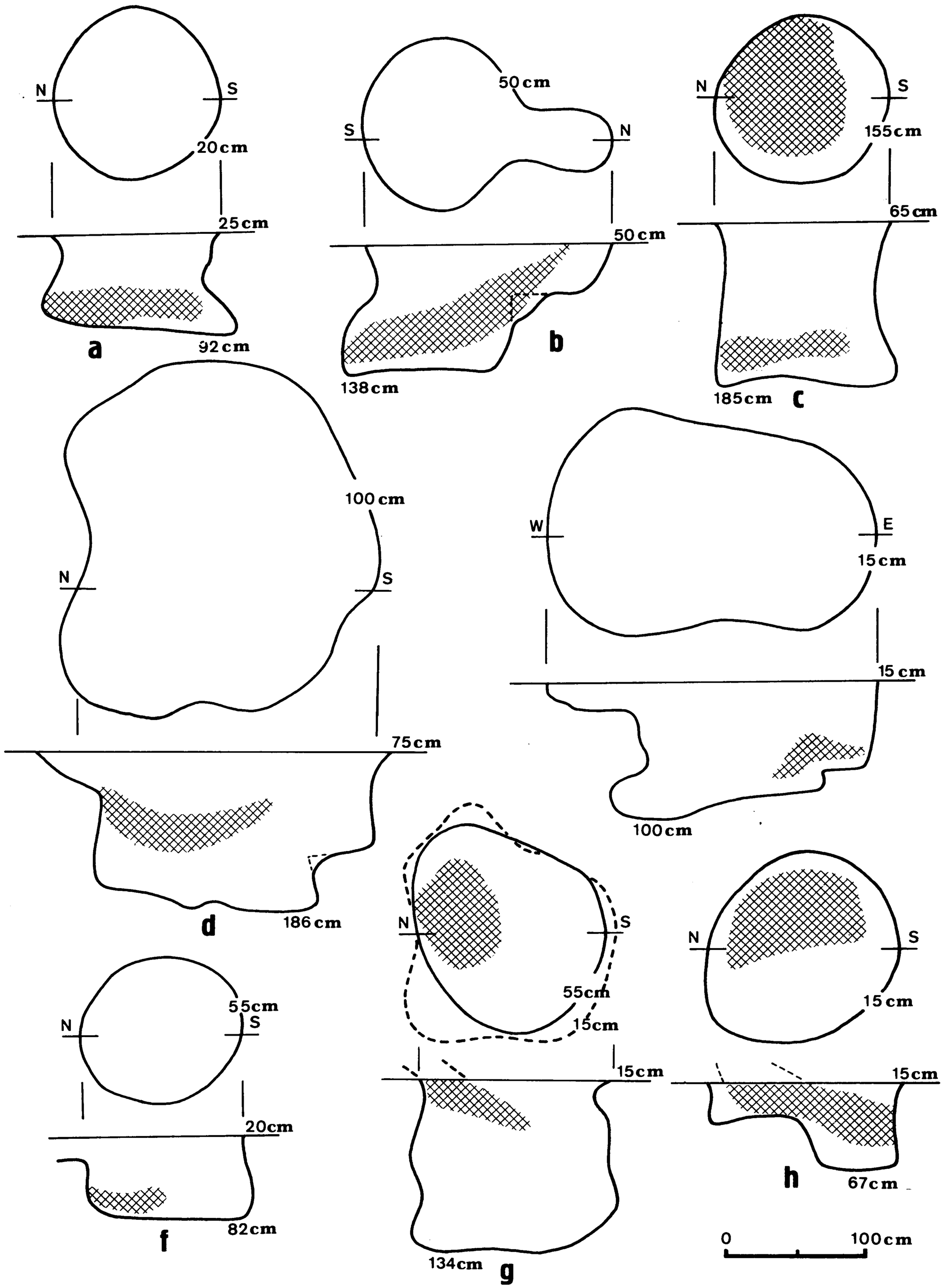

Fig. 4. Ćmielów, Tarnobrzeg Province. Gawroniec site. Location of flint artefact concentrations in pits: a — pit 42; b — pit 45; c — pit 57; d — pit 55; e — pit 41; f — pit 64; g — pit 75; h — pit 74.

