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THE CORRELATION OF RADIOCARBON AND POLLEN SAMPLES FROM ASKHAM BOG, YORKS

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The Askham Bog Project

The production of pollen diagrams from Askham Bog is intended th shed light on the history of the countryside round the city of York, mainly during the period from the time of the establishment of the Roman fortress (ca. 71 A.D.) through to the medieval period, this being the main area of interest to the York Archaeological Trust. A good radiocarbon chronology is essential to tie the pollen results into the sequence of archaeological events, from Roman to Viking and then Medieval.

Fieldwork

The bog is a few miles from the city centre, formed in an area enclosed by moraines. There is an existing pollen diagram (Gosden, unpublished) showing a succession from Pollen Zone V to VIII, but not in any great detail. Historical studies have shown that peat was cut in the area at various times, so there is the possibility that the upper layers may have been disturbed. The fieldwork, started in 1976, started with a series of borings to examine the sediment and if possible to judge the extent of disturbance so that a relatively undisturbed place could be found for sampling. In the end, two sampling pits were dug so that results could be compared, AB1 and AB2 from which were taken pollen samples at 3 cm intervals from the present ground surface down to about 50 cm. Two bulk samples for radiocarbon dating were collected from AB1 and one from AB2 so that there would be enough dating evidence, available at the same time as the pollen diagrams.

In 1977 a third core was taken, AB3, using specially made sampling boxes to collect a monolith from which pollen samples could be taken with great accuracy at any interval up to about 1 cm. Larger bulk samples were also taken for the study of macroscopic remains and insects. During the fieldwork, Cannabis seeds were found in the peat.

Palynological Evidence

The AB1 pollen diagram is complete, with samples every 3 cm, from 6-54 cm. below the present ground surface. A number of pollen zones are clearly defined:

54-51 cm. Large amounts of tree pollen (oak, lime, elm) very little from herbs. Should represent ± elm decline time, dated from other diagrams @5000 b

48-42 cm. Less tree pollen, more from herbs including Rumex and Plantago. would accord with a time after 5000 b.p. as above

39-24 cm. Cannabiaceae pollen appears, Cyperaceae increases. May date around 2000 b.p. on the basis of other work.

24-6 cm. less Cannabiaceae pollen. No date can be estimated.

The AB2 pollen diagram has only been started, and samples 63-57 cm on this seem to represent pre-elm decline conditions, with very large amounts of oak, lime, elm, alder and Coryloid pollen.

The Radiocarbon Evidence

The preliminary radiocarbon results gave the following dates:

AB1 25cm(HAR-2259) 470 ± 80 (ad 1480)
AB2 35cm(HAR-2258) 5160 ± 110 (3210 bc)
AB1 50cm(HAR-2256) 2010 ± 90 (60 bc.)

The depths from the present ground surface are approximate.

These results were not what would have been expected from the stratigraphic position of the samples, nor from the estimated dates for parts of the pollen diagram, vague though these are. It was therefore decided to compare the pollen content of the samples which had been submitted to the AERE Harwell with those of the bulk radiocarbon samples left in this laboratory, and in turn with the pollen diagrams, so a number of the AB2 pollen samples were prepared and counted as well. . . . . The bulk radiocarbon samples were prepared and counted twice as a check on their consistency

How to Compare Pollen Spectra

The pollen spectra are presented in the same order as they appear on the pollen diagram, and the percentages have been calculated on the same basis, as the % of total land pollen excluding Alnus, Coryloid and Cyperaceae which fluctuate greatly.

The pollen counts are smaller than those used in preparing the pollen diagram, but are sufficient for matching spectra for this purpose. Further counting will be done on some where more accuracy is needed. The possible variation in percentages within the 95% confidence limit based on the number of pollen grains counted can be checked in the standard tables, and the double counts of the radiocarbon samples AB1 50 and AB2 35 show the sort of variation that occurs in practice.

