AML site file: 2646

Ancient Monuments Laboratory
Report 156/88

POLLEN ANALYSIS OF THE PEAT
SEQUENCE FROM FISHERGATE, NORWICH,
NORFOLK.

Dr Rob Scaife

Ancient Monuments Laboratory Report 156/88

POLLEN ANALYSIS OF THE PEAT SEQUENCE FROM FISHERGATE, NORWICH, NORFOLK.

Dr Rob Scaife

Summary

A substantial peat deposit was discovered in the valley of the River Wensum, Norwich, Norfolk. This has been subjected to environmental analyses which include pollen, plant macrofossils and insects studies. This report presents the pollen analysis which has been carried out. Three pollen assemblage zones have been recognised. A basal zone which has also been radiocarbon dated to 9410 +/- 110 bp lies within the pre-boreal/boreal transition. The vegetation of this phase has been shown to be dominated by birch and then pine.
There is a marked hiatus between pollen zones I and II. Pollen zones II and III are obviously later and are thought on palynological grounds to span the late-prehistoric to saxon periods since they show evidence of anthropogenic activity. A radiocarbon date of 800AD has been obtained from the top of pollen zone III. The uppermost pollen zone IV is of Medieval age and is typical of urban pollen assemblages. The pollen spectra of this zone are dominated by herbaceous pollen types and especially that of cereal pollen and associated segetal taxa. These result from the presence of faecal debris and other organic waste which was dumped in the river Wensum channel.

Author's address :-

Ancient Monuments Laboratory
English Heritage
23 Savile Row
London
W1X 2HE

01 7346010 x536

FISHERGATE, NORWICH; POLLEN ANALYSIS OF THE PEAT SEQUENCE.

Robert G Scaife

INTRODUCTION

Peat deposits were discovered during the excavation of Middle Saxon to Post Medieval deposits adjacent to the River Wensum (North Bank). During the development of this site for the new magistrates courts (B Ayers), samples for environmental analysis were obtained by P Murphy (plant macrofossils and insects) and for pollen analysis by R Scaife. The deposits sampled for pollen include natural peats and sediments (contexts 96,97 and 175) and those which are thought to contain organic deposits of anthropogenic origin (contexts 95 and 78). Thus, and also noted by Murphy (1986), a number of different environments is represented. These might be expected to produce plant macrofossil assemblages and pollen spectra of diverse character. This has been confirmed with the pollen data presented here.

METHODOLOGY

Samples for pollen analysis were obtained from an open section close to the southern face of the excavation. These were taken nearby and in conjunction with samples for the plant macrofossils analysed by Peter Murphy (Murphy 1986). Samples of the organic deposits were taken at 8cm intervals and span contexts 78, 95, 96 97 and 175 (from the top downwards). Compacted peats below 176 cm were not sampled due to rapid influx of water into the trench and consequent threat of contamination. These basal deposits were, however, bulk sampled by P Murphy (1986) using a spade 'to lever up larger samples for plant macrofossils'. Vegetation data are thus available for the base of context 175 and which was shown to lie directly on gravels of presumed Devensian age.

Standard techniques were used for the extraction and concentration of the sub-fossil pollen and spores (Moore and Webb 1978). This included deflocculation of the organics using sodium hydroxide (10%); digestion of silica with hot hydrofluoric acid and removal of cellulose using Erdtman's acetolysis (Erdtman 1960). The extracted pollen was stained with safranin and mounted in glycerol jelly. Pollen and spores were not abundant and were in a moderate state of preservation. This is not surprising in view of the molluscan remains present which indicate a relatively high pH. It is likely that pollen preservation has resulted from the site being constantly waterlogged. The sum of identified and counted pollen grains and spores ranged from 300 to 925. These totals have been calculated as a sum of total pollen (excluding spores). Spores have been calculated as a percentage of total pollen. The results of these calculations are given in pollen diagram form (figure).

POLLEN STRATIGRAPHY

Three distinct pollen assemblage zones have been identified (figure). These are described from the base at 176 cm upwards. It appears that these pollen zones are broadly coincidental with the archaeological contexts described (Ayers and Murphy). The relationship of these contexts is given in the stratigraphical column shown in figure 1. From the base upwards, the pollen assemblage zones recognised are characterised as follows;

POLLEN ASSEMBLAGE ZONE I (176-156 cm; context 175).

The deposits of this zone comprise dark brown, highly humified detritus peat containing some monocotyledonous remains, fine silt and sand. Arboreal pollen is dominated by ***Pinus*** which increases throughout the zone to 53% of total pollen at 160 cm. ***Betula*** is represented (10% at 176 cm). Small numbers of ***Ulmus*** (individual occurrences), ***Quercus, Alnus*** and ***Corylus*** type are recorded. Dry land herb pollen is dominated by Gramineae (to 50% TP) and Cyperaceae (to 40% TP). Graminaceous pollen having a size of greater than 45 microns was recorded separately. Attention is drawn to ***Filipendula*** which increases throughout the zone. Pollen of aquatic plants is present (***Nymphaea, Nuphar, Myriophyllum alterniflorum*** and ***Potamogeton***). Other wetland and marginal plants include ***Caltha*** type, ***Alisma*** type, *Iris*, *Sparganium* type and *Typha latifolia*. Spores of *Dryopteris* type (monolete spores) attain 30% of total pollen at 160 cm.

