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## Stone Age – Mining Age



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## The Use of Siliceous Rocks in the Late Palaeolithic of the Swiss Plateau

### Abstract

The Late Palaeolithic of the central and eastern part of the Swiss Plateau constitutes a special cultural group (Fürsteiner) which shows obvious differences to the backed point groups (Azilien) of the neighbouring areas. This study comprises five sites of the Fürsteiner-Group: Lengnau-Chlini Ey situated in the Aare river valley, Wauwil-Sandmatt and Schötz-Fischerhäusern on the shore of the former lake of Wauwilemoos and Cham Grindel 1040, Cham-Grindel 1041 on the northern shore of the lake of Zug. Furthermore two sites situated on the shore of the Lake Neuchâtel (Neuchâtel/Monruz & Hauterive-Champréveyres), which according to the excavators can be compared to the Azilien. The Fürsteiner-Group seems to occupy the Swiss Plain east of the Lake Neuchâtel.

The typological and petrographic studies give a better understanding of this cultural unit. Due to the extremely few excavated sites and the bad conditions of preservation in the area there is almost no scientific dating of the Fürsteiner-Group. The Fürsteiner site itself had two cultural layers which according to the pollen analysis might belong to the Allerød and the latest Dryas. So far no radiocarbon dating has been made. Fürsteiner is characterised by a very high percentage of burins (normally more

than 40%) and a few backed tools (less than 10%). The quality of flint knapping is compared to other areas rather poor. Most tools are made on flakes, and regular blades are scarce.

In the Azilien the situation is exactly opposite. Backed tools and scrapers are dominating the assemblages and normally constitute less than 10% (maximum 20%). The recently excavated sites of the Neuchâtel area are well dated which is not the case for the other Azilien finds of Switzerland. A geographical gradient can be established concerning the selection of raw materials between the two cultural groups. In the sites at the Lake Neuchâtel the raw materials imported from the South are very important. They do not appear in the sites of the central and eastern part of the Swiss Plateau and are very rare in Lengnau-Chlini Ey. The raw materials coming from the North show a wider variation in the sites of the central plain and lack in the area of Neuchâtel. In the central and eastern Swiss Plateau the chert of Oteffingen-Weiherboden is the most important raw material. This type was known in the western group, but is extremely rarely used. Instead materials of local and southern Jura origin were preferred.

**Keywords:** Swiss Plateau, Fürsteiner, Azilien, Siliceous Rocks, Chronology, raw material

### Chronology and cultural differentiation

The Late Palaeolithic is defined as cultural groups with backed points succeeding the Magdalenian in Central Europe. It is mostly presumed that these groups should be dated to the pollen zones Allerød and Junger Dryas, and thus approximately to the time between 11800 and 10600 BC cal (Street *et al.* 1994). New dates from the important stratigraphy of Champréveyres (Lake Neuchâtel) indicate,

though, that the backed point groups existed already in the second half of Bölling, probably from around 12500 BC cal (Höneisen *et al.* 1995; Leesch, Cattin & Müller 2004). The end of these groups seems less clear as datings from Rochedane in the French Jura show an early Preboreal settlement (approximately 9300 BC cal), with small backed points, clearly in the Azilian tradition (Thevenin 1982). Furthermore a cultural layer with a developed Mesolithic assemblage with microlithic triangles, dated to the second half of the Junger Dryas (around 9800 BC cal) was exca-

vated in Abri de la Fru in the Savoyan Prealps (Pion 1990). These contradictory results are difficult to interpret at the moment.

Recent research shows the presence of at least two Late Palaeolithic cultural groups in the Swiss area (Nielsen 1999). As only a few modern excavations have been carried out and most find materials are thus stray finds and artefacts from old excavations, the chronological framework is based mainly on results from the neighbouring areas.

The backed point groups of the Swiss Jura are normally compared to the Azilian of the adjacent part of France. The few known sites of western Switzerland, west of the lake of Biel, seem to belong to the same group (Crotti 1995). In the Azilian the backed tools are often dominant while burins normally make less up than 10% of the tools (Pion 1990; Rozoy 1978; Thevenin 1982). Artefacts made of regular blades are rather common.