In comparing the pollen spectra a certain amount of palynological judgement has been used in choosing suitable parameters, as for example presence or absence of taxa like Plantago or Cerealia which only appear in certain parts of the pollen diagram.

The Results of the Pollen Counts

The first test was to examine the pollen spectra from the material returned from AERE Harwell and compare them with those obtained from the radiocarbon samples remaining in this laboratory:

HAR 2258 and AB1 50

There are 9 points of difference between this pair of pollen spectra: the values of Quercus, Tilia, Ulmus, Alnus, Gramineae, Cerealia, herbs, Plantago, Cyperaceae all seem significantly different, while Coryloid is inconclusive owing to the difference between the two AB 50 samples counted.

HAR 2258 and AB2 35

There are 8 similarities and no great differences between this pair: the two samples match in values of Quercus, Tilia, Ulmus, Hedera, Alnus, perhaps Coryloid, Cyperaceae and tree pollen, and there are absences in each case of Gramineae, Cerealia, herbs and Plantago. The first AB 35 preparation did have some Gramineae pollen and 10% Cannabiaceae, but the second preparation, sampled from the middle of the lump of peat, did not have this. The macroscopic remains from the samples appear to match.

HAR 2256 and AB1 50

There are 5 points of similarity and 5 differences; Ulmus, Hedera, perhaps Coryloid, Cerealia, herbs and Plantago values are similar, while Tilia, Alnus, Gramineae, Cyperaceae, tree pollen and possibly Quercus seem different. The macroscopic remains appear to match.

HAR 2256 and AB2 35

There are 7 points of difference and 2 similarities: Ulmus, Alnus, Gramineae, herbs, Plantago, Cyperaceae and tree pollen values are distinctly different, and only Tilia and Coryloid similar.

It therefore appears that the samples received at Harwell and the remainder of the radiocarbon sample in this laboratory correspond, with HAR 2258 and AB2 35 in one pair, and HAR 2256 and AB1 50 in the other, although in the latter case the match is not as close as might be expected.

Correlation with the Pollen Diagrams

The next check is to test the relation between the radiocarbon samples and the pollen samples. The AB1 pollen diagram has plenty of changes in pollen values going from a high tree pollen spectrum at the bottom, to a low tree pollen / high herbaceous pollen spectrum at the top of the profile.

The AB 2 pollen diagram is not yet complete, apart from the lowermost part of the diagram, but several other samples have been counted, as at 27 and 36 cm.

HAR 2256 /AB1 50 can be matched with the pollen diagram from AB1 at 45-48 cm. The Harwell sample is more like 48cm. on the diagram, the AB1 50 sample more like 45 cm. and this difference could be accounted for by the thickness of the piece of peat collected for dating. The date (2010 ± 90 bp) would seem to be possible, although it would be late for the first signs of cereal farming if this is an undisturbed section of peat.

HAR 2258 / AB2 35 matches the complete part of the AB2 pollen diagram at 57 cm.. It also matches the pollen spectrum from 36 cm, which suggests that the AB2 pollen diagram will turn out strangely. These pollen spectra are all "old" ones of pre-Elm Decline type which would probably represent a time before 5000 b.p. The radiocarbon date (5160 ± 110 bp) corresponds with the dates, for the Elm Decline, such as Tregaron Bog (4990 ± 70 b.p.), Nant Ffrancon (5050 ± 75 b.p.) and Din Moss (5390 ± 70 b.p.) (Hibbert & Switsur, 1976)) so the date for this horizon could be younger than it might have been expected to be.

HAR 2259 /AB1 25. A pollen sample was prepared from the remainder of the radiocarbon material in this laboratory, and its spectrum matched the AB1 diagram at 21-25 cm. so there appears to be no difficulty with this sample.

