

NIEDERWIL, A PALAEOBOTANICAL STUDY OF A SWISS NEOLITHIC LAKE SHORE SETTLEMENT

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ABSTRACT

In 1962 and 1963, excavations were carried out in the Neolithic lake shore settlement of Niederwil, in northeastern Switzerland. The site, which is dated from ca. 3700 to ca. 3625 B.C. (bristlecone pine calibrated ^{14}C dates), was founded on gyttja and overgrown by peat. In the settlement remains the conditions were favourable for the preservation of organic material. Information on the vegetation in the vicinity of Neolithic Niederwil is based upon the results of the examination of plant macrofossils, mainly wood, seeds, and fruits, recovered from the site, and upon the palynological study of sediment cores from outside the settlement.

At the time the natural vegetation of the uplands consisted of Carpinion betuli forests, in which, in addition to oak and beech, various other trees and a larger number of shrubs were found (table 1). In the river valleys Alno-Padion forests with poplar, ash and elm would have been present. In consequence of cutting and grazing, open vegetations came into existence (table 2), while *Prunetalia* shrub vegetations expanded considerably along forest edges.

The main crop plants of the Niederwil farmers were bread wheat (*Triticum aestivum*), naked barley (*Hordeum vulgare* var. *nudum*), flax (*Linum usitatissimum*), and opium poppy (*Papaver somniferum*). Further, wild plants would have played a more or less important part in the diet of the Neolithic inhabitants.

INTRODUCTION

The Egelsee, the locality of the lake shore settlement (*Pfahlbau*) of Niederwil, is found in northeastern Switzerland, near Frauenfeld, the capital of the canton of Thurgau (47°34'N, 8°52'E). The lake, which at a later stage developed into a peat bog, is situated in a depression of a moraine ridge which dates from the last (Würm) glacial period. To the north this moraine ridge is bordered by the valley of the Thur river, while to the south of the Egelsee this ridge is intersected by a rivulet, the Tegelbach (fig. 1).

The prehistoric settlement of Niederwil was discovered in 1862 by farmers who had started peat cutting in the small bog near their village. At a depth of about one metre wall posts and house floors were discovered. On the floors pottery, querns, axes, charred grain, etc. were found. In 1862 and succeeding years excavations of the settlement remains were carried out by Jacob Messikomer, who was a well-known investigator of lake dwelling sites. The results of the

earlier investigations of the Niederwil site were reported by Pupikofer (1863) and Keller (1863, 1878, pp. 73-81).

In the 20th century the memory of the Niederwil site was gradually lost. Thus, it happened that the cantonal government decided in 1962 that the bog could serve as a sedimentation basin for the waste water of a new sugar beet factory. When the plan came to the notice of the archaeologists it was already too late. Only a rescue excavation could solve some of the problems that still existed about the site. At the invitation of Mr. K. Keller-Tarnuzzer, the then curator of the prehistory department of the cantonal museum at Frauenfeld, excavations of this site were carried out by a team from the Biologisch-Archaeologisch Instituut in 1962 and 1963.

Notwithstanding the earlier excavations by Messikomer and the decay of the top parts since 1862 – the peat cutting had been preceded by a partial drainage of the bog – a culture deposit of more than 2 m thickness was still present over an area of about 60 × 40 m. In the excavated parts the remains were found of parallel buildings, which had a width of about 5 metres. Narrow passages separated the individual buildings. The floors consisted mostly of planks made by cleaving heavy oak timbers. They were covered by a layer of clay 5 cm thick and laid on a substructure of two to four crossing layers of widely spaced round timbers (plate 1). Each floor, with its substructure, was renewed ten to fifteen times on the same spot. In this way, the earlier floors were pressed down into the underlying mud (plate 2). The house walls were also made of planks.

Of the ovens, which were built of clay, only the basal parts were preserved. The drainage of the basin since the last century and the decay of the wood of the upper floors caused these hearths to emerge as low clay mounds from the surface of the settlement area. Thus, the oven mounds could be mapped, providing a means for reconstructing the settlement in its final stage: along both sides of the main street parallel long buildings were found (fig. 2). At least towards the land-side the village was defended by a heavy wooden fence. A preliminary report on the 1962 and 1963 excavations of Niederwil has been published by Waterbolk and Van Zeist ((1966) 1967).



Plate 1
House floor made of planks (left) and substructure of this floor consisting of crossed layers of round timbers (right).

It has already been mentioned that the house floors were pressed down into the wet lake sediment. After the settlement was abandoned it was overgrown by peat. These circumstances were favourable for the preservation of organic remains. In addition to the timber used for the construction of the houses, animal bones, antler and bone tools, fruits and seeds, textiles, and wooden objects were preserved.

From the dendrochronological analysis of the floor planks, the total duration of the settlement can be estimated at 75 years (M o o k et al 1972). This implies that on the average each floor had to be renewed every 5 years – there were 15 successive floors.

As for the dating of Niederwil, radiocarbon dates from charred grain samples range from ca. 3040 to ca. 2800 B.C. However, radiocarbon determinations from annual rings of the bristlecone pine (*Pinus aristata*) have shown that radiocarbon years do not always correspond with calendar years, but that considerable deviations occur. On the ground of a comparison of the Niederwil radiocarbon dates with the calibration curve based upon measurements of bristlecone

pine tree rings, W a t e r b o l k (oral communication) arrives at a date of ca. 3700 to ca. 3625 B.C. for this site.

THE STRATIGRAPHICAL POSITION OF THE SETTLEMENT

The sediments in the Niederwil basin were studied by means of two series of borings (fig. 3). Fig. 4 shows the east-west section. A palynological examination of two profiles, viz. at VIII A and IV, provided information on the Late- and Postglacial vegetational history. The sedimentation started with the deposition of partly laminated blue clay, which must be dated to the early Late-glacial, more than 11.000 B.C. Thereafter, a grey clay was deposited, followed by the sedimentation of gyttja. In the central part of the basin the sedimentation of gyttja continued up to shortly before the beginning of the settlement. At the edge of the basin the formation of peat had started some time before the



arrival of the Neolithic settlers. In the other part of the basin, peat formation began after the settlement had been abandoned.

The contention that gyttja formation had continued up to the time of the beginning of the habitation is the logical consequence of the conclusion that the settlement was built on top of the gyttja and not on peat. Since a water depth of at least 0.50 m is necessary for the sedimentation of gyttja, a drastic lowering of the lake level must have taken place before the lake bottom became to some extent suitable for habitation. The sudden lowering of the water level could have been caused naturally, e.g. by a change in climate (less precipitation, more evaporation), but it is also possible that prehistoric man had a hand in it.

The assumption that the settlement was built on top of the lake mud is largely based on the observations in section a (see fig. 2), in particular of a profile at a short distance outside the palisade. The lower part of this profile (fig. 5, lithology) consists of gyttja on top of which a 7 cm thick sedge peat layer is present. The upper part of this profile

consists of moss peat. For this profile a pollen diagram (NW a) was prepared, a part of which is represented in fig. 5. Four large sediment samples were examined for fruits and seeds. The results of the macrofossil analysis are shown to the right.

Both investigations show indications of human activity in the section between 95 and 72 cm (seed samples II and III). The pollen of crop plants, weeds from fields and ruderal places, and of other upland herbs show high percentages in this section. As for the macrofossil remains, *Papaver*, *Linum*, *Chenopodium album*, *Lapsana communis*, *Stellaria media* and other species are only represented in the section between 95 and 72 cm. Moreover, small sherds and charcoal were found in the upper part of the gyttja. On the other hand, in the peat above the gyttja no certain indications for the presence of farmers could be established. From this it is felt justified to conclude that the habitation took place on the lake mud and that in the larger part of the basin, peat formation did not start until after the settlement had been abandoned.