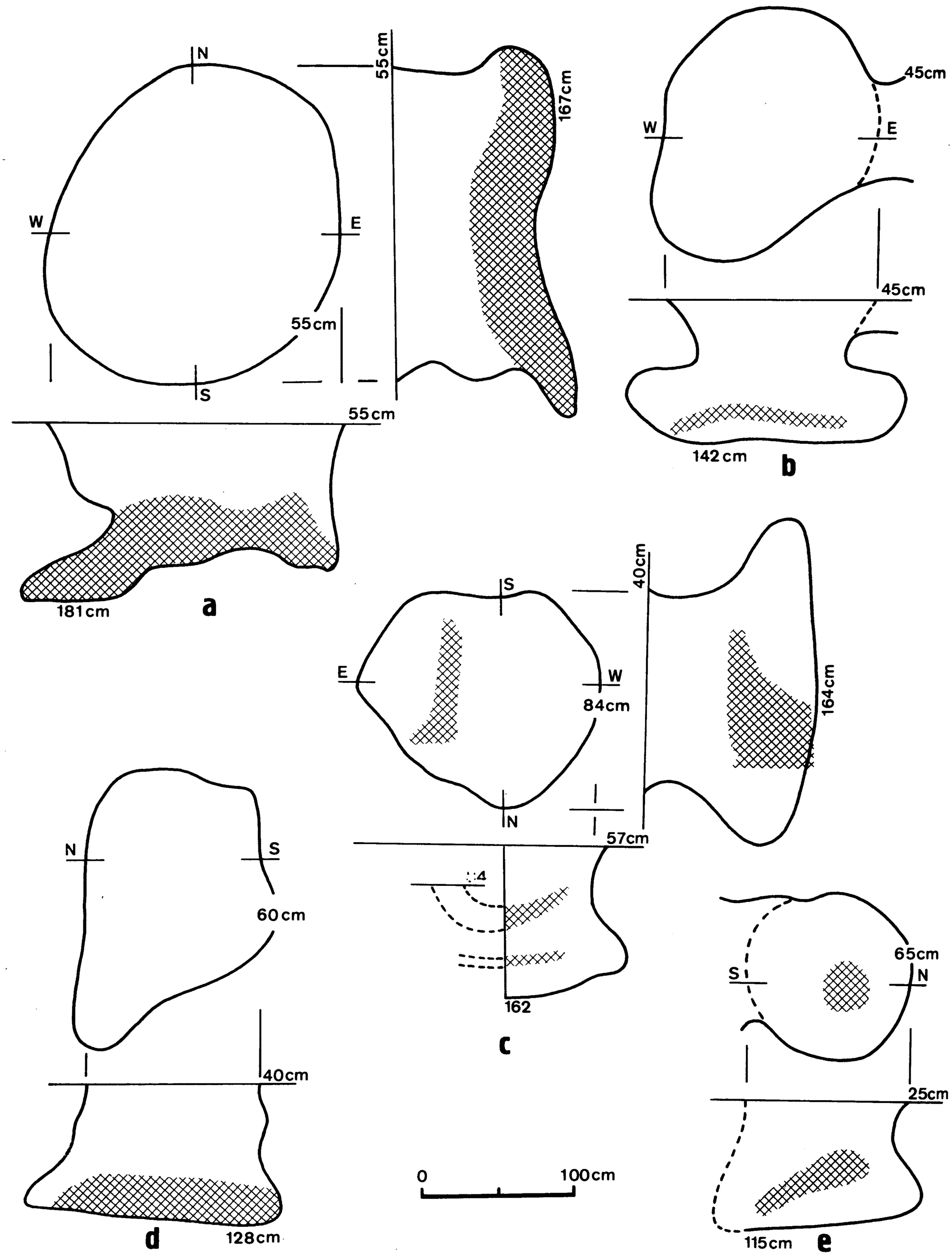

Fig. 5. Ćmielów, Tarnobrzeg Province. Gawroniec site. Location of flint artefact concentrations in pits: a — pit 102; b — pit 88.1; c — pit 106; d — pit 93; e — pit 47.1.

levels (Fig. 5c). The assemblages in seven pits were circular in shape, with diameters of 125–250 cm (Fig. 5a, d) and 50–60 cm for the smallest units (Fig. 4e–f). Oval-shaped or elongated accumulations were found in nine cases; *e.g.*, the accumulation 170 × 30 cm in Pit 45 (Fig. 4b).

The assemblages from eleven pits were deposited in horizontal layers, lens-shaped in section (Fig. 4b), flat or slightly convex, or hemispherical (Fig. 5a). The flint layers in the Pits 55 and 64 were basin-shaped (Fig. 4d, f), and the accumulation in the Pit 41 was conical (Fig. 4e). In five pits, they sloped down at the bottom according to the disposition of the earlier layers of filling that the flints had been deposited on (Figs 4b, g, h; 5e).