POLLEN ASSEMBLAGE ZONE II (158-132 cm; contexts; top of 175).

The peat of this zone consisted largely of dark brown, highly humified detritus peat. This was texturally similar and apparently the same as that comprising zone I. In the larger samples obtained for plant macrofossil analysis, Murphy (1986) noted the presence of *Phragmites*, other monocotyledonous remains and abundant twigs and wood. The principal arboreal taxa are *Quercus* (to 10% TP) and *Alnus* (to 10%TP). Low numbers of *Ulmus, Tilia* and *Fraxinus* and a single occurrence of *Fagus* were present in the analysis. The demise of *Pinus* (from 55% to 7% TP) is notable across the boundary with Zone I. In the shrub category, *Corylus* type is the principal component reaching a maximum value of 10%. Herbs are more numerous and are dominated again by Gramineae (to 60%TP) and Cyperaceae (to 40% TP). Large Gramineae of cereal type (>45 microns) are also noted. These were of cereal type. A more diverse range of herbs is present compared with Zone I. Of particular note are the relatively high values of *Plantago lanceolata* and *Taraxacum* type (Compositae group Liguliflorae). Pollen of aquatic taxa is reduced but with *Sparganium* type remaining important. Fern taxa are dominated by

Dryopteris type and notably *Pteridium* the latter which enters at the base of this zone.

POLLEN ZONE III 132-108 cm; contexts 97 ,96).

Stratigraphically, the peat of this zone was similar to that comprising Zones I and II (humified detritus peat). Murphy (pers comm.), has noted that some reworked peat/organic material may, however, be present in this zone. Palynologically this zone is differentiated from Zone II by the absence of *Tilia* and minor reductions in pollen of *Pinus, Alnus, Corylus* type, and *Salix. Plantago lanceolata, Taraxacum* type and Cyperaceae increase. Tree pollen remains dominated by *Quercus* and *Alnus.* Gramineae and Cyperaceae remain the dominant herbs. The spores of fern taxa remain little changed from zone II.

POLLEN ZONE IV (108-56 cm; contexts 95 and 78).

Stratigraphically this zone is highly heterogeneous comprising flints, quartzite pebbles and comminuted calcareous fragments. These are set in a humic loam. Murphy (1986 and this volume) has also noted the presence of wood, charcoal, fly puparia and molluscs. This pollen zone is characterized by a marked reduction in pollen of arboreal taxa which with the exception of *Quercus,* occur only sporadically. Herbaceous pollen are dominated by Gramineae. Wild grasses (that is, size of less than 45 microns, thin walled and with small pori and annuli) attain high percentage values. Cereal type pollen (Gramineae with a size greater than 45 microns, thick exine displaying coarser sculptural elements and large pori and annuli), is also dominant throughout this zone (to 45% TP). In contrast to pollen zones I and II, Cyperaceae are much diminished. Pollen of *Taraxacum* type (Liguliflorae) is co-dominant reaching up to 35% of total pollen. The 'curve' for this taxon does, however, fluctuate markedly from only isolated grains to the substantial values noted above. Other herb taxa which are of note include *Sinapis* type, *Plantago major* type and *Centaurea cyanus.* Pollen of aquatic and marginal taxa are largely absent with only individual occurrences of *Sparganium type* and *Typha latifolià.* Fern spores are similarly reduced.

DISCUSSION

It is clear that the four broad pollen zones represent three main periods of organic accumulation. The stratigraphical boundary between zones I and II is indistinct. This is perhaps due to the highly humified character of this apparent fen peat and its compaction. The junction between zones III and IV is, however more distinct because of the contrasting biofacies and lithofacies. This division into four units is not surprising in view of the diverse ages of the different stratigraphical units analysed. Zone I has been radiocarbon dated at 9410+/- 110 bp (HAR 7062) and therefore falls within the earlier part of Flandrian Zone I (Pre-boreal/early Boreal). In contrast, assemblage zone III is associated with Saxon deposits which have been dated at 800 AD (HAR 7061). This date was from wood obtained from deposits at the top of the pollen zone III. The intermediate pollen zone II, is more problematic since no absolute dating was undertaken on these deposits. This was due to the similarity of the peats in zones I and II which were initially thought to be part of a continuous depositional sequence. Suggestions are, however, made in light of the pollen evidence presented here (see below). Zone IV has been dated on artifactual evidence to the Medieval period.