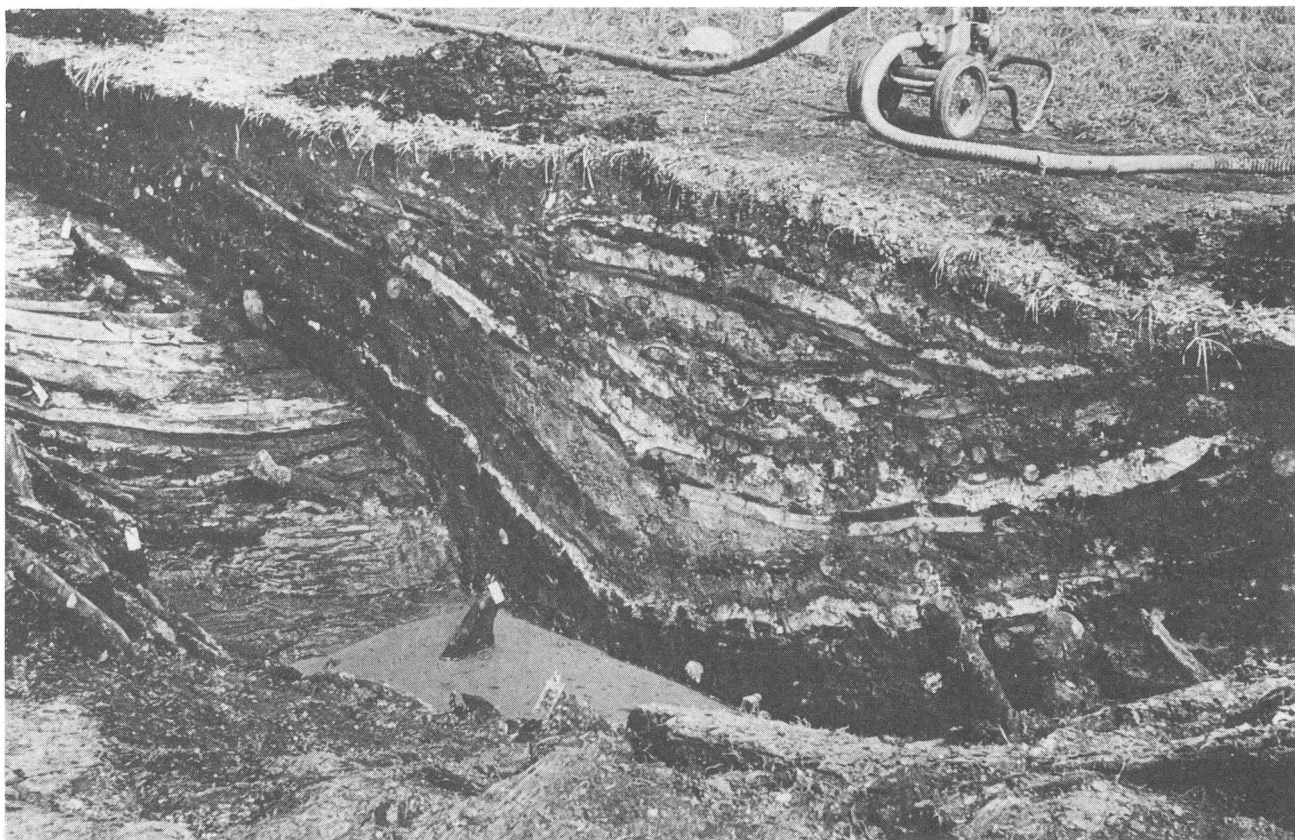


Plate 2
Section through a series of superimposed floors.

As habitation on the lake bottom excludes sedimentation of gyttja at the same time, the lake sediment must have been deposited before the construction of the first houses. Consequently, pollen and macrofossil remains of cultivated plants and of other indications for human activity must have arrived in the upper 20 cm of the gyttja after the deposition of this layer. This must be ascribed to the trampling of man and animals which caused a disturbance of the upper layer of the lake bottom.

The effects of treading could also be observed in profile NWV III A, from the centre of the depression. An abbreviated version of the pollen diagram which was prepared for this profile is shown in fig. 6. In this diagram, just as in NW a (fig. 5), the tree pollen is grouped into five categories: three groups which together represent the upland forest; one group includes trees and shrubs from marshes; the pollen of the last group originates from trees which did not grow in the area (long distance transport). The base of calculation of all the percentages is the tree pollen sum.

The herbs from the clearances in the upland forest are summarized in three groups: one group of culture indicators (cultivated plants, such as cereals and *Papaver*, and accompanying species, such as *Plantago lanceolata*, *Plantago major*,

Chenopodiaceae, *Urtica*, and *Polygonum convolvulus*-type); a group of other herbs, in general apophytes, such as *Artemisia*, *Rumex*, *Allium*-type, *Verbena*, *Succisa*, *Hypericum*, and *Helianthemum* which profited from the favourable light conditions in the clearances; the grasses are shown as a separate curve because they are also constituents of the peat forming vegetation. Curves for the upland trees are shown to the right, together with the curve for *Salix*. The radiocarbon dates, which are represented to the left, are not adapted to the bristlecone pine calibration curve.

During the Late-glacial, *Pinus* and *Betula* were the predominant trees in the Egelsee area (the lower part of the NW VIII A diagram is not shown in fig. 6). In the Younger Dryas-time *Corylus* arrived and became the most important arboreal species in the Preboreal, replacing *Pinus* which disappeared from the area between 7600 and 7300 B.C. In addition to *Corylus*, *Ulmus* must have been common in the lower part of the Preboreal (spectra 17 and 18). In the course of the Preboreal *Corylus* expanded further at the cost of *Ulmus* and *Quercus*; at that time pure hazel stands would have been found in the Egelsee area.

In Boreal times, *Quercus*, *Ulmus*, and *Tilia* increased gradually, *Acer* and *Fraxinus* arrived in the area, while *Fagus*