The flint layers were 10–50 cm thick, mostly 20–30 cm. They covered the whole (or almost whole) bottom in three pits (92, 93, 102; Fig. 5a, d), or, in eight pits they were placed 10–15 cm above bottom on the first layer of filling (Figs 4a, c; 5b). In five cases the flint layers occurred in the partly filled pits (*e.g.*, Pits 55 – Fig. 4d and 106 – Fig. 5c), sometimes in their upper part (Fig. 4g).

4. THE WORKSHOP AREA

There is no evidence that the pits containing the flint assemblages were prepared for that purpose in a special way. Podkowińska (1950:114) described the Pit 45 (Fig. 4b) as a flint workshop. She thought that the part of the pit in the form of a step formed a seat for a flint-knapper. If this were so, this entrance-step should be without any flint because the flint should have dropped directly into the pit, whereas, the layer of flints also extended beyond the step. Similar features were also present in other parts of the site; sometimes they contained ovens on their steps (Balcer 1989:354 and 365).

The evidence points to the fact that multiple remains of flint production had got into a pit during its filling – natural or intentional – with geological material and cultural remains.

The flints in the pit fillings were thus connected with their secondary function as rubbish dumps after abandonment. The presence of the layer of flints beyond the remains of the oven in the Pit 49 might be considered as proof.

The great quantity of the remains of flint production put into fifteen pits had not been mixed with other filling components. The excavators stated that the pieces of flint in the assemblages had adjoined each other or there were empty spaces between them. This might demonstrate that the flint deposits were intentional and that they were "pure", without other filling components.

Two layers of flint were evidenced in Pit 106 (Fig. 5c). They demonstrate that flint remains were deposited on two occasions, separated by a period when part of the pit fill accumulated.

The great flint groups found in those pits had been produced undoubtedly in workshops located outside the pits. There is, however, no evidence concerning their character and location. The flint mass-production at the Gawroniec settlement seems to exclude workshop location inside inhabited houses. It would be more practical to deal with flint processing out of houses, maybe even some distance from them. The present author believes that the houses were located in the south part of Gawroniec, near the top of the hill, and the most extended pits with roofs were placed in the middle part of the settlement (Balcer 1989:356).

The structural features of the pits and their disposition in the northern part of the site do not demonstrate its special character. Mainly auxiliary storage pits were found there. This part of the settlement was however distinguished by the presence of the WFA in the pits. This is an original trait, not only for the Gawroniec site.

In two other areas of the settlement, there were no workshop assemblages. Some dozens of flint pieces, sometimes about one hundred or more, were found there in several pits but scattered in their fillings. Those flints seem to result from the domestic treatment of artefacts and not from the mass-production that appears to have taken place in specialist workshops located on the northern edge of the site, on the part of the hill which, due to its slope, was inconvenient for buildings.

The quantity of flints in the WFA as well as their character are comparable only to workshop assemblages from mining sites. Only 235 tools among almost 59,000 flint artifacts were present there. Thus the production coefficient (number of production remains in ratio to number of tools) equals 1:249.4 and it is very high for a settlement.

Heaps of flint processing remains from workshops were dangerous for people and domestic animals in a settlement. Thus it was necessary to clear them away from a limited habitable surface. The abandoned pits served as underground rubbish heaps. It seems most probable that flints from workshops were transferred on mats, linens or animals skins spread during the work.

It is possible to suppose that the smallest groups of flints, consisting of several hundred pieces, could result from occasional knapping. Larger flint accumulations could have originated during repeated removing of refuse from workshops. Assuming the principle about rational behaviour of these people we can assume that refuse was removed to the nearest open (but disused) pits. Some pits from the workshop area (*e.g.*, Pits 44, 50, 81.4), containing flints dispersed in earth mixed with charcoal, might confirm this hypothesis: the flints would have been brushed aside gradually, together with earth from fire-places, directly from workshops.

The main conclusions resulting from the character of these WFA are as follows:

1. flint concentrations in the pits are parts or even the whole inventories of flint processing workshops that were located on the surface of the settlement;
2. workshops were situated in the neighbourhood of those pits, only in the northern part of Gawroniec settlement which can be considered as the workshop area of that settlement.

