IV Vuursteenmijnbouw - Flintmining

Flint Mining Among the Early Farming Communities of Poland

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Introduction

The beginnings of flint mining in Poland go back as far as the hunting and gathering groups in the late Pleistocene, but the major developments only take place when the Danubian I culture (LBK) appears in the Vistula and Oder river basins. In conventional radiocarbon chronology, flint mining spans the whole period from the late 5th to the middle of the 2nd Millennium B.C.

Raw Materials

Many of Poland's flint sources were known to the later LBK-groups. The main ones were the JURASSIC-CRACOW FLINT extracted from the Karstic clays in the Cracow Upland, 'CHOCOLATE' flint from the NE fringes of the Holy Cross Mountains, GREY-WHITE SPOTTED FLINT from Swieciechow and similar raw material from Ozarów both in the Middle Vistula basin, and STRIPED FLINT from the vicinity of Krzemionki Opatowskie.

Fig. 1 Distribution of the most important flint deposits exploited in prehistory of Poland, mines and flint exploitation points.

I - 'Chocolate' flint; II - Striped (banded) flint; III - Grey white-spotted flint; IV - flints of the Polish Jura (Cracow-Czestochowa Upland); V - Areas of a rich occurrence of erratic-'Baltic' flints: Va - Poznań-Staroleka region; Vb - Miedzychód region; Vc - Gorzów Wlkp. region; Vd - Upper Silesia region; Ve - Wlodawa region; Vf - Mielnik region; VI - Volhynian and Dniester flints.
1-20 mines and main flint exploitation sites.

I - 'Chocolate' flint mines and some exploitation points.
1. Orońsko, site 2; 2. Wierzbica, site 'Zele'; 3. Polany, site 2; 4. Tomaszów, site 1; 5. Polany Kolonie, site 2; 6. Glininay.
II - Striped (banded) flint mines and some exploitation points.
7. Krzemionki Opatowskie; 8. Ruda Kościelna; 9. Borwnia; 10. Korycizna.
III - Grey white-spotted flint mines and some exploitation points of the Ozarów flint.
11. Świeciechów, site 1; 12. Ozarów.
IV - Jurrassic-Cracow flint mines and some exploitation points.
13. Saspów, site 1; 14. Jerzmanowice-Dabrówka; 15. Bebło; 16. Brzowskwinia; 17. Wolowice.
V - Erratic-'Baltic' flint mine and exploitation points.
18. Gorzów-Wlkp.-Chwalecice, site 11, 19. Poznań-Staroleka; 20. Maków.