Two recently excavated sites in the Swiss Prealps show that this part of the country was also settled during the late Glacial period. From Einsiedeln - Langrütli a small number of late Palaeolithic tools, like backed points and bladelets, scrapers and burins are known. The raw material used for the tool production has not yet been analysed. A large part seems to have been imported from the Jura mountains (Leuzinger-Piccard 1996). While the rather low percentage of burins and high percentage of backed bladelets is comparable to the Azilian, the quality of the tool production is more like Fürsteiner (see below). A very small assemblage from the cave of Rüte - Altwasserhöhle 1 is of special interest as the points and microliths cannot be compared to finds from the other Swiss regions. Contacts to the late Glacial cultures in the southern Alps are thus discussed by the excavators. The raw material seems mainly to be of local origin or to have been imported from the Jura (Jagher *et al.* 1997). The Late Palaeolithic of the Swiss Plateau east of the lake of Biel differs distinctly from the above mentioned areas and constitutes a special cultural group, which has been named Fürsteiner group after a locality in the canton of Bern (Wyss 1968; 1973; Nielsen 1999). So far, more than a hundred Late Palaeolithic sites are known from the area of research. Characteristic is a rather poor quality of tool production, mainly based on irregular flakes and short blades. Among the tools, the burins, mostly truncated, are clearly dominant and normally constitute between 40 and 50% of the tool kits. The backed bladelets and the backed points are always represented, but rarely constitute more than 10% of the tools. Scrapers are mostly made of broad flakes, borers are very scarce.

The environmental changes in Late Glacial central Europe at the beginning of Bölling seem to have had a major impact on the settlement pattern of the hunter-gatherers of the region. A distinct rise in the number of settlements compared to the Magdalenian (Nielsen 1998), and clearly established local groups indicate basic changes in the way of living.

## Petrographic method

The analytical process used is non-destructive and has been described elsewhere (Affolter 1991; Affolter 2002). Most sedimentary silicas derive from carbonate-rich rocks and can be studied in the same way as these, namely by the analysis of their components and the interpretation of their sedimentary microfacies. Destructive thin sections are not necessary for the study of chert; equivalent results can be achieved by examining the chert surface when immersed in water under a binocular microscope, using a magnification between twenty and two hundred and fifty times. Using this method, a large number of artefacts can be analysed in a comparatively short space of time.

The raw materials used in the Late Palaeolithic sites of the Swiss Plateau are very varied. The main parts of the outcrops are situated in the Jura mountains or in the extension of these. They are mostly found in the Malm layers, in which the method used permitted the distinction of many sedimentary facies:

- ◆ the beach deposits at Alle,
- ◆ the gully facies at Pleigne,
- ◆ the back-reef facies at Lampenberg,
- ◆ the edge of an external platform at Liel,
- ◆ the pelagic environments at Olten and Wangen,
- ◆ the lower continental slope facies at the Lägern,
- ◆ the outer shore line at Kleinkems.

Some other varieties are coming from other geologic layers:

- ◆ from the Trias, the upper infratidal facies probably originated from the north of Schaffhouse, or the muddy subtidal zone at Dossenbach;
- ◆ from the Dogger, the detritic infratidal at Balmburg, or the internal platform at Orvin, the upper littoral zone at Lengnau;
- ◆ from the lower Cretaceous: the tidal flat at Saint-Blaise;
- ◆ from the upper Cretaceous: the open undep infratidal in the vicinity of Bellegarde and Seyssel, which can be redeposited in the burdigalian molasse;
- ◆ and from the Tertiary: the lacustrine littoral zone at Lör-rach, the lacustrine slope at Le Locle.

The most other raw material sources of the Jura mountains were not used in the Late Palaeolithic settlements of the Swiss Plateau.

The alpine raw materials were very strongly faulted during the uplift of the Alps. However, often found in the settlements they occur in small quantities only. They mostly belong to the flysch or deep-sea facies, and sometimes contain large quantities of Radiolarian. Alpine rock crystal is seldomly used.