Discussion

This work shows how important it is for there to be spare material in this laboratory and at AERE Harwell so that tests can be made if there is any peculiarity in the dates obtained, and it also shows how important it is to check the pollen content of the radiocarbon samples. It was originally thought that the AB2 35 and AB1 50 radiocarbon samples could have become transposed, considering the stratigraphic position of the samples and that the apparently deeper sample gave a younger date.

The AB3 core remains to be analysed, and in this the radiocarbon samples can be taken exactly from where the pollen samples came. First, however, the AB2 pollen diagram will have to be completed to try to find out about the inconsistency it about the peat, and whether there is any evidence from this of peat cutting or disturbance.

Pollen percentages

7	43	26	17	10	Quercus	43	35	49	56
1	6	10	1	1	Tilia	16	11	10	15
1	2	3	1	1	Ulmus	15	14	15	11
-	+	1	4	-	Hedera	1	2	+	-
8	46	39	13	10	(Alnus)	74	66	68	85
27	73	77	77	22	(Coryloid)	80	73	60	62
58	13	28	46	55	Gramineae	+	5	-	-
2	-	+	2	2	Cerealia	-	-	-	-
-	-	-	-	-	Cannabiaceae	-	10	-	-
3	4	2	3	7	Plantago	-	-	-	-
16	4	11	14	12	other herbs	+	1	-	+
56	13	38	74	63	(Cyperaceae)	2	8	7	1
14	65	47	31	18	tree pollen	86	68	81	93
346	236	167	120	269	pollen sum	179	250	189	168
AB1 42 P	AB1 51 P	HAR 2256	AB1 50	AB1 50		HAR 2258	AB2 35	AB2 35	AB2 36 P