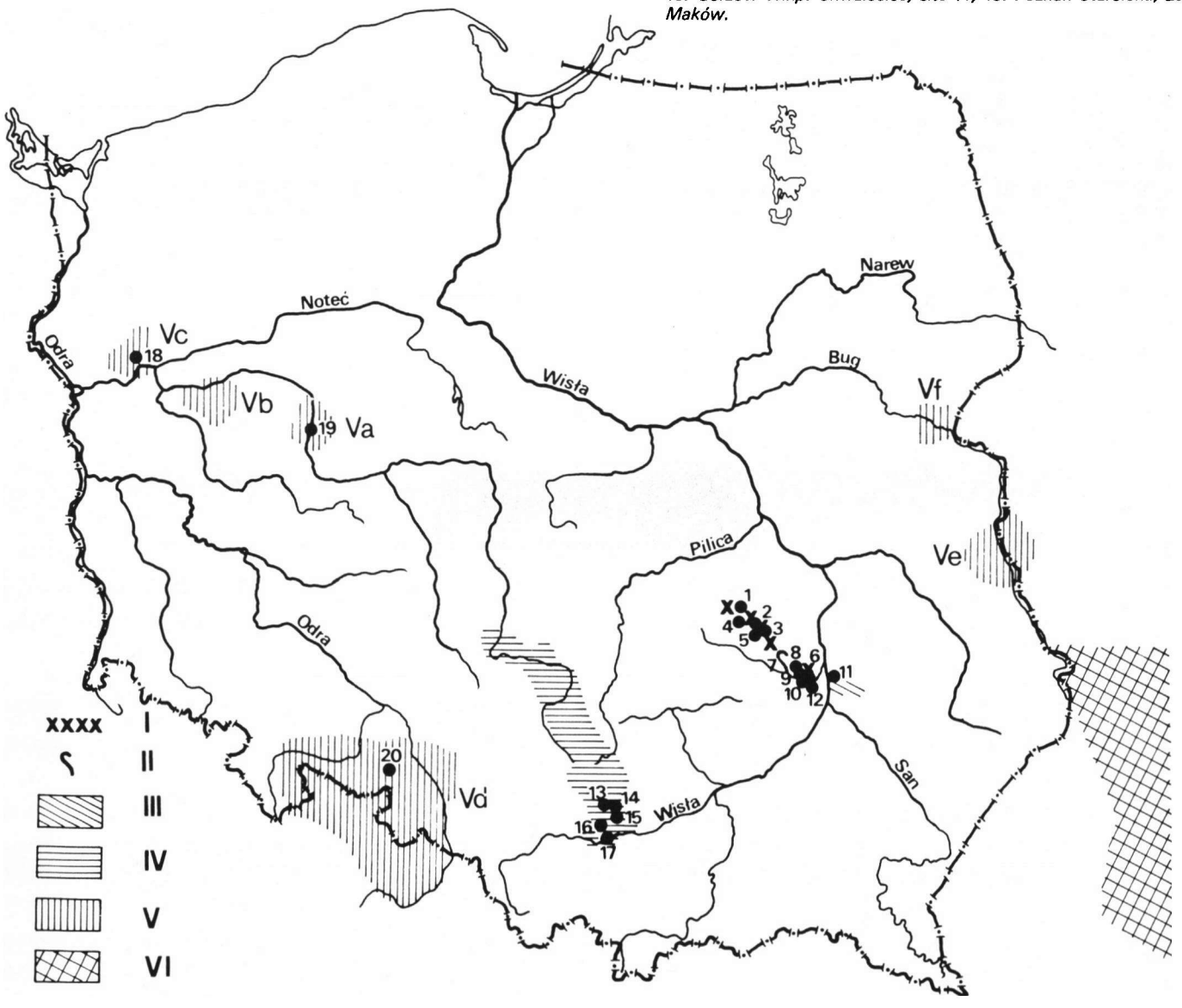


Fig. 2

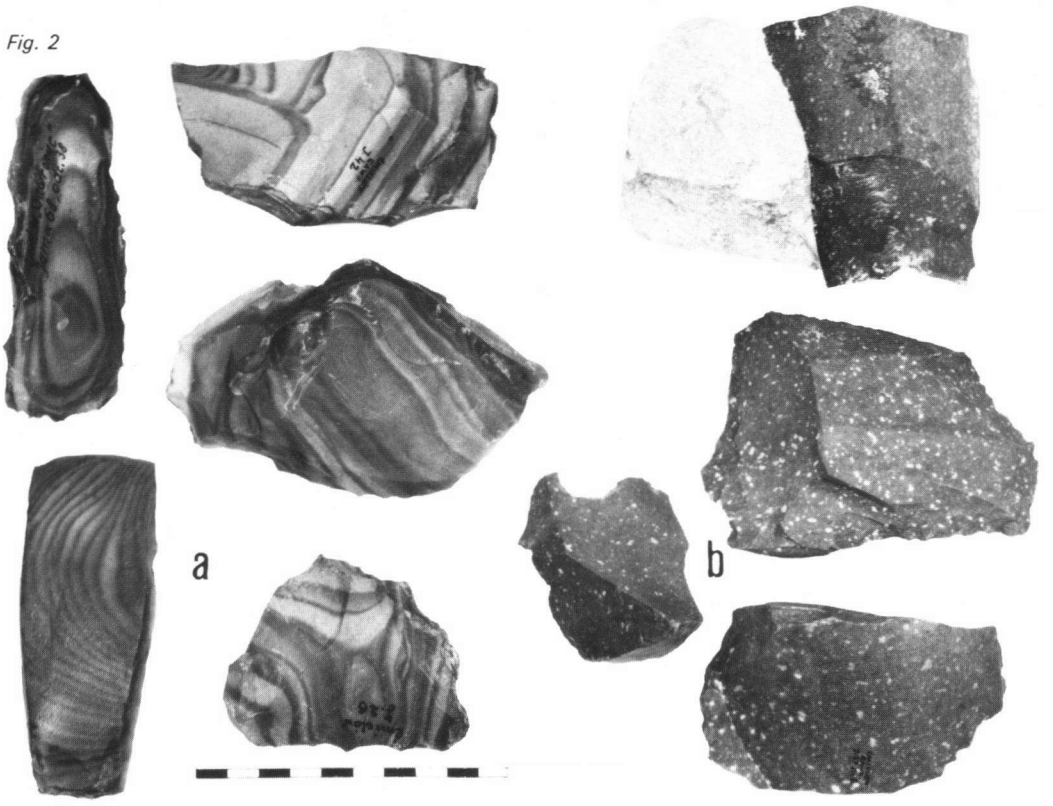


Fig. 2 Striped flint from Krzemionki flint mine (a) and gray white-spotted flint from Świeciechów flint mine (b).

Fig. 3 Polany II. View of antler tool from Shaft No. 6.

Fig. 4 Krzemionki. Stall.

Fig. 5 Krzemionki. Shaft No. 4. Nodules of striped flint.

Fig. 7 Michałowice, Prov. Cracow. Grave of a specialized flintworker;
a) flint blanks and tool;
b) bone puncher or retoucher. After J. Kruk.