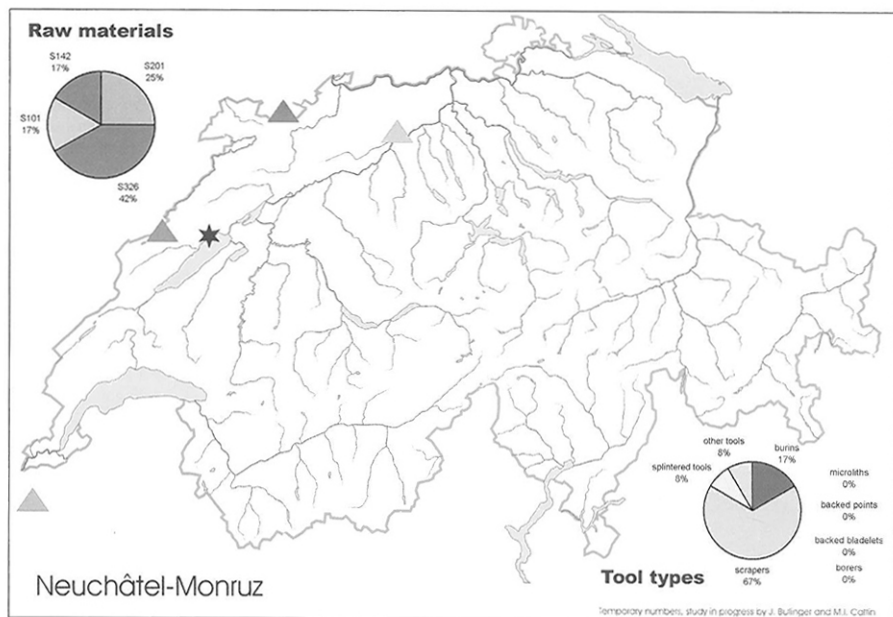


Fig. 1: Neuchâtel-Monruz, tool and raw material assemblages (Late Palaeolithic layer).

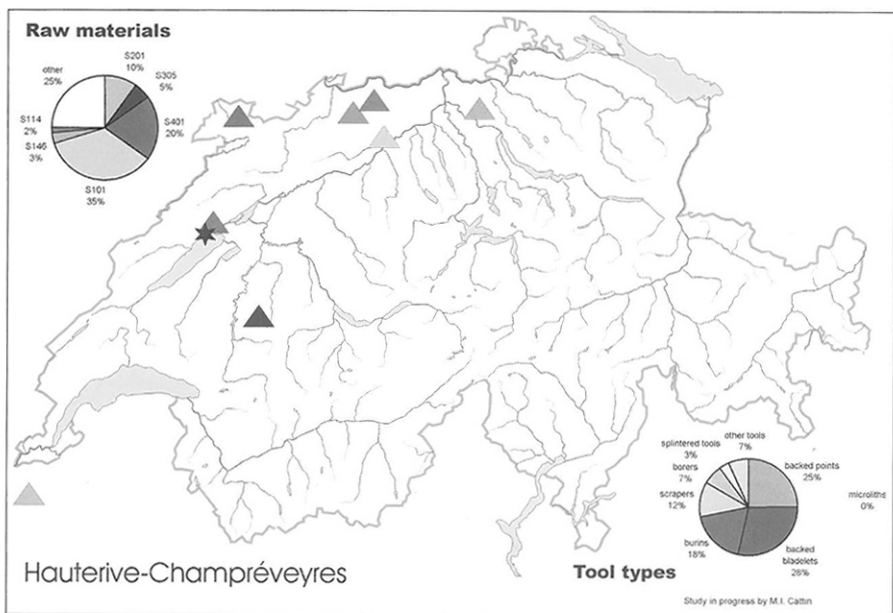


Fig. 2: Hauterive-Champréveyres, tool and raw material assemblages (Late Palaeolithic layer).

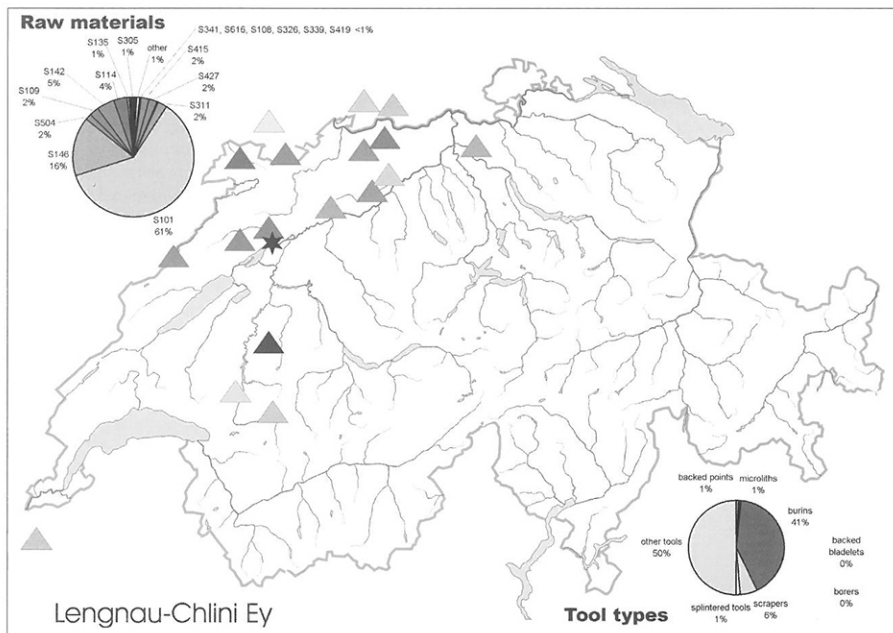


Fig. 3: Lengnau-Chliny Ey, tool and raw material assemblages.