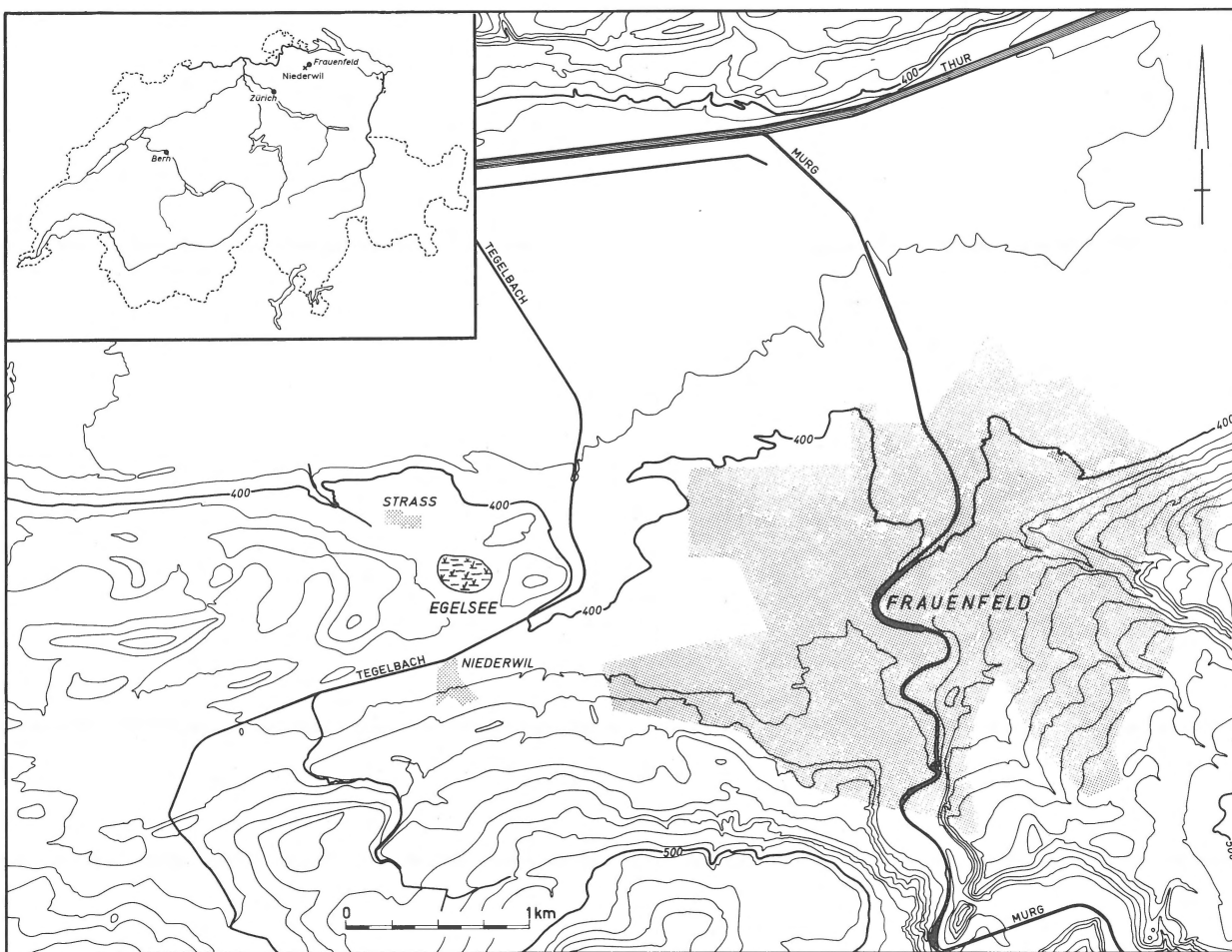


Fig. 1
Sketch map of the Egelsee area.

and *Abies* were approaching. Towards the end of the Boreal the hazel stands would have given way to mixed oak forests, in the understory of which *Corylus* could maintain itself. Still in the Boreal (spectra 35 and 36) *Alnus* appeared in northeastern Switzerland, and ca. 4600 B.C. (spectrum 43) an alder carr belt was formed around the Egelsee basin. From ca. 5000 B.C. on (spectrum 41), *Fagus* expanded considerably at the cost of, among others, *Quercus* and *Ulmus*.

From spectrum 47 onwards, there are distinct indications of the interference of man with the vegetation. As for the upland trees, the pollen values of particularly *Fagus*, *Ulmus*, and *Tilia* decrease. *Corylus* increases at first to show a slight decline at a later stage. *Hedera* reaches relatively high percentages. Pollen of culture indicators, in particular of Cerealia, is frequent, and various other herbaceous types, such as *Artemisia*, *Rumex*, *Ranunculus*, Tubuliflorae Compositae, Scrophulariaceae, and Cruciferae, increase markedly. In the upper part of the diagram, the curves for *Salix* and various marsh plants, such as *Filipendula*, *Caltha*, *Typha*

latifolia, *Mentha*-type, *Galium*-type, and Cyperaceae, show likewise a distinct rise. Locally a marsh vegetation developed.

The thickness of the section with high pollen percentages for culture indicators (from 2.30 to 2.00 m) is no measure for the duration of the habitation. In consequence of treading the exposed but soft lake bottom was disturbed up to a depth of ca. 30 cm. After the abandoning of the settlement the deposition of gyttja was not resumed.

THE RECONSTRUCTION OF THE VEGETATION

Our knowledge of the plant growth in the vicinity of Neolithic Niederwil and of plant cultivation by the inhabitants of this site is based upon the following investigations:

1. The identification of wood from the settlement. This was carried out by F.H. Schweingruber (manuscript).

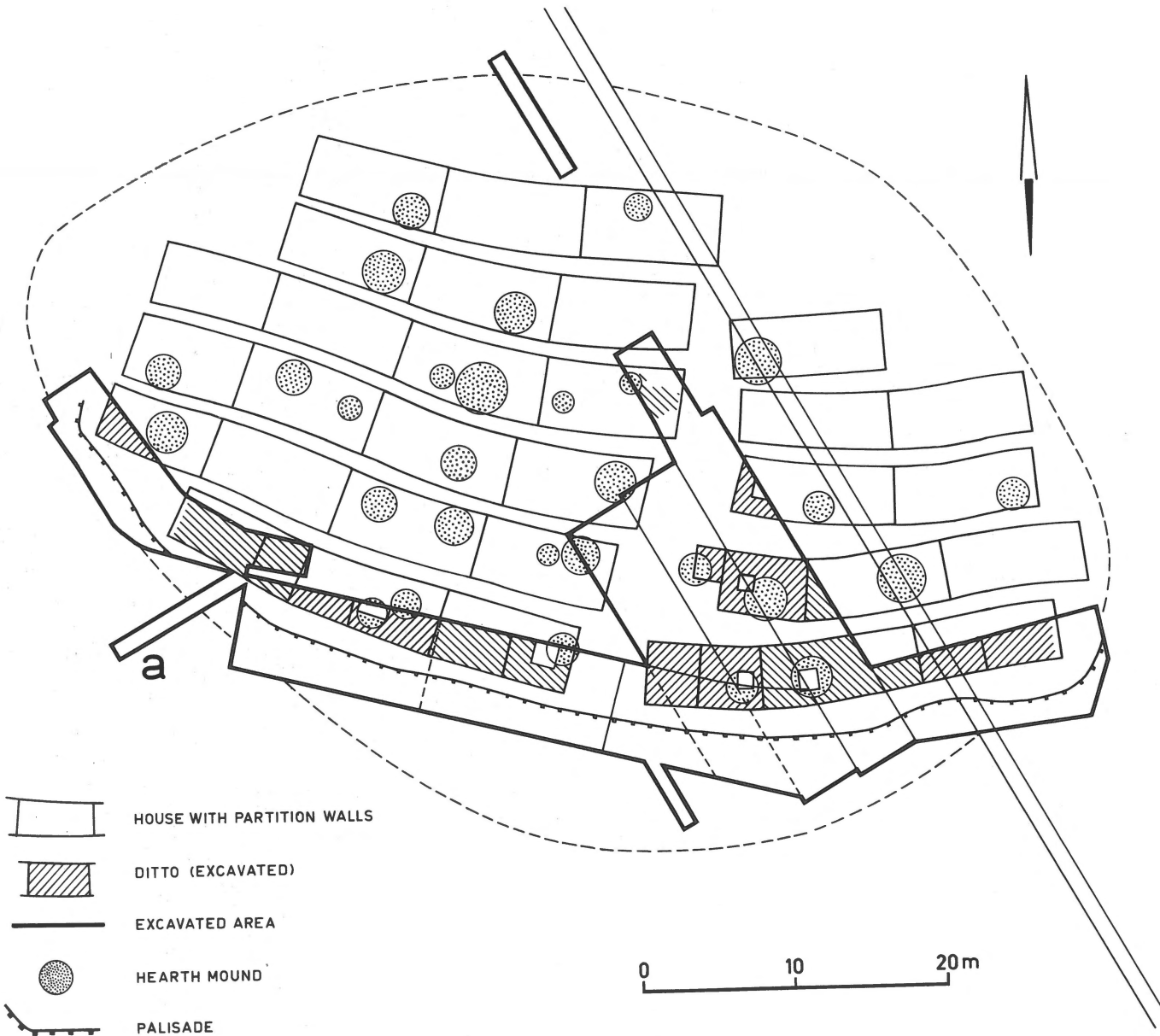


Fig. 2
Reconstructed plan of the Niederwil settlement (after Waterbolck and Praamstra, manuscript).

2. The study of subfossil and carbonized seeds, fruits, and other plant remains from the site.
3. The palynological study of sediments from the Egelsee basin, in particular of the levels which correspond with the Neolithic habitation.

Before discussing the interpretation of the botanical data some general remarks should be made. One may assume that fruits, seeds, wood, and other plant macrofossils found in the settlement remains originate from herbs, shrubs or trees which were present in the vicinity of the site. On other hand,

pollen may have been transported over a long distance. Consequently, plant taxa which are only represented by pollen grains did not necessarily grow in the area. It is, for instance, fairly certain that *Pinus* and *Picea* did not occur in the neighbourhood of Niederwil, although their share in the pollen rain amounted to 1-2%.