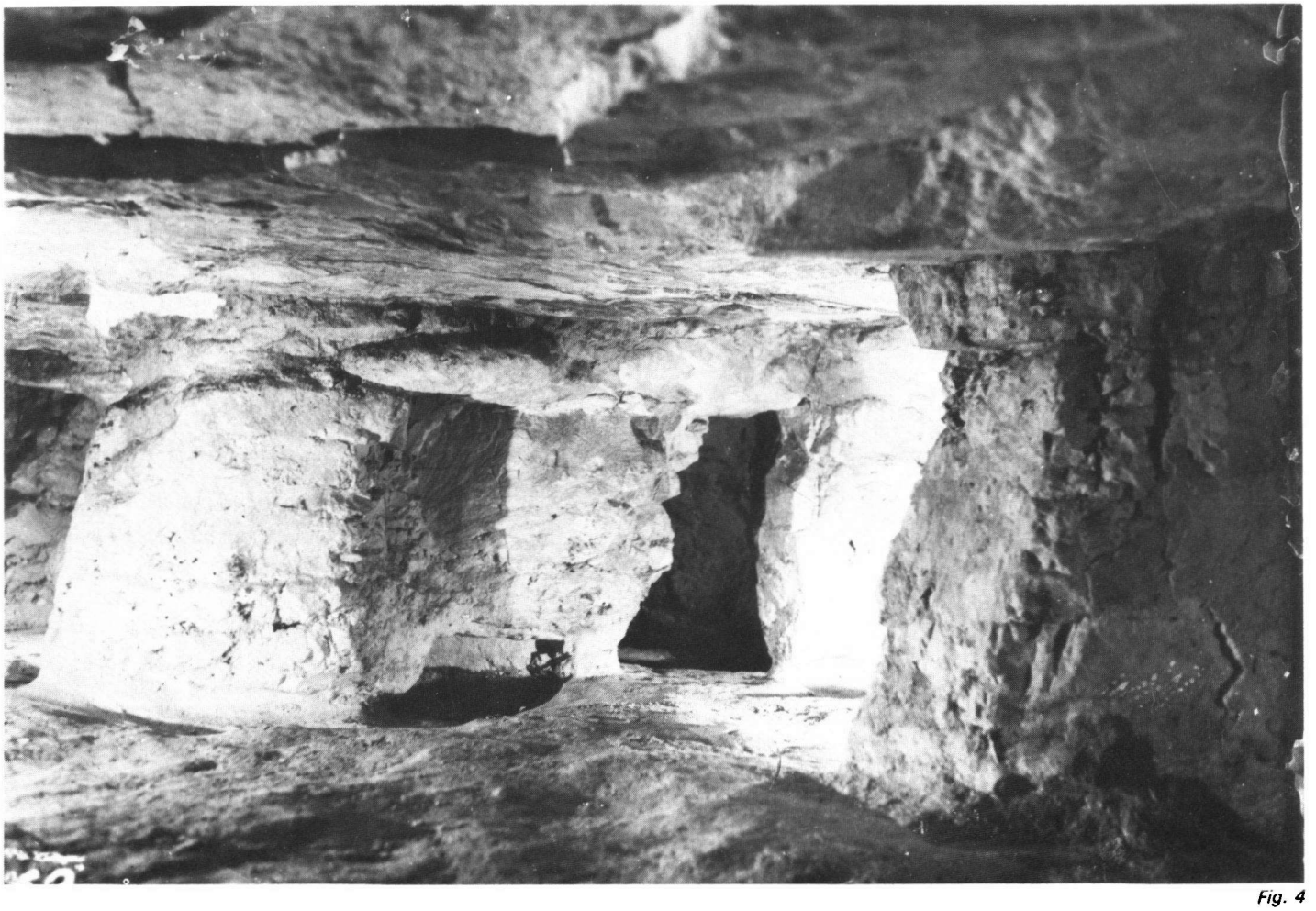


Fig. 4

Fig. 3

Fig. 7

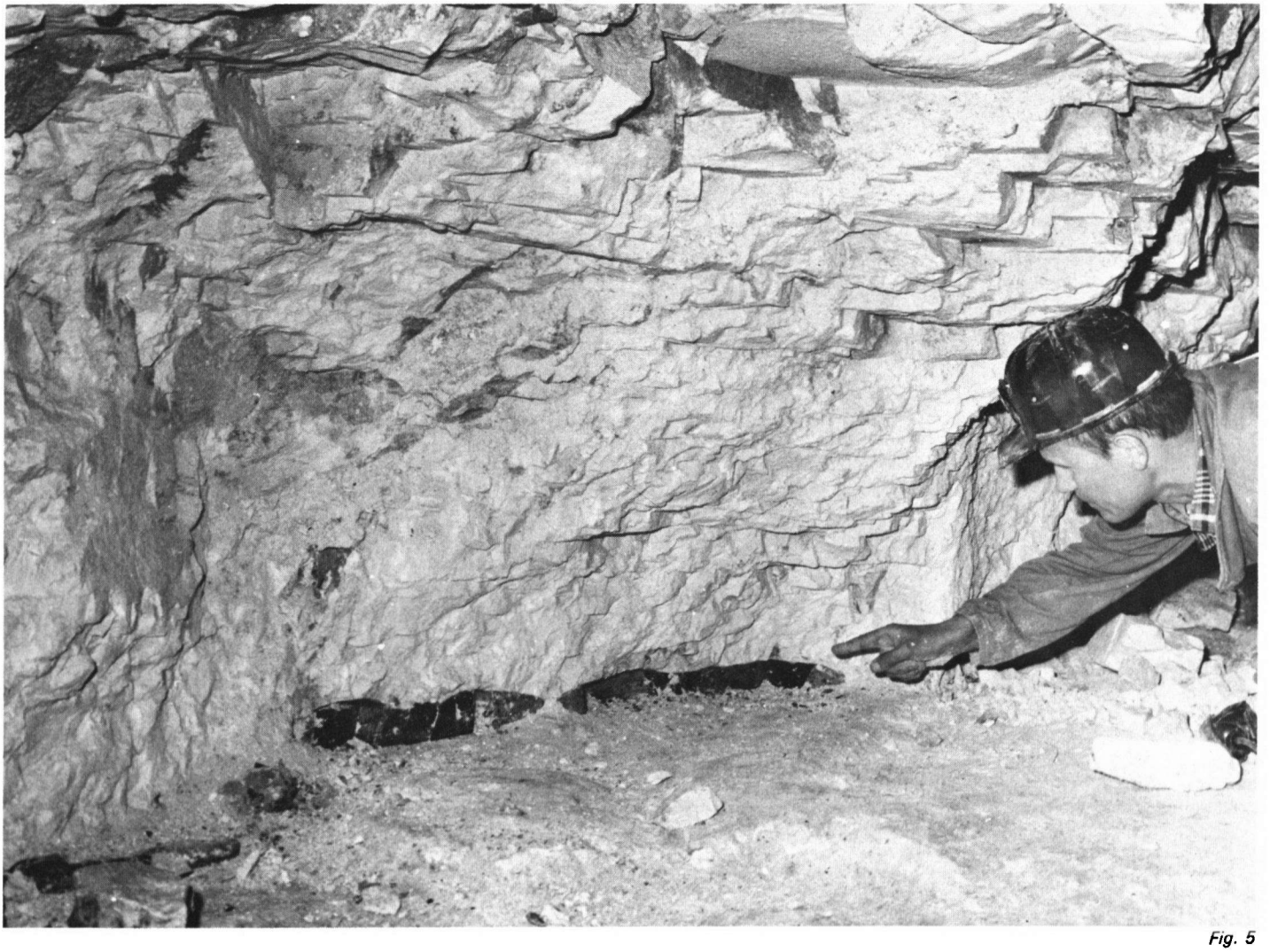


Fig. 5

In Central, North and West Poland flints found in glacial deposits were also used. These erratic flints (BALTIC FLINTS) occur all over Poland, but were only of real importance around Raciborz in Silesia.
In SE Poland VOLHYNIAN FLINT was popular. It comes from the Volhynia Uplands, which lie to the East of Poland in the Ukrainian SSR. It is possible that some of these flint sources are secondary deposits of glacial or even more recent date. However, the Volhynian flint is essentially a raw material imported into Poland from distant sources.
OBSIDIAN is another widespread raw material, originating from the Tokay-Presov mountains in SE Slovakia and NE Hungary.

Flints were exploited form three types of deposits.
1 Calcareous Upper Jurassic bedrock - the mine at Krzemionki Opatowskie.
2. Tertiary Karstic clays originating from (1) - mines at Saspow, Beblo, Jerzmanowice - Dabrowka (all in the Prov. of Cracow); Polany II and Tomaszow (Prov. Radom).
3. Quaternary glacial tills, sands and modern deposits. -Raciborz; Gorzow Wlkp., Poznań - Staroleka and Cracow-Nowa Huta.

Type 2 deposits were the most abundant, accessible and widely exploited. Obtaining flint from Type 1 deposits was much harder and slower, and Type 3 deposits had the poorest quality flint of all.

Mines
I have adopted Prof. E. SCHMID's classification of mining technology (24), with a few changes to include special forms known in Poland.
a) Natural Collecting
b) Mining
   1. Systematic extraction from landslips, gravels, glacial tills and Karstic clays
   2. Surface pits
   3. Open shafts
   4. Open shafts with side workings
   5. Underground shafts with niches
   6. Underground shafts with galleries
   7. Underground shafts with stalls
   8. Drift mining
   9. Horizontal mining changing into drift mining
c) Quarrying
All of these (exept 8 and 9) occur in Poland.