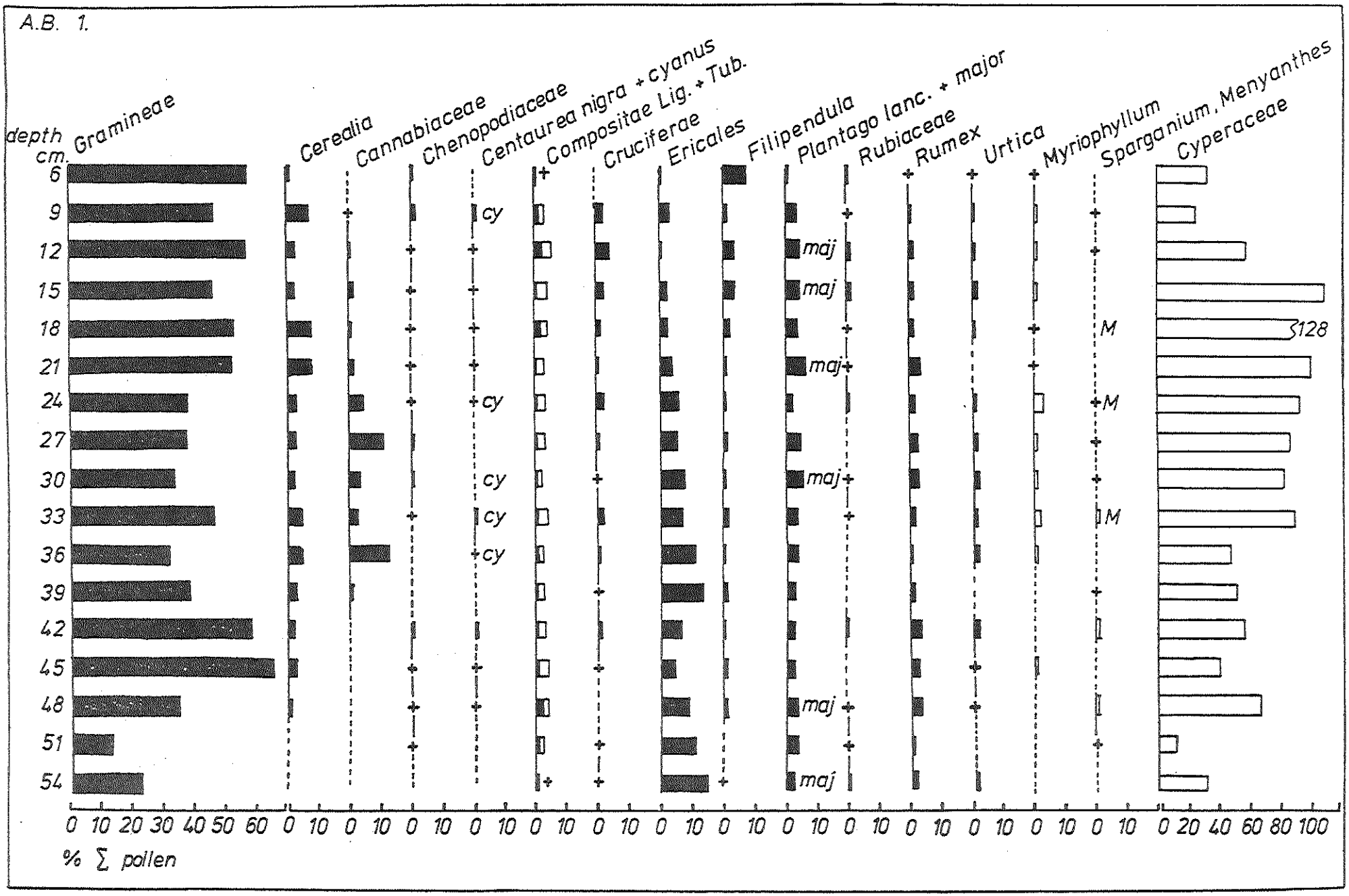
Notes

Pollen sum does not include Coryloid, Alnus, Cyperaceae.

AB1 51 P: Pollen sample

HAR: Part of radiocarbon sample returned from AERE Harwell

AB1 50: Part of radiocarbon sample remaining in this laboratory


A.B. 1.
depth cm.
Gramineae
Cerealia
Cannabiaceae
Chenopodiaceae
Centaurea nigra + cyanus
Compositae Lig. + Tub.
Cruciferae
Ericales
Filipendula
Plantago lanc. + major
Rubiaceae
Rumex
Urtica
Myriophyllum
Sparganium, Menyanthes
Cyperaceae
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
51
54
cy
maj
M
128
0 10 20 30 40 50 60
0 10 20 30 40 50 60 70 80 90 100
% Σ pollen

AB2 CORE

topsoil

AB2 - 35 ^{14}C sample
Sedge peat

Phragmites Peat

Incomplete
Pollen diagram
from samples @ 3cm

cannabis pollen — 27cm

? hiatus
signs of forest — 36cm

full forest as of
5000 b.p. — 63cm

Complete
Pollen Diagram
from samples @ 3cm

6cm

cannabis pollen

clearance

full forest as of
pre- 5000 b.p.