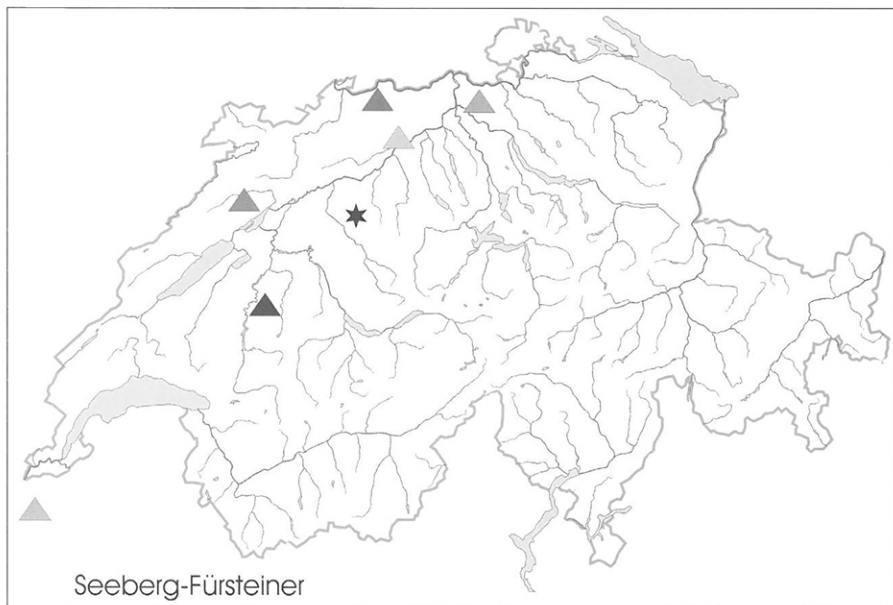


Fig. 4: Seeberg-Fürsteiner, raw material assemblage.

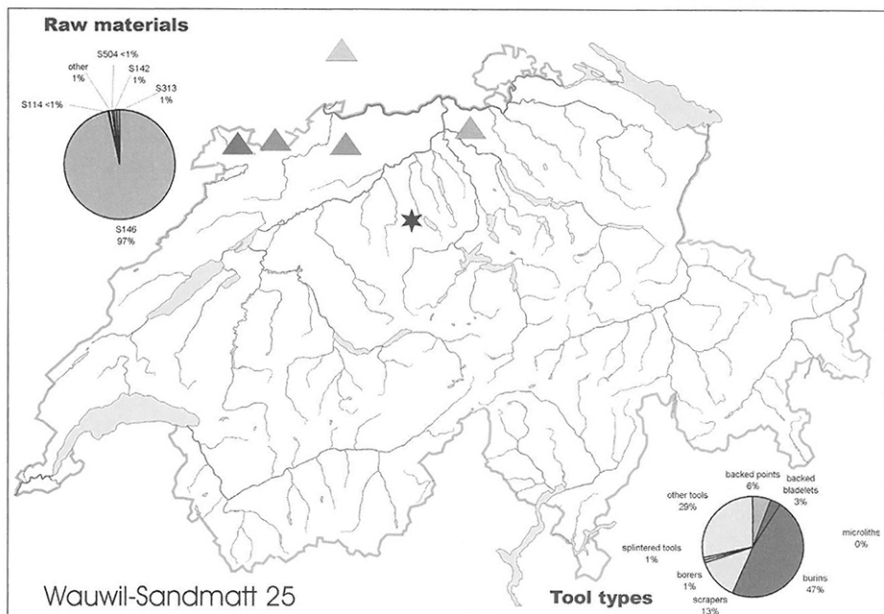


Fig. 5: Wauwil-Sandmatt, tool and raw material assemblages (site 25).