Mining technology must be studied in relation to the cultural background of the period. We can talk about exploitation when the flint deposits were systematically worked, with workshops on the site or nearby. Many of the flint sources lay far beyond the radius that was usually exploited all the year round by these communities, and expeditions would have to be organized and send out specially.
A good example is the systematic extraction of flint eroded by the river Warta in the region of Poznań-Staroleka, where there are many flint workshops belonging to TRB groups, Here, the river passes through a frontal moraine in a deep gorge (7). Other sites of the same type are known at Gorzów-Wlkp.-Chwalecice and on the Lengyel-Polgar settlement at Cracow-Pleszów (6, 8). Surface pits down to a depth of 1.5 m. could have been the work of one man, who would also have worked the raw material he had dug up. With the right kind of planning and a practical knowledge of the local geology, this would be simple enough, and the volume of waste rock would be between 1 and 5 m^3. Deposits at Świeciechów and Beblo were worked like this (1, 3, 6).
Open shafts need at least two people to work them properly, and more and better knowledge of mining is required. There is often a step in the shaft to help lift out flint and waste, which could be anything from 3 to 80 m^3. This is the commonest type of mine on the Vistula and Oder, and it is found at Saspów, Tomaszów, etc. (12, 21).
They vary from 2 to 5 m. in depth, and some at Saspów were nearly 8 m. in diameter at the mouth. Shafts from the mine Polany Kolonie II are a separate category between the open shafts and larger ones with niches and galleries (23).
Fully underground galleries, stalls and niches have been found only at Krzemionki Opatowskie, but as was the case at other large European flint mines, simpler shafts were in use alongside the more complicated ones. Galleries were about 60 cm. high, but some side niches and stalls were more than 1 m tall. Pillars were left to support the roof (10, 25).

Size of the Mined Areas
Making comparisons with the sizes of flint mining areas in modern primitive communities, we can suggest a 4-fold division.
1. Up to 1 ha. — Polany Kolonie II with a surface of about 0.2 ha. belongs in this group.
2. 1 to 5 ha. — Saspów (about 4-5 ha.) and probably mines at Tomaszów and Wierzbica - 'Zele' are among them.
3. 5 to 20 ha. — This includes Beblo (about 5-10 ha.).
4. Over 20 ha. — a group of very big mines such as Swieciechow and Krzemionki Opatowskie (about 35 ha.).

Dating
The start of flint mining goes back to palaeolithic and mesolithic groups (11). The mines for 'chocolate' flint at Tomaszów began at this time, and was carried on into the LBK culture of the 5th Mill. and far beyond into the 3rd and 2nd Mill. B.C. (21, 22).
The mines at Saspów began to be used in the 4th Mill. B.C., and at the same time mines elsewhere in the Cracow Uplands were being worked. The erratic cretaceous flint at Maków near Raciborz was probably being exploited from the 4th Mill. B.C. too.
Krzemionki Opatowskie's mines of striped flint were later, and were established sometime in the 3rd millennium, as were the ones of spotted flint at Swieciechow.
At the turn of the 3rd/2nd Mill. B.C. the mines at Polany Kolonie II and Krzemionki were functioning. Production of 'chocolate' flints is among the latest to be dated, since they were still in use in the middle of the 2nd Mill. B.C. (Polany II).

Mining Tools
Only a few flint tools can be linked with the oldest mines, since those of wood, bone and antler have all been destroyed by the highly acidic soils. At Saspów shaft No. 1 the outline of a tool like a spade was found, and antler tools were discovered among the materials in an occupation from the cave of Beblowska Dolna, which is only 1 km from the mine at Beblo (18). These hoes could have been used to dig the loess, clay or sand in the mine.
Flint picks were not much used in the oldest mines, although one 9 cm. long was found in the mine shaft at Jerzmanowice--Dabrówka, and there are a few others from Lengyel - Polgar settlements of the same data.
Macrolithic scrapers were probably used to clean the clay off the nodules, and they could also have been used in digging the mine shaft. They are common at most mines.
A much bigger variety of flint, stone and antler tools was found at the later sites, especially at Krzemionki Opatowskie, where there were picks, pickhammers, wedges, chisels and hammers. From the end of the 3rd Mill. B.C. mine at Polany Kolonie II came purpose-made mining tools of antler, and levers or wedges were particularly common. Clear marks on the walls of the shafts show how they were used, and 4 complete ones measured from 27 to 31 cm. in length. In addition, a pick hammer and a double-ended lever were found, all made of red deer antler *(Cervus Elaphus).*
There are also some specially made flint tools, such as bihorned pieces (in Polish 'dwurogacz'), which were very probably used to trim branches into usable wooden poles with a round section. Flint picks are now a frequent mining tool from the middle of the 3rd Mill. B.C. to the middle of the 2nd Mill. B.C. (Krzemionki, Polany II).