The radiocarbon date of 9410 +/- 110 bp (HAR 7062) clearly places the basal pollen asemblage zone within the early Flandrian. This date is commensurate with the vegetation/environmental data from many other English sites (including East Anglia). The environmental picture can be divided into two aspects; these are the 'on site' vegetation and the vegetation of the surrounding area. The former (autochthonous) record portrays a vegetation dominated by grass and sedge fen with areas of open water present. It is likely that the River Wensum was a slow flowing river in which aquatic plants grew (eg. ***Nuphar, Nymphaea, Potamogeton***). This was apparently bordered by fen swamp in which grasses, sedges and rooted marginal aquatics grew (eg. ***Alisma,*** *Sparganium, Typha angustifolia* and *T. latifolia*). This view is commensurate with Murphy's (this volume and 1986) interpretation of 'deposition in, or adjacent to, open reed swamp growing in shallow water, isolated from the main river channel'. Murphy also notes the presence of *Nymphaea alba, Nuphar lutea, Caltha palustris, Iris psuedacorus* and *Typha* species all of which were similarly recorded in the pollen record.

Pollen has the advantage over plant macrofossils in that it may also portray the characteristics of the regional vegetation. This is the case here. It appears that the basal sample represents the time at which *Pinus* was becoming competitively more important than *Betula*. This is a characteristic phenomenon of early Flandrian vegetation succession. Subsequent to climatic amelioration at the end of the last glacial stage (Devensian), *Betula* became rapidly dominant. This was superseded by *Pinus* which has a competitive ability over *Betula* and which similarly became dominant. *Corylus* is often associated with this phase of the Flandrian vegetation development. Its arrival in England has been shown to be asynchronous due to differing migration routes (Deacon 1974; Godwin 1975). It appears that the uppermost level of pollen assemblage zone I (160 cm) pre-dates this arrival. Since we are here dealing with negative evidence, it may be argued that *Corylus* may never have been present in such dominance at this site. When compared to the majority of early Flandrian pollen records, this does, however, seem unlikely. It is therefore suggested that this pollen record represents the early Boreal period immediately before *Corylus* became co-dominant with

Pinus. In view of the early Holocene date of these peats, it is not surprising that *Ulmus* and *Quercus* are present in only small values.

From the pollen evidence there is a distinct break in the stratigraphical record between 152-160 cm. No unconformity was apparent in the peat stratigraphy, all of which falls within context 175. Murphy (1976 and this volume) has also pointed to drying out of the marsh surface at the top of context 175. There is undoubtedly a major hiatus between zones I and II when peat accumulation ceased or where the peat stratigraphy has been removed by erosion. It has often been noted that the climate of the Boreal period (Flandrian Ib and Ic) was a time of continental dryness. Evidence cited by a number of writers includes the reworking of sediments on the margins of Lake Windermere (Pennington 1970) and Hockham Mere, Norfolk (Godwin and Tallantire 1951) during the late Boreal. It is not inconceivable therefore that such a period of dryness may have upset the hydrological status of this area. Lowering of water levels may have caused a cessation of peat growth and have been responsible for the highly humified and detrital character of the peat. Alternatively, such cessation of peat growth may have resulted from spatial shifts in the drainage channel. This can only be verified with a wider stratigraphical survey of these basal peat sequences.

Pollen zone II is of interest and it is unfortunate that at present no absolute dating is available for the basal peats of this zone. It is hoped that with future excavation this will be feasable. It is clear that the depositional environment was similar to that of zone 1, but of much later date; that is, with open water and fringing reed swamp with associated plant taxa. The 'terrestrial' flora is, however, substantially different to that of pollen zone I. ***Pinus*** and ***Betula*** woodland was replaced by ***Quercus***. ***Tilia*** (lime) and ***Fraxinus*** (ash) are also present in small pollen frequencies. These two trees are insect pollinated, produce small quantities of pollen and hence are usually under represented in pollen spectra. Consequently, when present in pollen spectra their relative importance must be considered in relation to these factors. It appears therefore that some ***Quercus*** woodland with ***Tilia*** and ***Fraxinus*** was present in the region. Alder pollen is also in evidence in this zone. It is difficult to assess whether its pollen came from sporadic local growth or whether it was transported from areas of dominance growing at a distance from the site. The herb pollen spectra provide an insight into the dating of this zone. Pollen of ***Plantago lanceolata*** and large Gramineae (which may include cereal pollen) and the spores of ***Pteridium aquilinum*** (bracken) are indicative of post-Neolithic anthropogenic disturbance. This is also substantiated by the relative absence of ***Ulmus*** and the presence of ***Fraxinus***. From this it is clear that we are dealing with a post Elm Decline sequence. It has often been shown that ***Fraxinus*** expanded into those areas once dominated by elm. Similarly, ***Tilia*** might be expected in higher frequencies for any period between Flandrian II (Atlantic at 7000 bp) and the ***Tilia*** decline which has been variously dated from the Late Neolithic to Iron Age. It is perhaps presumptive to note the higher values of ***Tilia*** in the basal level of this zone (104cm). Throughout southern and Eastern

England, a *Tilia* decline in the pollen record has been shown to have been the result of anthropogenic clearance for agriculture. This event is asynchronous but appears to have taken place especially during the middle and late Bronze Age (Turner 1964; Baker, Moxey and Oxford 1978; Scaife 1980). Such clearance of woodland for agriculture could have the effect of raising the water table causing renewal of the peat forming community adjacent to the River Wensum.