It will be superfluous to emphasize that pollen production and pollen dispersal differ considerably for the various species, so that the share of a species in the pollen precipitation does not necessarily correspond to its share in

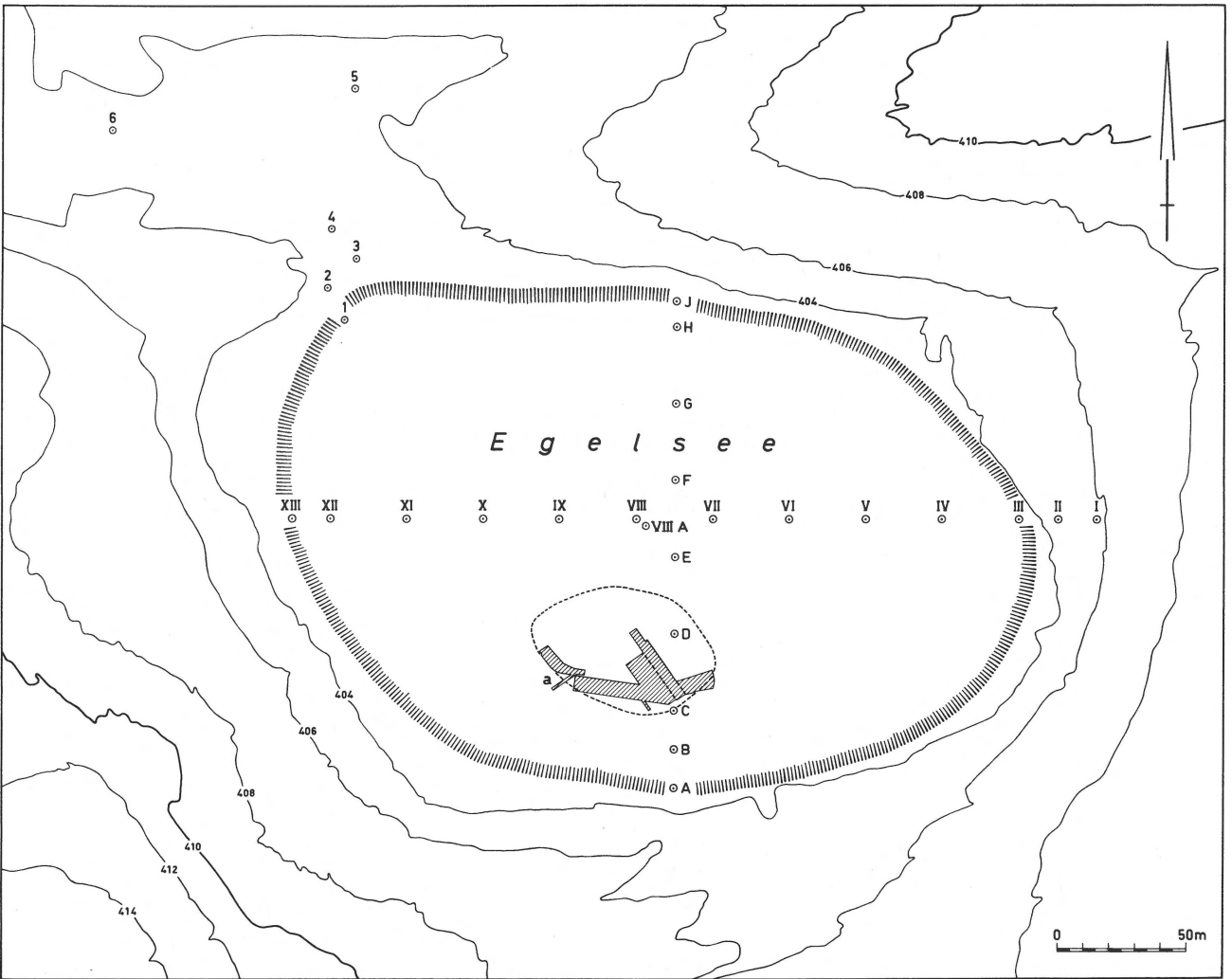


Fig. 3
The Egelsee basin, with location of settlement and borings.

the vegetation. As for the relative frequencies of wood and other plant macrofossils, one should likewise be very reluctant to convert these into a quantitative reconstruction of the vegetation. Just as for pollen, the seed production shows large differences among the various plant species. Moreover, the seeds or fruits of some wild species were collected intentionally, in consequence of which they are found in large numbers in the settlement samples. The seeds of many other species, on the other hand, must have arrived in the settlement by accident. Of this category, seeds and fruits which stick easily to man or domestic animals had a much better chance to end up in the settlement than the others. Further, the chance of remaining preserved in subfossil state is not the same for the various seeds and fruits. The thick hazelnut shells, for instance, are preserved even under unfavourable conditions, whereas subfossil willow

seeds have never been found to our knowledge.

The relative frequencies of the various types of timber encountered in the site tell us just as little about the role of the tree species concerned in the vegetation. For the construction of different parts of the houses certain types of wood were preferred: oak for the floors and the walls; ash and to a minor extent oak, alder, and willow for the posts; alder, ash, poplar, and willow for the substructures of the floors. For the manufacture of the wooden objects also certain species, such as ash, oak, and maple, were more suitable than others.

From the above it will be clear that a quantitative reconstruction of the vegetation must remain a pipe-dream, at least in the case of Niederwil. The reconstruction of the vegetation is further handicapped by the fact that only a part of the plants found in the vicinity of the site at the time is

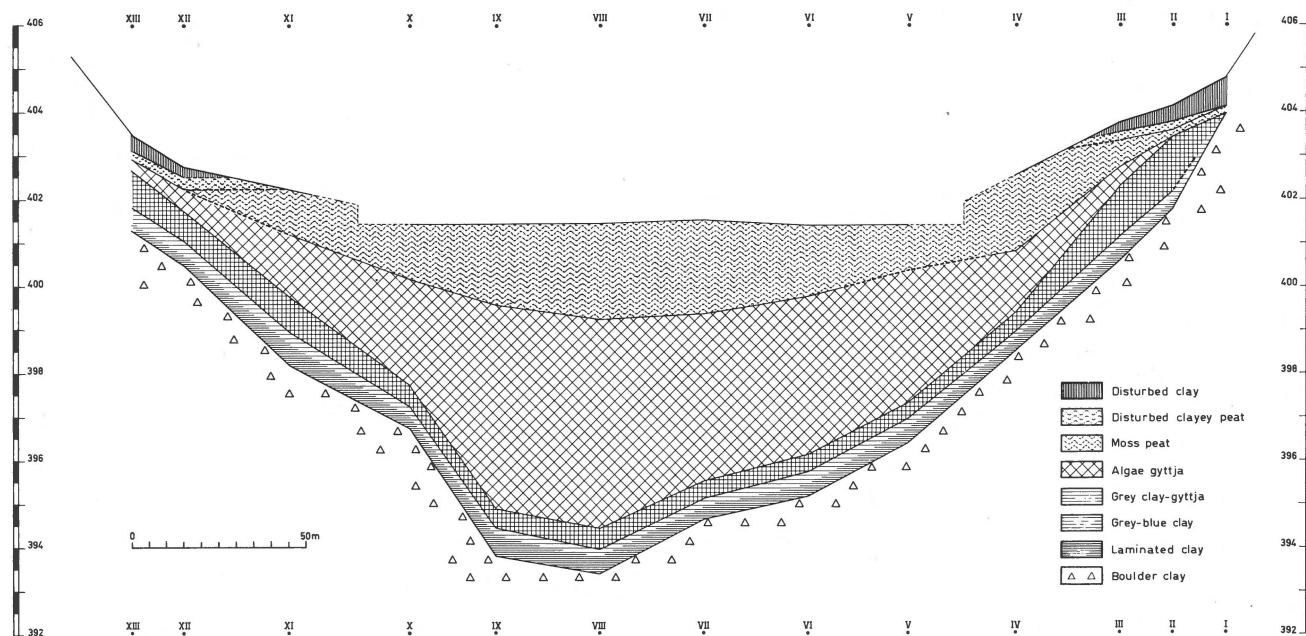


Fig. 4
East-west section through the Egelsee basin.

represented by pollen or macrofossil remains. For instance, the herbs from the forest are poorly represented in the samples from Niederwil. Consequently, one must determine the presence of prehistoric vegetations on the ground of only a part of the species from the vegetation types concerned.