The differences between the workshop area and other parts of the site as to the structure and quantity of flint finds suggest the distinction between the production centres and the flint use in the FBC settlements (Balcer 1980:97). Such existence of an area of flint processing workshops inside the settlement could testify to an intrinsic group specialisation of its inhabitants. At the same time, it gives to the site as a whole the character of a settlement highly specialized in flint processing for barter. The working of two main kinds of flint raw materials: the striped Krzemionki flint and grey, white spotted flint from Świeciechów, was concentrated there.

5. FLINT MATERIALS FROM THE GAWRONIEC SETTLEMENT AS A SOURCE FOR THE STUDY OF FLINT MINING

The materials from the workshop area directly reflect the production process of blade blanks and axe roughouts of the flint industry in the Little-Poland (Małopolska) group of the FBC (Balcer 1988:67–73).

The investigation of the numerical structure of the mass finds of different kinds of flint allow us to estimate indirectly also the settlement inhabitants' contribution to the flint mining. It should be assumed that the great quantity of the flint to be treated did not result from exchange, but was exploited independently by the people from the settlement. The early observation of predominant finds of the striped flint among the materials from the surface prospection suggested that the Gawroniec settlement was the home site of miners from Krzemionki (Krukowski 1939:84–97).

The striped flint is predominant in WFA (57% of artefacts), the Świeciechów flint taking second position (43% of artefacts; Table 2). But the numerical structure alone does not reveal the real share of both raw materials. It is necessary to examine the weight of flint finds as well. This examination proves that the Świeciechów flint finds weigh relatively more (51%) than the striped flint finds (about 49%) in the whole mass about 950 kg of flints from WFA. It allows us to suppose that the raw materials of similar weight were brought to the settlement from both flint mines.

The overall type structure of WFA (Table 2) clearly indicates that the Świeciechów flint is associated with the production of blade cores and blades (Table 2.5, 2.7), and that the Krzemionki flint is mostly confined to the manufacturing of axes (Table 2.3).

Seventy percent of tools at the Gawroniec site were made of the Świeciechów flint, and only 30% of striped flint. The striped flint was of secondary importance, even in axe production in FBC (which is what it was mainly used for). In the Gawroniec settlement a lot of small flakes resulted from this production, so their number is greater than those of the Świeciechów flint. Instead, as the last type of flint was used mainly to obtain blade cores, the number of remains was minor but they were of some size and heavier. The Świeciechów flint was distributed within a radius

Table 2. Ćmielów, Tarnobrzeg Province, Gawroniec site. Finds from workshop assemblages.

Artifacts varieties / Flint	1	2	3		4	5		6		7		8		9	10	
	n	n	n	%	n	n	%	n	%	n	%	n	%	n	n	%
Krzemionki striped flint	5	–	178	95	1	1	5	32961	57.6	296	26.5	70	30	3	33515	56.95
Świeciechów flint	3	1	9	5	–	20	95	24247	42.3	817	73.1	163	69	4	25264	42.93
Others and indefinite	–	–	–	–	–	–	–	63	0.1	4	0.4	–	–	–	69	0.12
Total	8	1	187	100	1	21	100	52271	100.0	1117	100.0	235	100	7	58848	100.00

Key:

1. — initially worked nodules
2. — pre-cores
3. — axe roughouts and their fragments
4. — flake cores
5. — blade cores
6. — flakes and waste
7. — blades and blade-like flakes and their fragments
8. — tools
9. — scaled pieces
10. — total

of 470 km from its mine (Balcer 1975:224–38). The finds of the striped flint occured in the FBC mainly in the neighbourhood of its outcrops and they were of local range; only few sites were at a distance of 280 km (Balcer and Kowalski 1978:134, fig. 6). The great ratio of the striped flint artefacts at the FBC settlement on Gawroniec hill, in the vicinity of its outcrops, is thus balanced by the weight of the Świeciechów flint finds. It supports a hypothesis about only an initial role of the FBC people in the exploitation of the striped flint (Balcer 1975:248; Balcer and Kowalski 1978:134–5). The same has been confirmed for the striped flint mine of Krzemionki (Borkowski 1993). The products of the Świeciechów flint were more in demand in the FBC in spite of longer distance from the mine, and the much more simple open-pit exploitation (Balcer 1976:188) could make up for the difficulties of the longer distance and the necessity of crossing the Vistula river.

A close relation between the upland settlement of FBC at the site "Pieczyska" near Zawichost and the flint mine of Świeciechów should be mentioned (Krukowski 1939:89; Balcer 1975:181–3). The sites are located on both banks of the Vistula, some 14 km from each other (Fig. 1).

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