54cm

AB1

topsoil

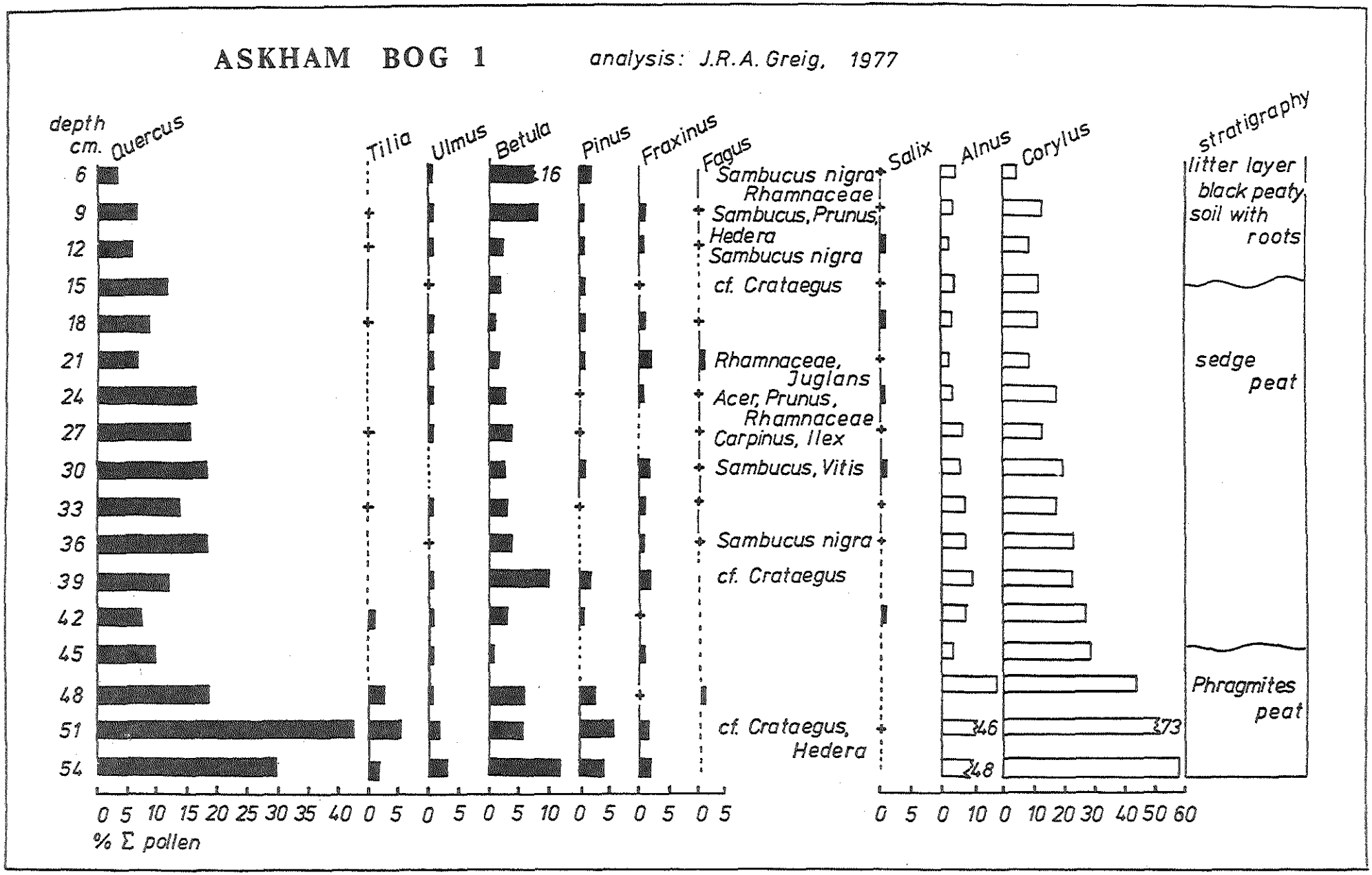
AB1 - 25 ^{14}C sample

Sedge peat

AB1 - 50 ^{14}C sample

Phragmites peat

ca. 400 yards


ASKHAM BOG 1
analysis: J.R.A. Greig, 1977
depth cm.
Quercus
Tilia
Ulmus
Betula
Pinus
Fraxinus
Fagus
Salix
Alnus
Corylus
stratigraphy
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
51
54
16
Sambucus nigra
Rhamnaceae
Sambucus, Prunus,
Hedera
Sambucus nigra
cf. Crataegus
Rhamnaceae,
Juglans
Acer, Prunus,
Rhamnaceae
Carpinus, Ilex
Sambucus, Vitis
Sambucus nigra
cf. Crataegus
cf. Crataegus,
Hedera
46
73
48
litter layer
black peaty
soil with
roots
sedge
peat
Phragmites
peat
0 5 10 15 20 25 30 35 40
0 5
0 5
0 5 10
0 5
0 5
0 5
0 10
0 10 20 30 40 50 60
% Σ pollen