In attempting to reconstruct the vegetation of 5000 to 6000 years ago one should not yield to the temptation to go too far into detail. Through natural causes, such as a change in climate, plants may have appeared or disappeared from the area, while man is responsible for the intentional or unintentional introduction of a great many species. Consequently, the composition of vegetation units of thousands of years ago would not have been exactly the same as that of the present-day.

The botanical samples are from various phases of the settlement. As the habitation did not last more than about 75 years, the results of all samples have been combined for the reconstruction of the vegetation.

The reconstruction of the vegetation types is primarily based upon the botanical data. However, the present-day topography of the Niederwil area was also taken into consideration. Moreover, the topography gives indications where the prehistoric vegetation types could be found. The main topographic features are: the depression filled by the lake, which in a later stage developed into a bog; the fertile upland soils of the moraine ridge; and the valleys of the Thur and the Tegelbach at a short distance from the site (fig. 1).

THE VEGETATION TYPES

Table 1 shows which forest vegetations could be established for the vicinity of Neolithic Niederwil. Behind the plant names the kind of palaeobotanical evidence is indicated: S for seeds and fruits, W for wood, Ma for other macrofossil remains, and P for pollen and spores. At the top of the table the forest vegetation types at Niederwil are shown. A cross indicates that the plant species concerned is found in the vegetation type shown at the top. The presence of a vegetation type is concluded if a larger number of species common in and/or characteristic of that particular vegetation is represented in Niederwil.

The palaeobotanical results suggest that the natural upland vegetation was a mixed beech-oak forest (*Carpinion betuli*) in which in addition to *Quercus* and *Fagus*, many other trees, such as *Ulmus*, *Acer*, *Malus*, *Abies*, *Tilia*, *Taxus*, and *Fraxinus*, played a more or less important part. Not only trees, but also shrubs, such as *Prunus spinosa*, *Cornus sanguinea*, *Sambucus nigra*, *Corylus avellana*, and *Prunus padus*, which are found in *Carpinion betuli* vegetations, could be established.

It has already been mentioned that forest herbs are scarcely represented among the pollen and macrofossil remains. From the mixed beech-oak forests only *Fragaria vesca*, *Moehringia trinervia*, *Anemone*, and *Allium ursinum* are represented. Of the 22 woody species of the upland

TABLE 1

Forest and shrub vegetations established for Niederwil.

W: wood; P: pollen and spores; S: seeds and fruits; Ma: other plant macrofossil remains.

		Prunetalia spinosae shrub vegetations	Carpinion betuli upland forests	Alno-Padion river valley forests	Alnion glutinosae alder carr	Salicion cinereae willow carr
Viburnum lantana	WPS	x	.	.	.	.
Polygonum dumetorum	S	x	.	.	.	.
Betula pendula	WPS	x	.	.	.	.
Berberis vulgaris	W	x	.	.	.	.
Inula conyza	S	x	.	.	.	.
Prunus spinosa	WS	x	x	x	.	.
Ulmus	WP	x	x	x	.	.
Acer	WP	x	x	x	.	.
Malus sylvestris	WS	x	x	x	.	.
Sambucus nigra	S	x	x	x	.	.
Cornus sanguinea	WPS	x	x	x	.	.
Corylus avellana	WPS	x	x	x	.	.
Fragaria vesca	S	x	x	.	.	.
Rubus fruticosus	S	x	x	.	.	.
Anemone-type	P	x	x	x	.	.
Moehringia trinervia	S	x	x	.	.	.
Hedera helix	WP	x	x	.	.	.
Populus	WP	x	.	x	.	.
Viburnum opulus	WPS	x	.	x	.	.
Clematis vitalba	WPS	x	.	x	.	.
Abies alba	PMa	.	x	.	.	.
Fagus sylvatica	WPS	.	x	.	.	.
Tilia	WP	.	x	.	.	.
Carpinus betulus	P	.	x	.	.	.
Taxus baccata	WP	.	x	.	.	.
Viscum album	W	.	x	x	.	.
Quercus	WPS	.	x	x	.	.
Fraxinus excelsior	WP	.	x	x	.	.
Prunus padus	WS	.	x	x	.	.
Allium ursinum	PS	.	x	x	.	.
Rumex sanguineus	PS	.	.	x	.	.
Chrysosplenium alternifolium	S	.	.	x	.	.
Carex otrubae/vulpina	S	.	.	x	.	.
Scirpus sylvaticus	S	.	.	x	x	.
Alnus glutinosa	WPS	.	.	x	x	.
Cirsium palustre	S	.	.	x	x	.
Filipendula ulmaria	PS	.	.	x	x	.
Solanum dulcamara	PS	.	.	.	x	.
Dryopteris (thelypteris)	P	.	.	.	x	.
Lycopus europaeus	S	.	.	.	x	.
Carex paniculata	S	.	.	.	x	.
Carex pseudocyperus	S	.	.	.	x	.
Mentha (cf.) aquatica	PS	.	.	.	x	.
Salix	WP	.	.	.	x	x
Betula pubescens	WPS	.	.	.	x	x
Frangula alnus	P	.	.	.	x	x

TABLE 2

Herbaceous vegetations established for Niederwil.

		Phragmitetea swamp vegetations	Molinio- Arrhenatheretea wet meadows	Mesobromion dry grasslands	Bidentation wet, nitrate-rich places	Lolio-Plantaginietum heavily trodden places
Carex otrubae/vulpina	S	x	.	.	.	.
Lycopus europaeus	S	x	.	.	.	.
Carex paniculata	S	x	.	.	.	.
Carex pseudocyperus	S	x	.	.	.	.
Typha latifolia	PS	x	.	.	.	.
Phragmites communis	S	x	.	.	.	.
Sparganium erectum	PS	x	.	.	.	.
Carex disticha	S	x	.	.	.	.
Carex rostrata/vesicaria	S	x	.	.	.	.
Carex acutiformis/riparia	S	x	.	.	.	.
Poa palustris	S	x	.	.	.	.
Menyanthes trifoliata	P	x	.	.	.	.
Comarum palustre	P	x	.	.	.	.
Veronica anagallis-aquatica	S	x	.	.	.	.
Lythrum salicaria	PS	x	x	.	.	.
Epilobium hirsutum-type	S	x	x	.	.	.
Epilobium palustre	S	x	x	.	.	.
Scirpus sylvaticus	S	.	x	.	.	.
Cirsium palustre	S	.	x	.	.	.
Filipendula ulmaria	PS	.	x	.	.	.
Mentha (cf.) aquatica	PS	.	x	.	.	.
Molinia coerulea	S	.	x	.	.	.
Juncus acutiflorus	S	.	x	.	.	.
Juncus effusus-type	S	.	x	.	.	.
Prunella vulgaris	S	.	x	.	.	.
Ajuga reptans	S	.	x	.	.	.
Cerastium holosteoides	S	.	x	.	.	.
Poa pratensis/trivialis	S	.	x	.	.	.
Rhinanthus	S	.	x	.	.	.
Rumex acetosa	PS	.	x	.	.	.
Trifolium repens	Ma	.	x	.	.	.
Ranunculus repens	PS	.	x	.	.	.
Achillea millefolium	S	.	x	x	.	.
Potentilla (erecta)	P	.	x	x	.	.
Plantago lanceolata	PS	.	x	x	.	.
Centaurea jacea	PS	.	x	x	.	.
Daucus carota	S	.	x	x	.	.
Agrimonia eupatoria	PS	.	.	x	.	.
Campanula glomerata	S	.	.	x	.	.
Hypericum perforatum	PS	.	.	x	.	.
Silene vulgaris	S	.	.	x	.	.
Hieracium cf. umbellatum	S	.	.	x	.	.
Gentiana cf. cruciata	S	.	.	x	.	.
Bidens tripartita	S	.	.	.	x	.
Polygonum hydropiper	S	.	.	.	x	.
Ranunculus sceleratus	S	.	.	.	x	.
Polygonum aviculare	S	.	.	.	.	x
Juncus compressus	S	.	.	.	.	x
Plantago major	PS	.	.	.	.	x
Agrostis	S	.	.	.	.	x
Capsella bursa-pastoris	S	.	.	.	.	x