The organic deposits of pollen zones II and III are compacted and humified detrital peats, and it is likely therefore that the time span represented is relatively long. The date of 1150 +/-80bp (HAR-7061) at the top of zone III provides an upper date for this peat accumulation. Consequently, the underlying peats down to 158 cm may span all or parts of the Bronze Age, Iron Age and Romano British periods. This view would be commensurate with the interpretation given above that we are seeing (in zone II) the *Tilia* decline and recursion of organic deposition consequent upon higher ground water tables. This view is substantiated by the major representation of marsh taxa in the pollen and seed record (Murphy 1986).

Zone IV exhibits markedly different characteristics to zones I, II and III both in the biostratigraphy and the lithostratigraphy. Whilst the deposits of zones I to III contain pollen which were derived through normal and natural taphonomic processes, zone IV displays many of those elements indicative of different modes of arrival. The pollen spectra between 108 and 56 cm are typical of those assemblages found on, or adjacent to urban areas. This is of course in accord with the

Saxon to Medieval urban character of this area of Norwich. Such urban pollen and plant macrofossil assemblages are normally very diverse in their character. This is generally due to the importance of plant materials used by the occupants in urban areas. Such uses are numerous but notably include human and animal food; building materials; floor coverings; and the bi-products of crop processing. Urban dwellers were responsible for producing substantial quantities of refuse and ordure. This was frequently dumped into stream channels and on waste ground. Organic waste and especially human and animal faecal material may contain large quantities of pollen which has remained in foodstuffs during their preparation. On ingestion this pollen is readily preserved in the gut and intestinal tract (Greig 1981; Scaife 1986). Ultimately this is excreted as faeces and becomes a major constituent of urban waste. The presence of intestinal parasites is also common in such circumstances. Here this was similarly the case with numbers of ***Trichuris*** (Whip worm) and ***Ascaris*** (Maws worm) nematode eggs present in the pollen preparations. In addition, urban waste areas may have a prolific growth of weed assemblages which may contribute to the pollen and seed record where suitable conditions for preservation occur (Greig 1976; Hall ***et al*** 1983 ;Krzywinski ***et al*** 1983; Scaife 1982,1986). It is these elements which have contributed to the pollen record of assemblage zone III. High values of cereal pollen noted in figure *** are likely to have come from faecal (coprolitic) material which was dumped into the river Wensum or its fringing marsh land. Murphy (this volume) has noted the presence of coprolites in a number

of contexts. One of these (from context 94) was shown to have arable weed seeds incorporated. This helps to substantiate the view that the high cereal frequencies recorded here result from faecal debris and not by direct transport from local crop cultivation or cereal processing. It is further likely that much amorphous human and animal ordure was similarly dumped into this wetland area and contributed to the pollen spectra of the segetals associated with arable cultivation (***Centaurea cyanus, Sinapis***
type and other weeds). It appears that woodland was sparse by the time of deposition of contexts 78 and 95. This is, however, problematic because the natural pollen rain may have been swamped by the large quantities of pollen incorporated in the organic material introduced by man.

CONCLUSION

Pollen analysis has been carried out on peats recovered from the River Wensum channel. Four pollen assemblage zone have been recognised. These represent three broadly different periods of organic accumulation. Zone I has been radiocarbon dated at 9410+/-110 bp. The pollen spectra are certainly representative of the Pre-boreal or very early Boreal periods. A local vegetation of fen and open water is indicated by the aquatic and marginal aquatic plants assemblages. Dry land vegetation was birch which gave way to Pine. There is a distinct hiatus in the biostratigraphy at 160 cm. The subsequent pollen zones II and III illustrate the restoration of marsh/fenland habitat. It differs at least locally to that of Zone I in having evidence of alder growth along its edges. The time span represented by zones II and III is problematic and it is suggested that this phase is post-Neolithic, possibly spanning the middle or late Bronze Age to Saxon period. A date of 1150 +/-80bp, however, represent the latest date of organic accumulation within this unit (pollen zones II and III). Zone IV is markedly different to the previous pollen zones. This zone which dates to the Medieval period, exhibits many characteristics common to urban pollen assemblages. Thus, cereal pollen percentages and the presence of arable weed types is noted. These are perhaps derived from human or animal ordure and waste food stuffs which were dumped onto waste areas and into drainage channels.

BIBLIOGRAPHY

Baker, C.A., Moxey, P.A. and Oxford, P.M. 1978 'Woodland continuity and change in Epping Forest'. *Field Studies* 4,645-669.

Deacon, J. 1974 'The location of refugia of *Corylus avellana* L. during the Weichselian glaciation'. *New Phytologist* 73,1055-1063.

Erdtman, G. 1960 'The acetolysis method'. *Svensk. Bot. Tidskr.* 54,561-564.

Godwin, H. and Tallantire, P.A. 1951 'Studies in the post glacial history of British vegetation. XII. Hockham Mere, Norfolk. *J. Ecol.* 39,285-307.

Greig, J.R.A. 1981 'The investigation of a medieval barrel-latrine from Worcester'. *Journal of Archaeological Science* 8,265-282.