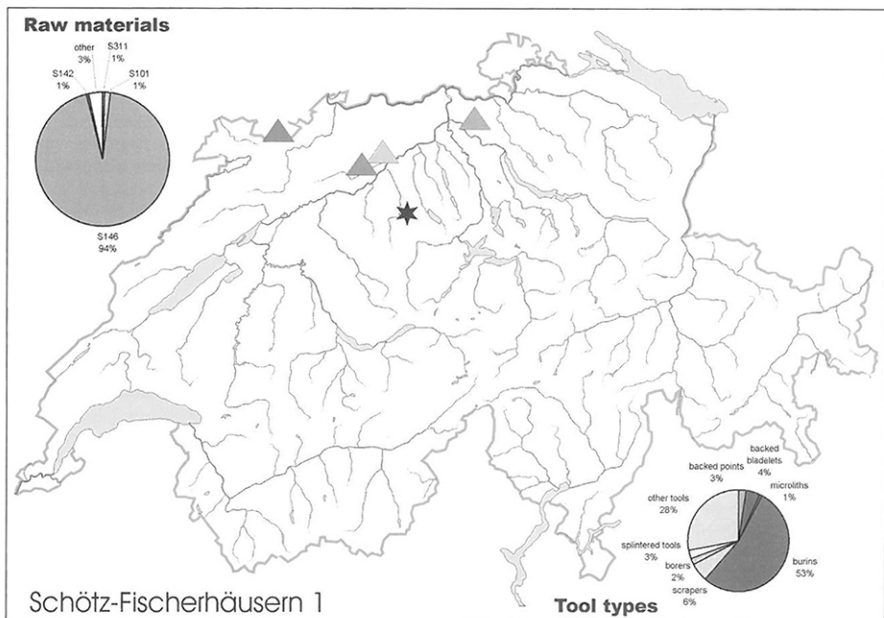


Fig. 6: Schötz-Fischerhäusern 1, tool and raw material assemblages.

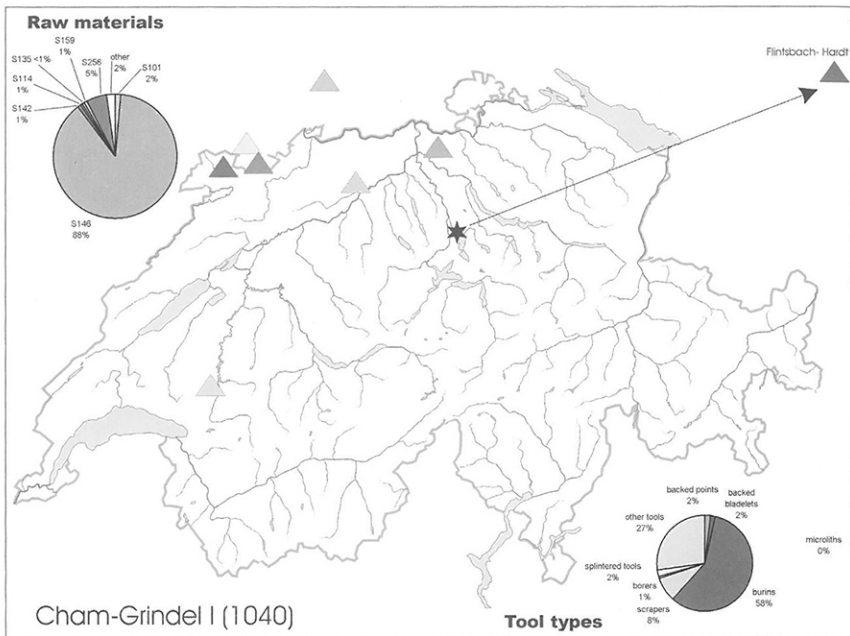


Fig. 7: Cham-Grindel I south, tool and raw material assemblages (1040).

## Analysed sites

For this study the following archaeological sites were chosen:

Hauterive-Champréveyres and Neuchâtel-Monruz are two recently excavated sites comprising Magdalenian and Azilian layers, situated on the shore of the Lake Neuchâtel in western Switzerland. The results of the excavation have not yet been fully published (Leesch 1997; Leesch, Cattin & Müller 2004). According to the scientists in charge the assemblage can be contributed to the Azilian. Although the layers are dated as early as to the middle of Bölling, there are no arctic animals. The botanical analysis shows an open forest.

At Neuchâtel-Monruz (Fig. 1), the tools are so scarce to be attributed to a special group. The layer can be attributed to the Azilian due to its stratigraphical situation and to the radiocarbon datings, which are comparable to Hauterive-Champréveyres. The numbers given here are temporary, because the typological studies are in progress by Marie-Isabelle Cattin. The tools seem to be made exclusively of raw materials which are exposed along the Jura slope. The chert from Pleigne can be achieved along the Rhine and Birs rivers. The chert from Le Locle originates from the top of the first chain, and is thus an exception.

At Hauterive-Champréveyres (Fig. 2), the backed tools (bladelets and points) are very abundant and clearly show that this settlement belongs to the Azilian group (Cattin 2002). There is about the same circulation pattern of raw material along the east foot of the Jura mountains. The quantities of chert coming from the north and from the south are equivalent. An intense use of local raw material could also be established.