The Finished Products from the Mines
Over the 3000 years in which Polish flint mines were operating, a number of trends in their products can be seen.
For the Danubian cultures, flint blades were the main tools, at first only a few centimetres long, but lengthening until by the end of the 4th Mill. B.C. specially long blades were being regularly made (6). The same tendency occurs among flint working in the TRB Culture in South Poland at the same time (1).
Another important stimulus to underground flint mining is the change in the shape and type of axe. The axe of polished stone which was used in Danubian group is replaced by a rectangular-sectioned one of flint by the TRB Communities, and with this change went an increase in the level of technological skill needed to make an axe. In those areas where the Danubian groups had good access to flint sources, they made blades but discarded the

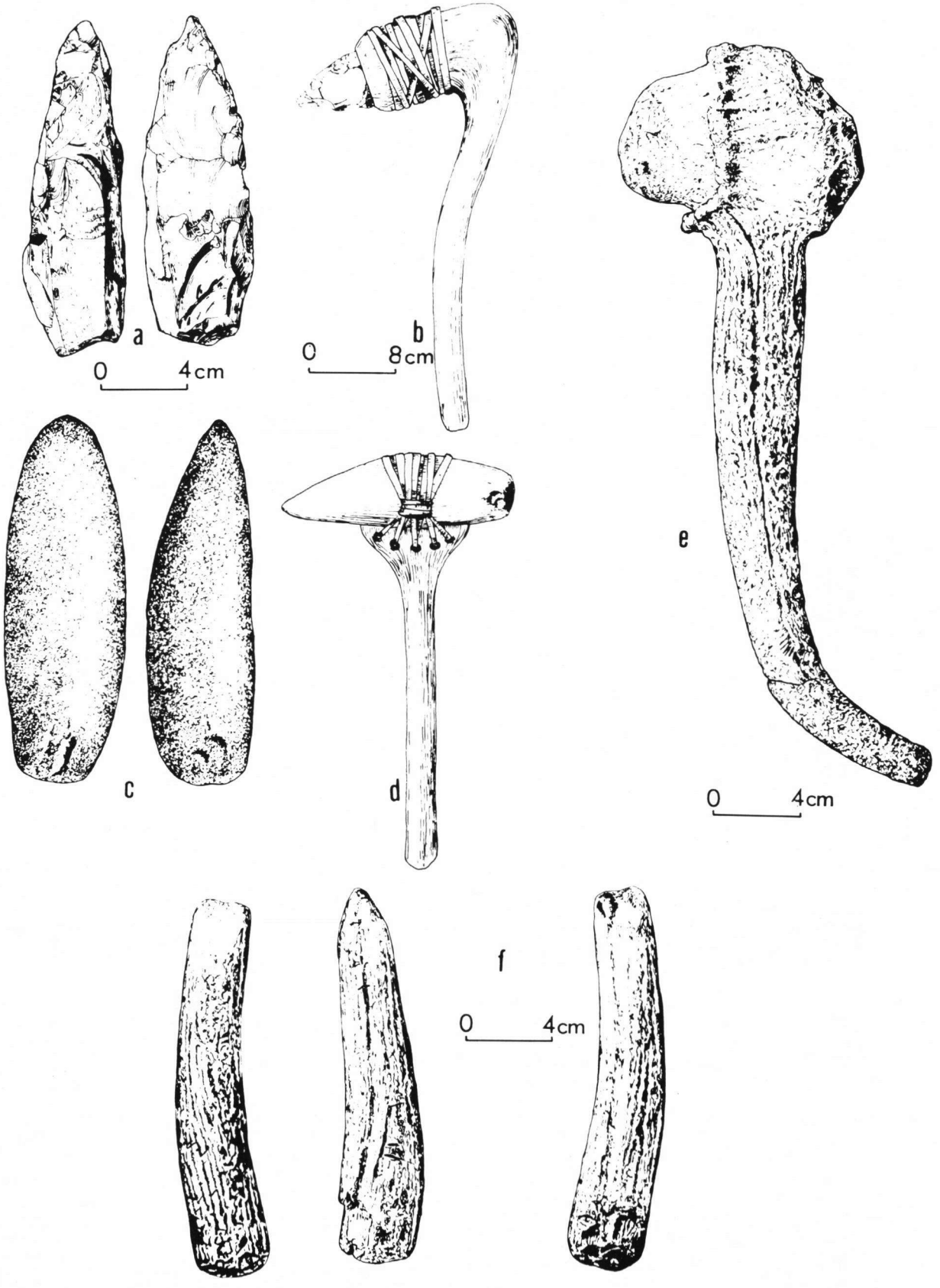


Fig. 6 Mining tools from Krzemionki, acc. to S. Krukowski.

worn out cores as worthless. But in the TRB culture, these cores were kept, and worked into good flint axes (1). The development of the flint axe as one of the major tools of its time was due to the lack of any other suitable stone. In the Danubian cultures, suitable axe material was imported from far away sources. One example of this is the site of Cracow-Olszanica where most of the polished stone tools were made of amphibolites, which is not found any closer than lower Silesia (16). After some time these stone axes were replaced by flint ones.