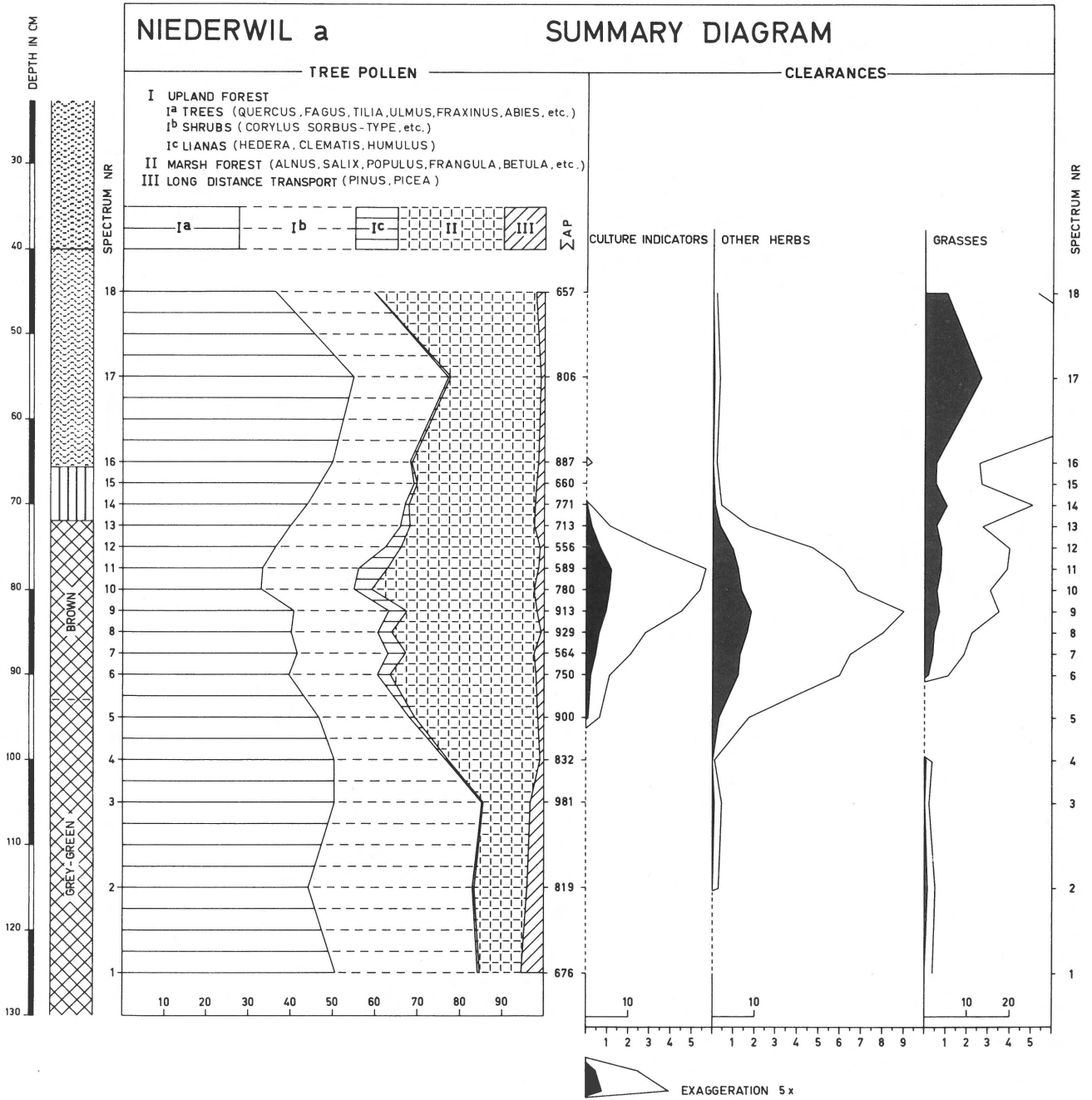


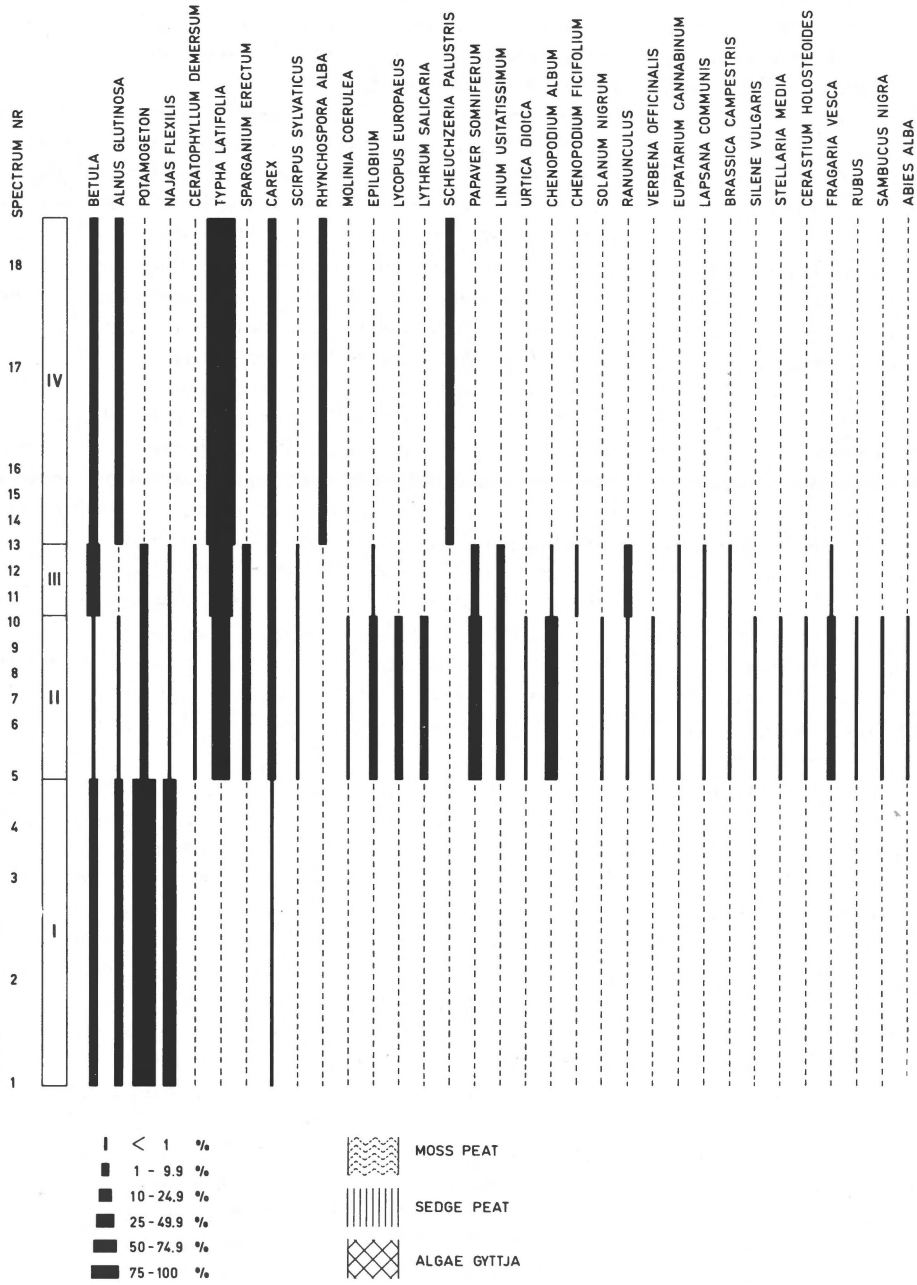
Fig. 5
 Pollen and seed diagram Niederwil a.

forest which could be established for Niederwil, only 9 are represented by seeds or fruits. Among the species which are not represented by seeds or fruits are elm, maple, linden, yew, and ash. In this case pollen analysis and wood identifications proved to be better tools for the reconstruction of the vegetation than the study of seeds and fruits.