Greig, J.R.A. 1982 'The interpretation of pollen spectra from urban archaeological deposits'. In Hall, A.R. and Kenward, H.K. (eds.) *'Environmental archaeology in the urban context'*. Council for British Archaeology 43,47-65.

Hall, A.R., Jones, A.K.G., and Kenward, H.K. 1983 Cereal bran and human faecal remains from archeological deposits-some preliminary observations'. In Proudfoot, B. (ed) *'Site, Environment and Economy'*. Symposia of Assoc. for Environmental Archaeology No3. B.A.R. International Series 173 pp85-104

Krwzinski, K. Fjelldal, S. and Soltvedt, E. 'Recent palaeoethnobotanical work at the Medieval excavations at Bryggen, Bergen, Norway. In Proudfoot, B. (ed) *'Site, Environment and Economy'*. Symposia of Assoc. for Environmental Archaeology No3. B.A.R. International Series 173 pp85-104

Moore, P.D. and Webb, J.A. (1978) *'An illustrated guide to pollen analysis'*. Hodder and Stoughton, London.

Murphy, P. 1986 Fishergate, Norwich (Site 732N). Environmental studies. Ancient Monuments Laboratory Report 38/86

Pennington, W. 1970 'Vegetation history in the North-West of Englands:A regional synthesis'. pp.41-79 in Walker, D. and West, R.G. *'Studies in the vegetational history of the British Isles.* Camb. Univ. Press.

Scaife, R.G. 1980 *'Late Devensian and Flandrian palaeoecological studies in the Isle of Wight'.*
. Unpubl. Ph.D. thesis of the University of London, King's College, Dept. of Geography.

Scaife, R.G. 1982 'Pollen analysis'. In Mills, P. 'Excavations at Broad Sanctuary, Westminster'. *Transactions of the London and Middlesex Archaeological Society.* 33,345-365.

Scaife, R.G. 1986 'Pollen in human palaeofaeces; and a preliminary investigation of the stomach and gut contents of Lindow man'. pp. 126-139. In Stead, I., Bourke, B. and Brothwell, D. (eds.) 'Lindow Man. The body in the bog' British Museum Publication.

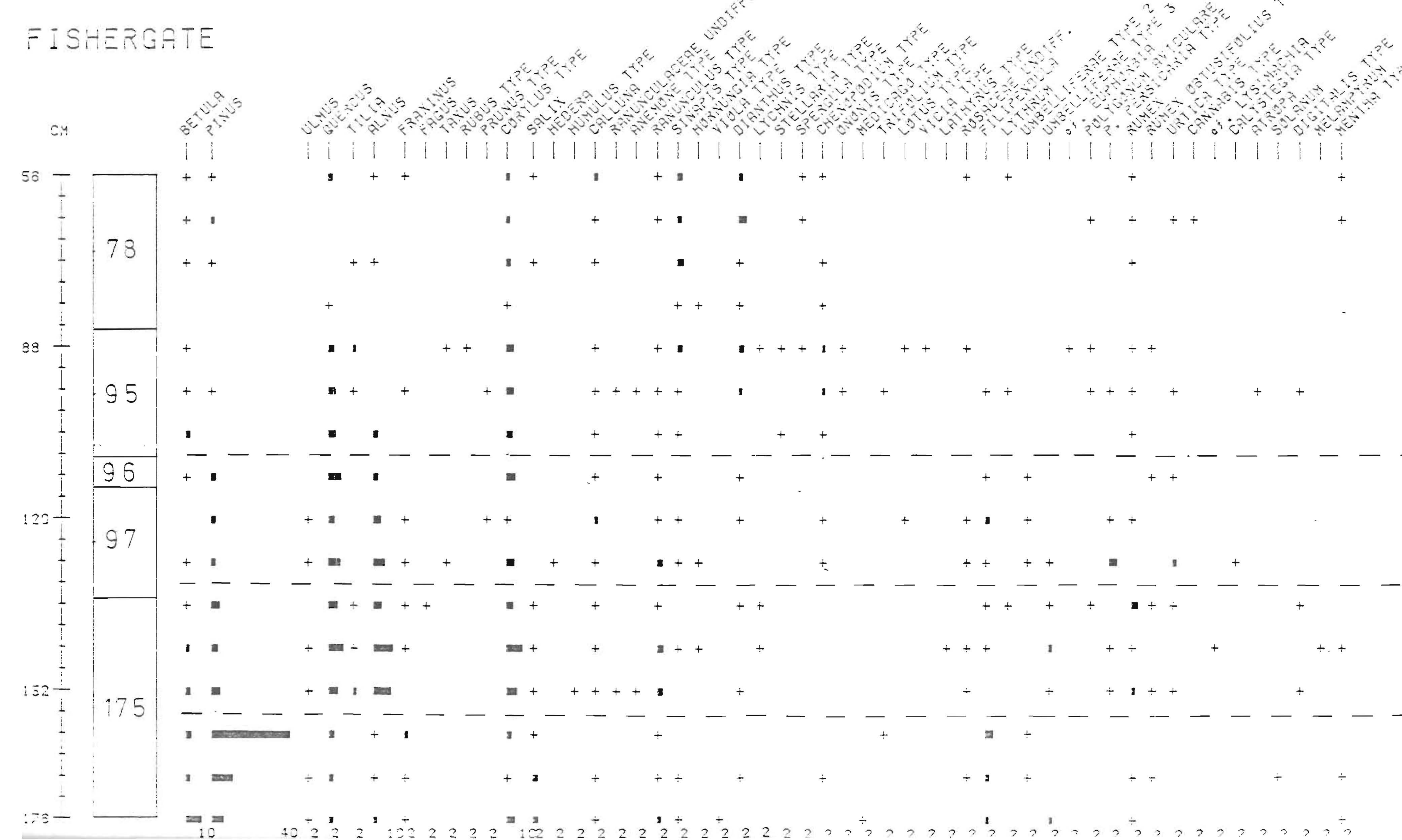
Turner, J. 1962 'The Tilia decline: an anthropogenic interpretation'. *New Phytologist* 63,73-90.