Lengnau-Chlani Ey (Fig. 3) is situated on a low sandy hill in the Aare river valley (Nielsen, in prep.). Over many years, a large number of flint artefacts have been collected from the surface of the site. Typologically and statistically the assemblage, with more than 40% burins, clearly belongs to the Fürstener group of the Late Palaeolithic. The most important raw material used at Lengnau-Chlani Ey is the chert from Olten-Wangen. The chert of the Lägern is however well represented with about 15%, and almost all other varieties from the Malm were known. The local raw materials of poor quality were seldom used. Only one artefact is made of chert from the south.

The site of Seeburg-Fürstener (Fig. 4) will not be described in detail here, because the petrographical analysis of this assemblage could not be completed in time. Only a small sample was quickly examined. There were cherts

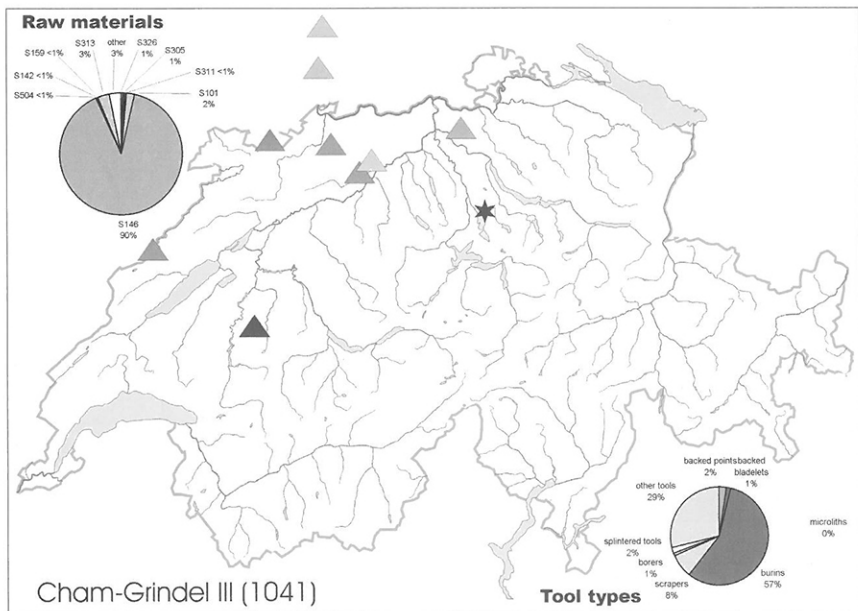


Fig. 8: Cham-Grindel III south-East, tool and raw material assemblages (1041).

from Olten-Wangen, Lausen, the Lägern, the surroundings of Biel and a few pieces from the south.

A large number of Palaeolithic and Mesolithic sites are known from the shores of the former and still existing lakes of Wauwilermoos (Nielsen 1992; 1998). From approximately a hundred sites, 47 Late Palaeolithic sites are known.

Wauwil-Sandmatt (site 25) is situated on the shore of the former lake of Wauwil (Nielsen 1999). The Late Palaeolithic assemblage, collected from the surface, represents a typical Fürsteiner one, with 47% burins and less than 10% backed tools (Fig. 5). Wauwil-Sandmatt is clearly dominated by chert from the Lägern. A few other Malm cherts are present, but only in low quantities. There is no material from the south. A recent excavation in a site close to this settlement shows that during the Early Postglacial the cultural layers of this part of the former lake were torn up by the rising water of the lake and subsequently redeposited. So a few tools, e.g. a shouldered point, might be late Magdalenian.

Schötz-Fischerhäusern (site 1) is situated on a morainic hill on the western shore of the former lake of Wauwil (Nielsen 2000). The site was partly excavated 1933 and yielded a large number of Late Palaeolithic artefacts: The

distribution and typological analysis of the flint artefacts suggest multiple settlements during a rather short period of the Late-Glacial. With more than 50% of the assemblage comprising burins, and the few backed tools, it can be attributed to the Fürsteiner group (Fig. 6). At Schötz-Fischerhäusern the raw material use seems to be the same as at Wauwil-Sandmatt. Two other alpine varieties of chert were used also. The raw material from the south is lacking too.