Populus (nigra), *Fraxinus*, *Alnus*, and *Ulmus* would have

constituted the predominant trees in the Alno-Padion forests in the periodically flooded river valleys. The shrubs of riverine forests represented in Niederwil include *Viburnum opulus*, *Corylus avellana*, *Prunus padus*, and *Sambucus nigra*.

The course of the *Salix* pollen curve in the Niederwil diagrams (cf. fig. 6) suggests that originally no willow shrub vegetation was present in the Egelsee basin. This vegetation



type did not develop until the lake had been drained, so that the establishment of a willow carr was possibly the indirect result of the interference of man.

The influence of man on the vegetation consisted in the first place of cutting trees. Forest clearings were necessary to obtain arable land, and the wood was used for the construction of houses. Where the soil conditions were suitable for

agriculture, such as in the area of the upland forests, parts of the forest would have been cleared completely, whereas for instance in the river valley forests, only trees which were preferred for some specific purpose would have been cut.

Prunetalia spinosae shrub vegetations would have been found along forest edges. Most Prunetalia species occur also in mixed beech-oak forests, but because of the favourable

light conditions, they grow more luxuriantly along forest edges. Of the shrubs and lianas which are found in these vegetations, the following could with certainty be demonstrated for Niederwil: *Rubus fruticosus*, *Prunus spinosa*, *Viburnum lantana*, *Viburnum opulus*, *Clematis vitalba*, *Sambucus nigra*, *Berberis vulgaris*, *Corylus avellana*, *Cornus sanguinea*, and *Hedera helix*.

Table 2 shows the herbaceous vegetations which could be established with more or less certainty. After the drainage of the lake, the centre of the basin would have been covered by vegetations in which *Typha latifolia*, various *Carex* sp., *Menyanthes trifoliata*, *Comarum palustre*, *Phragmites*, and other species would have occurred (Phragmitetea). One may assume that in the area of the alder and willow car, wet meadows developed after the cutting of trees followed by grazing. Molinio-Arrhenatheretea species which are represented in Niederwil include: *Cirsium palustre*, *Filipendula ulmaria*, *Molinia coerulea*, *Prunella vulgaris*, *Poa pratensis* / *trivialis*, and *Rumex acetosa*. On the other hand, dry grassland vegetations would have been present in dry habitats. More or less characteristic of the Mesobromion vegetations are: *Agrimonia eupatoria*, *Daucus carota*, *Silene vulgaris*, and *Campanula glomerata*.

In upland places which were frequented by men and animals a vegetation type would have been found which showed much resemblance to the present-day Lolio-Plantaginetum, a plant association from heavily trodden places. Characteristic species are *Polygonum aviculare* and *Plantago major*. This is the only time that it was felt justified to specify a particular plant association. In all other cases the determination is less detailed and concerns vegetation units of a higher syntaxonomic rank.

In addition to the species shown in tables 1 and 2, a larger number of plants from fields, roadsides and ruderal places is represented in Niederwil, such as *Chenopodium album*, *Polygonum persicaria*, *Stellaria media*, *Solanum nigrum*, and *Lapsana communis*. The information on herbs is mainly based upon seeds and fruits. It is very likely that many of these herbs are represented by pollen, but they cannot be recognized as such. *Scirpus sylvaticus*, *Rhynchospora alba* and seven *Carex* species could be identified, but in the pollen diagrams from Niederwil they only show up as Cyperaceae. Seven wild grass species could be established for Niederwil on the ground of the caryopses, but pollen analytically they cannot be distinguished. The seeds of four *Juncus* species were found, but *Juncus* pollen is never preserved.

PLANT HUSBANDRY IN NIEDERWIL

By far the main cereal species grown by the Niederwil farmers were *Triticum aestivum* (bread wheat) and *Hordeum vulgare* var. *nudum* (naked barley). Our knowledge of both cereals is based upon the charred grains. In contrast to the great number of charred cereal grains, no subfossil caryopses of barley and wheat were found, although subfossil fruits of

other grasses, such as *Poa* and *Molinia*, do occur. Apparently the conditions were not favourable for the preservation of non-carbonized cereal grains. On the other hand, in diagram NW a (fig. 5), from just outside the settlement, cereal-type pollen (included in the curve for culture indicators) shows relatively high percentages.

Another crop plant of the Niederwil farmers was *Papaver somniferum* (opium poppy). It is likely that the cultivators of opium poppy were acquainted with the narcotic properties of the milky juice of this species. Whether the narcotic properties were also used to forget the hardships of life from time to time or whether they were only reserved for medicinal purposes, must remain an unanswered question. The relatively high pollen values for *Papaver* suggest that this plant was also grown around the depression.

On the other hand, not a single pollen grain of flax (*Linum usitatissimum*) was encountered, although the seeds of this crop plant were very numerous. This would apparently indicate that linseed was cultivated at a greater distance from the settlement, in places from where the run-off water did not flow into the Egelsee basin.

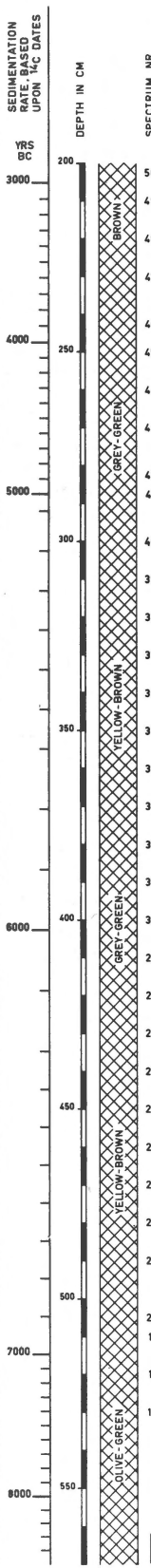
Together with those of *Papaver*, the seeds of flax would have met the demand for vegetal fat by the inhabitants of the site. It is likely that flax was especially cultivated because of its fibres. The remains of fabrics and ropes were nearly exclusively made of flax. Although sheep were bred, apparently the wool was not used for the manufacture of clothing.

As for the diet of the inhabitants of Niederwil, the following may be remarked. Bread wheat and naked barley constituted the main source of carbohydrates. Further, the large numbers of seeds of *Chenopodium album*, which were found in the settlement remains, suggest that they were collected on purpose. Already in 1905 Neuweiler presented his view that seeds of *Chenopodium album* served as human food in prehistoric times.

One may assume that the demand for fats was largely covered by the two cultivated oil plants: linseed and opium poppy. On the other hand, wild and cultivated plants could only provide a minor part of the necessary proteins. For their proteins the Niederwil people depended largely on meat. Cattle was the main meat producer, in importance followed by pig. Other domestic animals included goat, sheep and dog. Wild animals also played a part in the meat supply, in particular red deer and wild boar (Clason (1966) 1967). A major source of vegetal protein were the hazelnuts, with a protein content of about 15%. In view of the numerous remains of hazelnut shells one must assume that these nuts were consumed in large quantities.