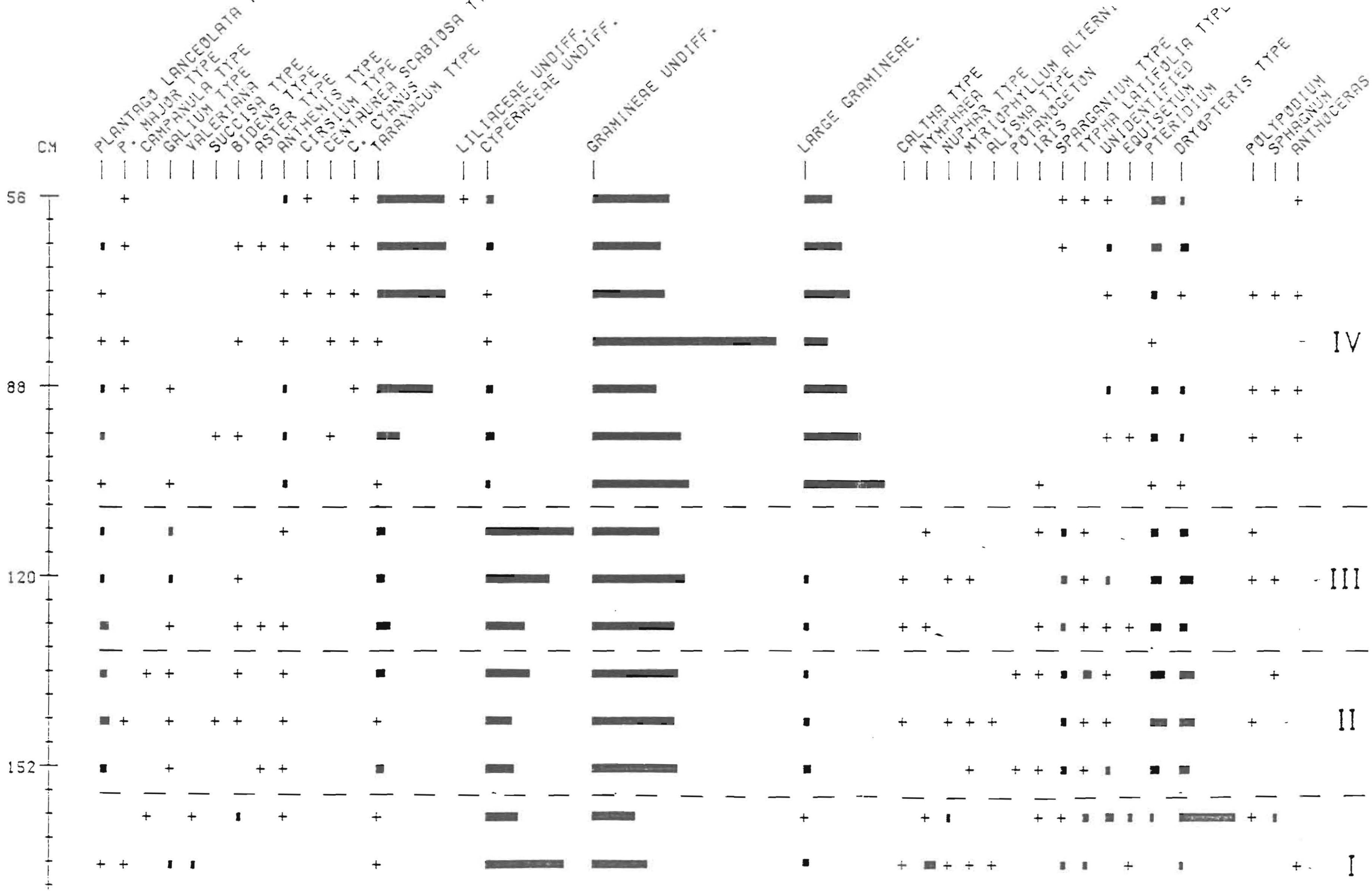
NO OF TAXA
85.0
NO OF LEVELS
16.0

←TOP PROFILE 4cm ints. BOTTOM PROFILE→

BETULA,3,2,1,0,3,1,7,3,0,4,3,5,7,6,5,30
PINUS,3,4,3,0,0,1,0,6,6,6,15,11,16,107,37,23
ULMUS,0,0,0,0,0,0,0,0,1,1,0,2,1,0,1,2
QUERCUS,8,0,0,2,10,13,14,19,10,23,17,29,18,6,6,6
TILIA,0,0,2,0,4,1,0,0,0,0,2,3,5,0,0,0
ALNUS,2,0,1,0,0,0,8,6,12,21,14,37,33,1,1,4
FRAXINUS,1,0,0,0,0,1,0,0,2,1,4,1,0,3,2,3
FAGUS,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0
TAXUS,0,0,0,0,1,0,0,0,0,1,0,0,0,0,0,0
RUBUS TYPE,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0
PRUNUS TYPE,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,0
CORYLUS TYPE,5,5,7,2,12,12,10,12,3,13,11,30,19,5,2,14
SALIX,2,0,1,0,0,0,0,0,0,0,1,1,1,1,7,9
HEDERA,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0
HUMULUS TYPE,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0
CALLUNA,5,3,2,0,2,1,3,1,4,3,2,2,3,0,1,1
RANUNCULACEAE UNDIFF.,0,0,0,0,0,1,0,0,0,0,0,0,2,0,0,0
ANEMONE TYPE,0,0,0,0,0,1,0,0,0,0,0,0,2,0,0,0
RANUNCULUS TYPE,1,1,0,0,1,1,1,1,3,9,1,10,9,2,1,5
SINAPIS TYPE,9,6,11,4,8,1,1,0,1,4,0,1,0,0,1,2
HORNUNGIA TYPE,0,0,0,1,0,0,0,0,0,2,0,1,0,0,0,0
VIOLA TYPE,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1
DIANTHUS TYPE,6,13,3,2,8,4,0,2,1,0,2,0,1,0,1,0
LYCHNIS TYPE,0,0,0,0,1,0,0,0,0,0,1,1,0,0,0,0
STELLARIA TYPE,0,0,0,0,1,0,2,0,0,0,0,0,0,0,0,0
SPERGULA TYPE,1,2,0,0,1,0,0,0,0,0,0,0,0,0,0,0
CHENOPODIUM TYPE,1,0,1,2,4,4,1,0,1,1,0,0,0,0,1,0
ONONIS TYPE,0,0,0,0,1,1,0,0,0,0,0,0,0,0,0,0
MEDICAGO TYPE,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,3
TRIFOLIUM TYPE,0,0,0,0,0,2,0,0,0,0,0,0,0,1,0,0
LOTUS TYPE,0,0,0,0,1,0,0,0,1,0,0,0,0,0,0,0
VICIA TYPE,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0
LATHYRUS TYPE,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0
ROSACEAE UNDIFF.,1,0,0,0,1,0,0,0,1,1,0,2,1,0,2,0
FILIPENDULA,0,0,0,0,0,2,0,3,6,2,1,2,0,9,5,4
LYTHRUM,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,0
UMBELLIFERAE TYPE 2,0,0,0,0,0,0,0,1,2,1,0,0,0,1,2,0
UMBELLIFERAE TYPE 3,0,0,0,0,0,0,0,0,0,1,1,4,3,0,0,4
cf. EUPHORBIA,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0
POLYGONUM AVICULARE TYPE,0,1,0,0,1,1,0,0,0,0,2,0,0,0,0,0
P. PERSICARIA TYPE,0,0,0,0,0,2,0,0,2,13,0,1,1,0,0,0
RUMEX,2,2,2,0,1,3,2,0,3,0,11,3,5,0,1,2