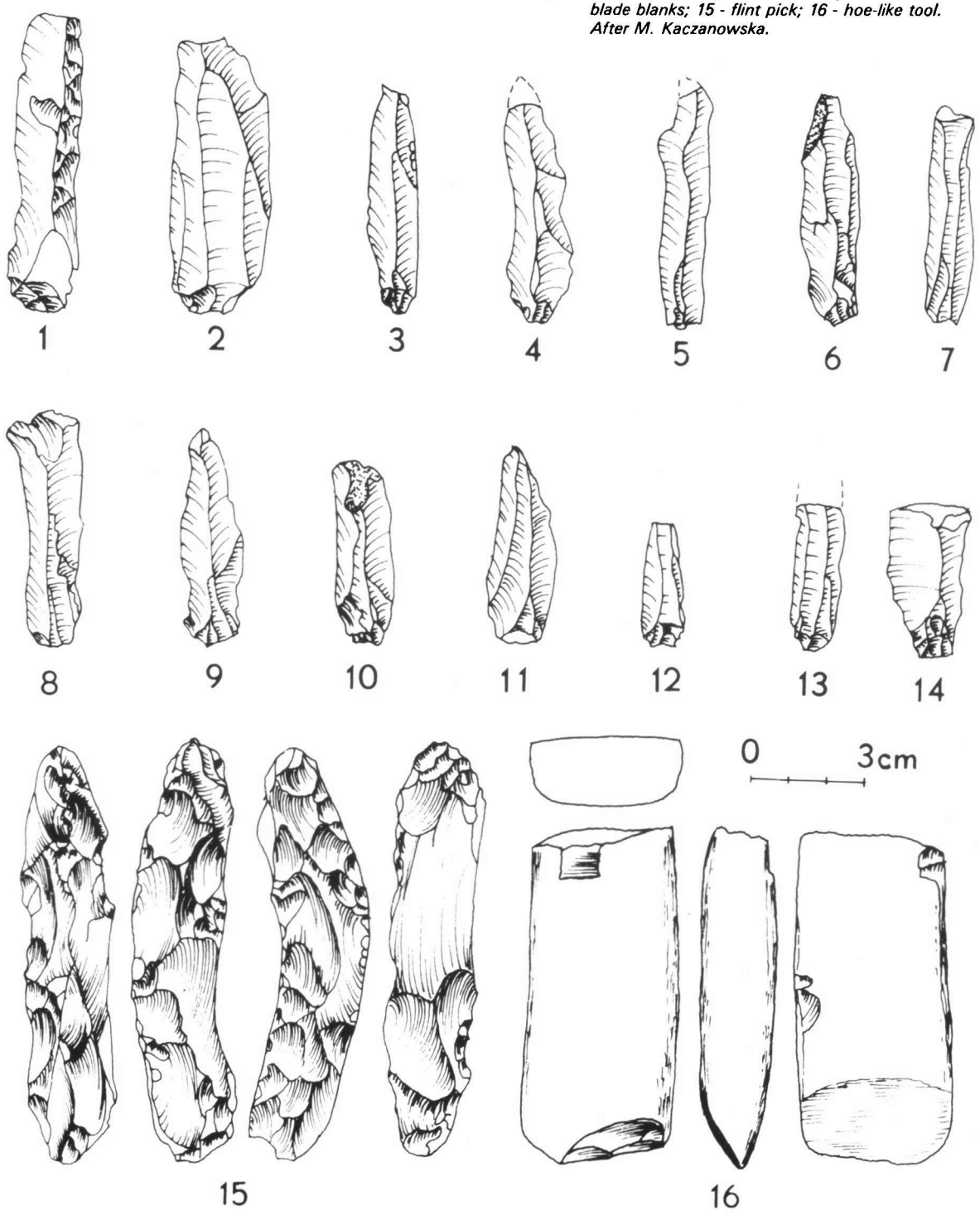
Another turning point in flint work took place towards the end of the 3rd Mill. B.C. when the mine at Polany Kolonie II was functioning. Instead of the previous blade technology, tools made on cores become more important. These are now more sickles, foliate and bifacial knives, large preforators on cores, daggers, and the bihorned pieces for heavy woodworking (23). Once these trends were established, they lasted until the finial decline in flint as a basic raw material.

The Distribution of Special kinds of Flint

The fact that few kinds of flint were exploited in Poland makes it possible to study their distributions, and to see something of the mutual contacts between prehistoric communities.

Along the Vistula and Oder river basins, flint is found on LBK sites in all directions up to 200 km. away from its source. Elsewhere, there are more local patterns, as in Lower Silesia, where the settlements used the Jurassic-Cracow flint, while in Kujavia 'chocolate' flint from the Holy Cross Mountains was employed (6, 13). In both cases it is likely that expeditions were sent out specifically to seek flint, although exchange was also important, especially when it is remembered that there was often no technological reason for it. These seem to be relations of a purely social character. Small amounts of Obsidian also moved great distance to many sites in South Poland, and 'chocolate' flint as well as the Swieciechów flint has also been found far afield at Olszanica and Mogila 63. The striped flint was not exploited at this time. The

Fig. 8 Cracow-Pleszów, pit 937. Grave goods from a miner burial, 1-14 - blade blanks; 15 - flint pick; 16 - hoe-like tool. After M. Kaczanowska.