A number of sites on the former northern shore of the lake of Zug have delivered a large number of mainly Late Palaeolithic tools (Nielsen 1996). Two sites, namely Cham-Grindel I south (site 1040) and Cham-Grindel III south-east (site 1041) have so far been analysed and clearly belong to the Fürsteiner group (Fig. 7 and 8), although there seem to be indications of a local tradition also. Both sites have more than 55% burins and 4% or less backed tools. Backed points with retouched base, which are rarely seen in Late Palaeolithic settlements outside this region, are rather common in these sites. In both settlements the Lägern chert constitutes 90% of the inventory. Several regional alpine radiolarites were used in small quantities. At Cham-Grindel I (1040), some pieces are made of an exogenous flint originating from Bavaria. At Cham-Grindel III (1041) the exogenous chert originates from Baden; the local raw materials are more varied.



geological provenience	Raw Mat.	NEMZ	HRCH	LEKE	FüRS	WASA	SCFI	CH1040	CH1041
Bellegarde-Seysse (F)	S201								
Rougemont (VD); morains	S616								
Albeuve (FR); morains	S108								
Im Fang (FR); morains	S305								
unknown	S301								
Saint-Blaise (NE)	S401								
Le Locle (NE)	S326								
unknown	S105								
Orvin/Pierrefeu (BE)	S415								
Lengnau (BE)	S427								
Balmberg (SO)	S339								
Egerkingen (SO)	S311								
Olten/Chalchofen (SO)	S102								
Olten-Aarau (SO-AR)	S101								
Lägern (ZH)	S146								
Lampenberg/Stälzler (BL)	S504								
Lausen/Chohlholz (BL)	S109								
Pleigne/Löwenburg (JU)	S142								
Alle/Noir-Bois (JU)	S114								
Bendorf/Kohlberg (F)	S135								
unknown	S349								
Dossenbach (D)	S419								
Lörrach (D)	S341								
Kleinkems (D)	S159								
Liel (D)	S313								
Flinsbach/Hardt (D)	S256								
Alps and Prealps	other								
Flint varieties		4	12	21	7	6	6	10	19
determined pieces		12	59	385	50	255	151	262	595

Fig. 9: Presence of the raw materials in the Late Palaeolithic settlements of the Swiss Plateau.

## Results

By comparing the presence of each raw material in the Late Palaeolithic sites of the Swiss Plateau (Fig. 9), it is obvious that numerous flint types occur in most settlements. Nevertheless, some sites show a great variety of raw materials, while other sites have a narrow raw material spectrum. This pattern does not depend on the size of the samples analysed (Fig. 10). If there is a direct relationship between these two factors (number of raw material varieties and number of artefacts analysed), both curves on the graph should be strictly parallel. This is not the case here. The variation in the number of raw material types in the different archaeological sites is thus linked to other factors than the size of the analysed samples.

The examination of the presence of raw material types shows a certain degree of affinity between all sites analysed. The degree of affinity can be shown by the Jaccard coefficient (Fig. 11). In this coefficient the relationship between two sites is investigated using the number of raw material types in common for both sites and the total number of raw material types used in these sites. The settlements which were studied all show a loose affinity although the number of features in common seem to be higher along the Jura-foot axis (Fig. 12). This fact is not

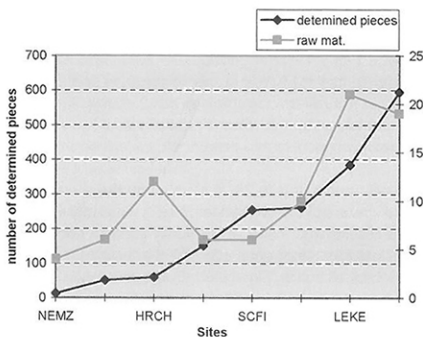


Fig. 10: Relation between the number of raw material varieties and the size of the analysed samples.

linked to the proximity of the raw material sources, in which case, the spectrum would be wider near the Jura chain, and decrease regularly towards the east. Cham-Grindel III (1041), for instance, shows the widest spectrum of raw materials coming from the Jura, although it is the site with the greatest distance from the raw material sources.

	NEMZ n=9	HRCH n=18	LEKE n=20	FüRS n=6	WASA n=6	SCFI n=6	CH1040 n=11	CH1041 n=19	
NEMZ n=9		22	28	20	20	20	20	17	coefficient of Jaccard
HRCH n=18	6		21	25	12,5	<0,1	0,1	11	
LEKE n=20	8	8		19	19	15	16	20	
FüRS n=6	3	6	5		8	8	12	8	
WASA n=6	3	3	5	1		17	18	20	
SCFI n=6	3	1	4	1	2		18	20	
CH1040 n=11	4	3	5	2	3	3		20	
CH1041 n=19	5	4	8	2	5	5	6		

number of raw material types in common

Fig. 11: Table of the Jaccard-coefficient.