RUMEX OBTUSIFOLIUS TYPE,0,0,0,0,1,0,0,1,0,0,3,0,1,0,1,0
URTICA TYPE,0,1,0,0,0,1,0,1,0,6,1,0,1,0,0,0
CANNABIS TYPE,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0
cf. LYSIMACHIA,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0
CALYSTEGIA TYPE,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0
ATROPA,0,0,0,0,0,2,0,0,0,0,0,0,0,0,0,0
SOLANUM,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0

```
DIGITALIS TYPE,0,0,0,0,0,1,0,0,0,0,1,0,1,0,0,0
MELAMPYRUM,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0
MENTHA TYPE,3,1,0,0,0,0,0,0,0,0,0,1,0,0,1,2
PLANTAGO LANCEOLATA TYPE,0,4,2,1,5,5,1,4,5,13,10,15,11,0,1,1
P. MAJOR TYPE,2,1,0,1,1,0,0,0,0,0,0,1,0,0,1,1
CAMPANULA TYPE,0,0,0,0,0,0,0,0,0,0,1,0,0,1,0,0
GALIUM TYPE,0,0,0,0,1,0,2,4,5,1,2,2,4,0,4,5
VALERIANA,0,0,0,0,0,0,0,0,0,0,0,0,0,2,4,0
SUCCISA TYPE,0,0,0,0,0,1,0,0,0,0,0,1,0,0,0,0
BIDENS TYPE,0,2,0,1,0,3,0,0,2,4,2,3,0,3,0,3
ASTER TYPE,0,2,0,0,0,0,0,0,0,1,0,0,2,0,0,0
ANTHEMIS TYPE,5,1,3,1,4,4,6,1,0,1,2,1,1,1,0,1
CIRSIUM TYPE,1,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0
CENTAUREA SCABIOSA TYPE,0,1,4,1,0,1,0,0,0,0,0,0,0,0,0,0
C. CYANUS,2,1,2,2,2,0,0,0,0,0,0,0,0,0,0,1
TARAXACUM TYPE,130,128,130,2,104,41,3,10,12,24,14,2,12,2,1,1
LILIACEAE UNDIFF.,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
CYPERACEAE UNDIFF.,11,10,3,1,10,12,5,124,117,71,81,45,51,38,125,67
GRAMINEAE UNDIFF.,145,124,134,800,117,165,182,94,172,154,162,152,163,52
LARGE GRAMINEAE.,52,70,87,100,80,108,155,0,6,8,7,9,12,1,8,24
CALTHA TYPE,0,0,0,0,0,0,0,0,1,1,0,1,0,0,1,2
NYMPHAEA,0,0,0,0,0,0,0,1,0,1,0,0,0,1,17,7
NUPHAR TYPE,0,0,0,0,0,0,0,0,3,0,0,1,0,3,1,0
MYRIOPHYLLUM ALTERNIFLORUM,0,0,0,0,0,0,0,1,0,0,1,3,0,1,6
ALISMA TYPE,0,0,0,0,0,0,0,0,0,0,1,0,0,1,1
POTAMOGETON,0,0,0,0,0,0,0,0,0,0,1,0,1,0,0,1
IRIS,0,0,0,0,0,0,1,1,0,1,2,0,1,1,0,0
SPARGANIUM TYPE,1,1,0,0,0,0,0,6,9,6,9,8,9,1,6,10
TYPHA LATIFOLIA TYPE,1,0,0,0,0,0,0,1,1,2,13,2,1,6,5,2
UNIDENTIFIED,4,6,1,0,5,1,0,0,4,1,3,1,6,9,0,3
EQUISETUM,0,0,0,0,0,2,0,0,0,1,0,0,0,4,3,7
PTERIDIUM,26,17,9,2,11,10,3,9,19,19,27,32,16,3,0,0
DRYOPTERIS TYPE,5,13,3,0,7,5,1,10,25,12,29,29,17,94,4,2
POLYPODIUM,0,0,2,0,3,1,0,2,3,0,0,1,0,1,0,0
SPHAGNUM,0,0,1,0,1,0,0,0,1,0,1,0,0,3,0,0
ANTHOCERAS,2,0,2,0,1,1,0,0,0,0,0,0,0,0,1,0
```