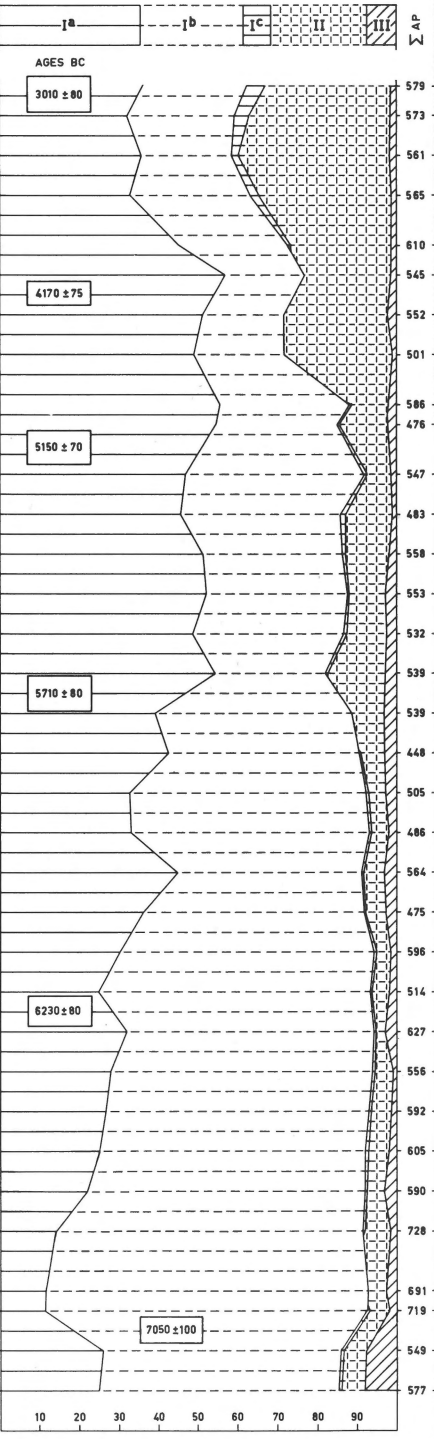
The young leaves of various wild plants which are represented in Niederwil, such as *Achillea millefolium*, *Chenopodium album*, *Urtica dioica*, *Rumex acetosa*, *Lapsana communis*, and *Sonchus oleraceus*, could have been eaten as vegetables. There can be no doubt that in addition to the cultivated plants, various wild plants contributed to the nourishment of the people. However, it is impossible to

NIEDERWIL VIII A SUMMARY DIAGRAM

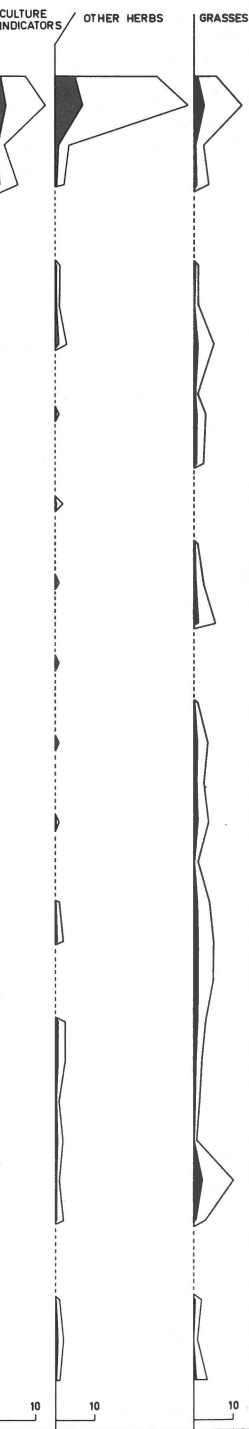


TREE POLLEN

I UPLAND FOREST
 I^a TREES (QUERCUS, FAGUS, TILIA, ULMUS, FRAXINUS, ABIES, etc.)
 I^b SHRUBS (CORYLUS, SORBUS-TYPE, etc.)
 I^c LIANAS (HEDERA, CLEMATIS, HUMULUS)
II MARSH FOREST (ALNUS, SALIX, POPULUS, FRANGULA, BETULA, etc.)
III LONG DISTANCE TRANSPORT (PINUS, PICEA)



CLEARANCES



UPLAND TREES

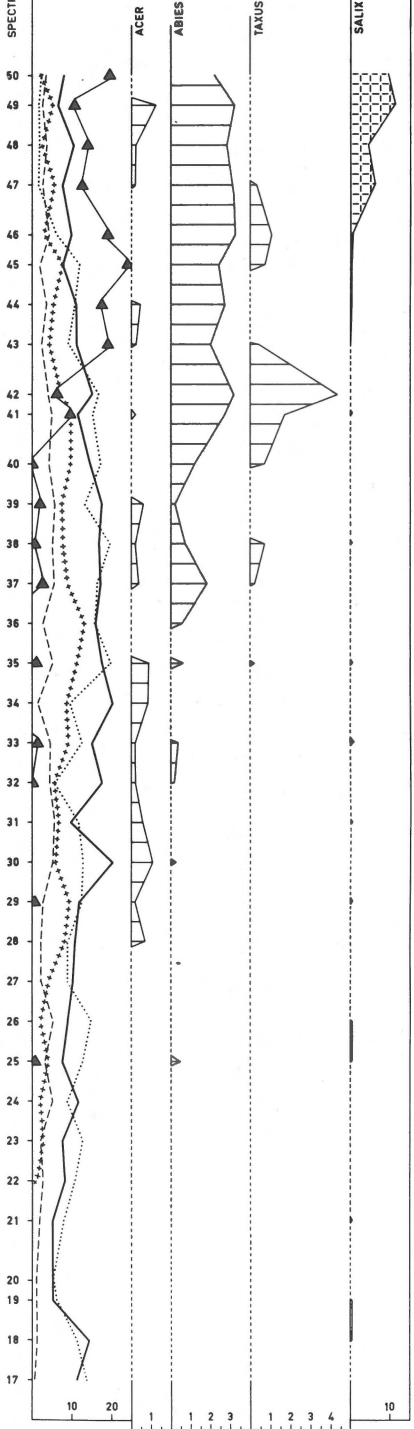


Fig. 6 Pollen diagram Niederwil VIII A.

determine the share of the wild plants in the human diet.

Wild fruits from the area were a source of vitamin C and of various minerals. The tree cutting activities of the Niederwil farmers would undoubtedly have favoured the increase of wild strawberries (*Fragaria vesca*), blackberries (*Rubus fruticosus*), raspberries (*Rubus idaeus*), and elder (*Sambucus nigra*). Wild apple would not have profited from the clearances, but perhaps this tree was spared because of the fruits. At Niederwil it could be established that the apples were dried, so that they could be stored for a longer time. Unfortunately, vitamin C is no longer present in dried apples, so that in late winter and early spring people would have suffered from a shortage of vitamin C.

Many more uses would have been made of wild plants, but it is not intended to be exhaustive in this respect. Only to medicinal plants will some attention finally be paid. Among the plants, seeds or fruits of which have been recovered from Niederwil, a large number is known as medicinal plants, that is to say as plants to which curative properties are attributed in folk medicine. At present, the alleged therapeutic properties of many of them are questioned, but nevertheless enough plants, the curative properties of which are beyond doubt, remained for the medicine-man of Niederwil. It is, of course, not possible to determine which medicinal plants were known as such to the inhabitants of the Neolithic lake shore sites of Central Europe. Some medicinal plants, such as *Artemisia vulgaris*, *Arctium pubens*, *Agrimonia eupatoria*, *Achillea millefolium*, and *Verbena officinalis*, were either abundant in one or a few samples or encountered regularly, although the mature plants would not have been collected for human nutrition. This may indicate that they were actually used for medicinal purposes.

EPILOGUE

From the above it will be clear that each of the palaeobotanical investigations carried out for Niederwil, viz. pollen analysis, the study of seeds and fruits, and the identification of wood, has its advantages and its limitations. Fortunately, these investigations supplement each other to

some extent, so that together they provide us with fairly detailed information on the plant growth in the vicinity of Neolithic Niederwil.

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