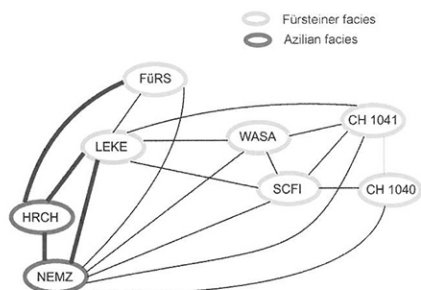


Fig. 12: Illustration of the Jaccard-coefficient.

By grouping the raw materials into three clusters, namely:

1. cherts from the north,
2. cherts of local origin,
3. cherts originating from the south,

a very strong gradual geographic change can be established (Fig. 13). As a conclusion, it can be said that the percentage of chert of southern origin is higher the farther to the south-west on the Swiss Plateau the site is situated. The procurement of chert from the north varies in inverse proportions. The use of local raw materials, which are usually of a poorer quality, seems to be greater both at the west and the east end of the Swiss Plateau.

An important question is, whether it is possible to establish a correlation between the raw materials used and the

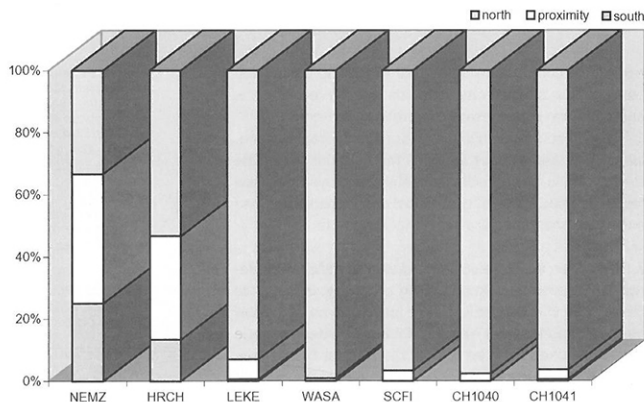


Fig. 13: Geographical gradient in the use of the raw materials.

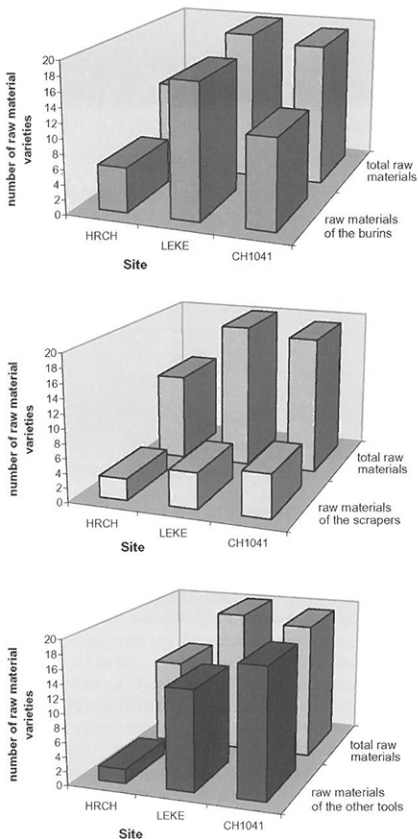


Fig. 14: Relation between the tool-types and the variety of the raw materials.

typological composition of the tool kits. If the connection between the different raw materials and the tool types is analysed, two situations can theoretically be expected:

1. There is no selection in the use of the different raw materials to make specific types of tools. In this case, the raw materials are all indiscriminately employed; the raw materials used for each type of tool should be very varied and reflect the general raw material spectrum.

2. There is an active selection, and thus specific raw materials were favourite to knap certain tool types. In this case the number of raw materials used for each type of tool will be lower than the total number of the raw materials. Thus only a few chert varieties should be used for the production of each tool type, and they do not reflect the general spectrum of the raw material types.

The Late Palaeolithic assemblages of the Swiss Plateau were analysed in this way. For many categories of tools, like microliths, borers, composite tools and splintered pieces, the number of artefacts in each settlement is too low to allow judicious conclusions, though. The raw material variety of the burins is very high and only a restricted selection can be established (Fig. 14). The same situation is noted for the other large tool categories. The typological differences in the composition of the tool assemblages are thus not directly linked to the raw materials used.

## Conclusion

The present archaeological study shows the existence of two groups of assemblages during the Late Palaeolithic on the Swiss Plateau: the Azilian group with numerous backed tools and few burins, and the Fürsteiner group characterised by a high percentage of burins and a few backed tools.

The petrographical analysis of the sedimentary microfacies indicates that both typologically defined groups did largely use the same raw material sources. The study shows within both groups the presence of two kinds of assemblages, namely one with a large variety of raw materials and another one with a narrow raw material spectrum. These differences do not occur only due to a selection of specific raw materials for producing particular tools. At the moment, it is not possible to determine why these differences exist.

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