FISHERGATE
CM
BETULA
PINUS
ULMUS
QUERCUS
TILIA
ALNUS
FRAXINUS
FAGUS
TAXUS
RUBUS TYPE
PRUNUS TYPE
CORYLUS TYPE
SALIX
HEDERA
HUMULUS TYPE
CALLUNA
RANUNCULACEAE UNDIFF
ANEMONE TYPE
RANUNCULUS TYPE
SINAPIS TYPE
HORNUNGIA TYPE
VIOLA TYPE
DIANTHUS TYPE
LYCHNIS TYPE
STELLARIA TYPE
SPERGULA TYPE
CHENOPODIUM TYPE
ONONIS TYPE
MEDICAGO TYPE
TRIFOLIUM TYPE
LOTUS TYPE
VICIA TYPE
LATHYRUS TYPE
ROSACEAE UNDIFF.
FILIPENDULA
LYTHRUM
UMBELLIFERAE TYPE 2
UMBELLIFERAE TYPE 3
cf. EUPHRASIA
POLYGONUM AVICULARE
P. PERSICARIA TYPE
RUMEX
RUMEX OBTUSIFOLIUS
URTICA TYPE
CANNABIS TYPE
cf. LYSIMACHIA
CALYSTEGIA TYPE
ATROPA
SOLANUM
DIGITALIS TYPE
MELAMPYRUM
MENTHA TYPE
56
88
120
152
176
78
95
96
97
175
10
40
100


CM
PLANTAGO LANCEOLATA
P. MAJOR TYPE
CAMPANULA TYPE
GALIUM TYPE
VALERIANA
SUCCISA TYPE
BIDENS TYPE
ASTER TYPE
ANTHEMIS TYPE
CIRSIUM TYPE
CENTAUREA SCABIOSA
C. CYANUS
TARAXACUM TYPE
LILIACEAE UNDIFF.
CYPERACEAE UNDIFF.
GRAMINEAE UNDIFF.
LARGE GRAMINEAE.
CALTHA TYPE
NYMPHAEA
NUPHAR TYPE
MYRIOPHYLLUM ALTERN
ALISMA TYPE
POTAMOGETON
IRIS
SPARGANIUM TYPE
TYPHA LATIFOLIA TYPE
UNIDENTIFIED
EQUISETUM
PTERIDIUM
DRYOPTERIS TYPE
POLYPODIUM
SPHAGNUM
ANTHOCERAS
56
88
120
152
IV
III
II
I