Jurassic-Cracow flint even reached settlements on the Danube river, and has been discovered at Sturovo in South Slovakia, as well as Vedrovice-Zabrdovice and Bohusice in Southern Moravia. They are all 260 to 300 km. south of the flint sources, and Krimice near Pilsen in Bohemia, has the same material and is 450 km. away. At the LBK settlements of Bylany, this imported flint was dominant, and isolated artefacts of 'chocolate' and Świeciechów flint were also recovered.

In later cultures, local flint replaces the imported varieties as the dominant material. Thus, on the TRB settlements at Bronocice and Ksiaznice Wlk. in the Nida Basin, the Jurassic flint dominates, and it is the striped flint from Krzemionki Opatowskie that is used at the settlement of Ćmielów which lies only 10 km. away from the mine.

Apart from this there is a special trade in long blades, which can only be made from certain kinds of flint. In the TRB culture these blades were of Świeciechów and Volhynian flint, and they spread as far as Silesia to the South and to Kujavia in the North: distances of 300 and 400 km. respectively. Blades of Świeciechów flint have even been found on the Bohemian-Moravian Uplands at Cimburk and at Mradice (1).

The striped flint from Krzemionki Opatowskie does not make good blades but is excellent for axes, and it is a good example of how the different qualities of the various flints affected their use and distribution. So, striped flint only really becomes important in TRB times, and its use then increases enormously among the succeeding GAK groups. Axes of striped flint are even found in Pomerania, and the majority of the larger, galleried mines at Krzemionki Opatowskie were dug at this time. It seems that axes made of this flint has some other meaning besides an ordinary technological one to the GAK groups, because they are mostly found in graves, and are usually in mint condition (1, 2).

In the succeeding EBA Mierzanowice and Trzciniec cultures striped flint falls off in popularity, and the only flint used is that which is most easily found close by.

The Social Aspects of Flint Mining

Although the distribution of raw materials shows that there was increasingly close interaction between LBK settlements, it is probable that the social relations implied in these patterns were of more importance than the economic advantages of one flint over another (13).

These may be related to forms of tribal organization, such as the long houses and simple burials suggest, and the relative egalitarianism would not be at variance with a certain amount of specialization among groups. Thus, big settlements dealing with flint mining like Cracow-Olszanica in South Poland, or equally large ones like Bylany in Bohemia importing flint, fall into an intelligible pattern. This may well have provided a basis for individuals to begin to specialize in making composite tools, suchs as the workshop for making sickles found at Vedrovice-Zabrdovice in Moravia (17).

In the 4th Mill. B.C. a developed mining and processing organization existed for flint, and different sorts of workshops can be seen in Lengyel-Polgar contexts. Some were for preliminary processing of cores, or blades, or for finishing off the blades.

All this was time consuming, and demanded an organization of groups of men for periods up to several weeks (3, 12). Older and more experienced men may well have done much of this work, and the grave of one was discovered at Michalowice near Cracow (9). He was over 50 years old, tightly flexed on his right side, with his right hand under his head, and his left lying close to the pelvis. Nearby were nine blades, three waste flakes and a flint tool that looks like a fabricator or retoucher. In his left hand was a bone awl, about 10 cm long, which is like other bone punchers and retouchers used in flintworking. This seems a clear case of a man distinguished in death as in life as a specialized flintworker, and would explain his grave goods. A similar set of grave goods was found at the site of Cracow-Pleszów (pit 937), and included blades, a pick 11 cm. long and a hoe-like tool of shale, possibly for mining (5). Unfortunately, the sex and age of this burial are unknown. Both graves lie within 15 to 30 km of the mines at Saspów. In economies where hoe cultiviation and animal breeding were the basic means of subsistance, specialized activities like flintworking were probably undertaken periodically, as flint was needed. It is likely that what surplus was produced in these societies was re-distributed among the whole community, and that the specialist would acquire prestige. Cultural anthropology tends to support such a reconstruction of the rôle of the specialist in early agricultural settlement, and in this way the relative egalitarianism of segmentary tribes persisted as a stable arrangment. Existing differences were the product of 'non-commercial' relations, which were simply part of the general community organization (4, 14, 15, 19, 20)

From the beginning of the 3rd Mill. B.C. economic and social relations become more differentiated. Settlements became larger, and there is a population increase. In the TRB and GAK groups social transformations may be seen to begin, as shown by the appearance of the Kujavian long barrows, passage graves and stone chambers. How all this can be tied in to changes in the organization of flint mining is still an open question. Perhaps the older Danubian models persisted, since we do not yet have any archaeological finds to show that Polish 'miners' changed their social status, or had more sophisticated organizations. Despite the presence of large underground galleries and stalls or the existance of big flint workshops, there is no evidence yet that mining was a *full-time* specialist activity.

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