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A CONTRIBUTION TO THE HISTORY OF
FOREST CLEARANCE IN NORTHUMBERLAND

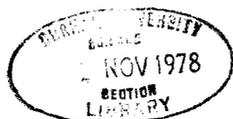
GRANT DAVIES

A Thesis presented for the Degree of
Master of Science in the Faculty
of Science in the University of Durham

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December 1977



(a) No part of this thesis has previously been submitted for a degree at this or any other university.

(b) The work presented is wholly my own except where due reference is given.

G. Davies

ABSTRACT

Four pollen diagrams have been constructed from different locations within Northumberland and three of these have been radiocarbon dated. It is considered that three of the sites, two of which were radiocarbon dated, show a regional picture of vegetation changes, whilst one site was more 'local' in character. In addition, pollen analysis was carried out on samples from a number of archaeological sites.

The pollen diagrams from the 'regional' sites show a remarkable degree of similarity. In each there are three more or less contemporaneous periods of extensive forest clearance separated by some forest regeneration. It is suggested that because the sites are so widely separated, the sequence of events is representative of what was happening over much of the Northumberland uplands.

Not until the beginning of Romano-British times did man have a great effect on the forests of the Northumberland hills. The indications are that, at that time, clearance took place on a scale approaching that of modern times in an area which has often been regarded as a zone of conflict and political unrest. After forest regeneration there was a further but shorter period of forest clearance which is associated with Norse settlement. The final episode of extensive clearance has lasted up to the present day and began after the depression of the fourteenth century.

The situation on the Fell Sandstone hills, at least around Camp Hill Moss, is somewhat different in that the uplands there were apparently less desirable and were not cleared of forest until the fourteenth century and possibly later than that.

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CHAPTER 1

INTRODUCTION

In recent years, pollen diagrams have been produced from sites in many parts of Britain by workers who have been primarily interested in the history of man's interference with the original forest vegetation (e.g. Simmons, 1959a; Hicks, 1971; Bartley, 1975; Tinsley, 1975). As a result it has become apparent that man has played a major part in creating the plant communities which prevail today, including many whose origin had been in contention. The 'Breckland' heaths, for example, have been attributed to the activities of Neolithic people (Godwin, 1944) and more recently, Moore (1975) has emphasised the anthropogenic factor in the development of blanket mires in the uplands. Furthermore, radiocarbon dated pollen diagrams with detailed analysis of the levels in which the effects of forest clearance become manifest, can be correlated with the archaeological and historical record to provide much valuable information about the nature and extent of human activity around the sample site.

Studies of this kind have been undertaken in Co. Durham at Hallowell Moss, Durham City (Donaldson and Turner, 1977) and in parts of Weardale (Roberts et al, 1973) and they have enabled the authors to build up a fairly comprehensive understanding of the vegetation and land use of the area surrounding the sites, during the last 3,000-5,000 years. Whilst a number of pollen diagrams has been produced from Post-glacial deposits in Northumberland (Raistrick and Blackburn, 1931a, 1931b; Blackburn, 1953; Pearson, 1960; Chapman, 1964; Clapperton et al, 1971), there are no diagrams available that include a detailed radiocarbon dated analysis of forest clearance episodes. One such study has been done at Bolton Fell, N.E. Cumbria (Barber, private communication) and is discussed later.

Pollen analytical studies in the Pennines and in the Cumbrian Hills



have shown that, without exception, the first extensive clearances of woodland did not occur until at least the pre-Roman Iron Age, and that the Romano-British period was a particularly active time. However, the situation in the uplands of Northumberland was uncertain because of the paucity of palynological evidence, and the abundance of archaeological remains from the Bronze Age onwards (Chapter 4). In addition, much interest was centred around the Romano-British period in Northumberland, because of the presence of Hadrian's Wall in the south of the county. For much of the Roman occupation it was the frontier of the Empire and represented a definite geographical boundary. Thus, an important question to be answered was how and to what extent did the Roman presence influence the native agricultural economy north of the wall?

Recent opinion has tended towards a relatively peaceful occupation of the north by the Anglo-Saxons, and continuity of occupation of settlements (Cramp, 1970). At Hallowell Moss, however, agricultural land seems to have been abandoned rather suddenly at about a.d. 595 \pm 50 (A.D. 630-670). The decline was attributed to a change over to more intensive farming practised in the eastern lowlands.

Northumberland is an area where the archaeological record is very extensive, but where little is known of the effect that different cultures and societies had in changing the vegetation. The aim of this study was to integrate the vegetation history recorded at several sites in the Northumberland hills, with the archaeological and historical evidence for settlement.

The sites chosen for investigation were in different parts of the Northumberland hills and were sites where a large depth of peat had accumulated in a basin situation, forming raised bogs. These are described in more detail in chapters four to eight.

CHAPTER 2

TECHNIQUES

2.1 Field Methods

Methods used to survey sites, determine stratigraphy and collect samples for pollen analysis and radiocarbon dating are described separately for each site, in the appropriate chapter.

2.2 Preparation of samples for pollen analysis

In the laboratory, material for pollen analysis was prepared by the standard method of sodium hydroxide treatment followed by acetolysis (Faegri and Iversen, 1975). Macro samples retained on the sieve after sodium hydroxide treatment were kept for identification. Samples which contained a high proportion of mineral material, such as those from archaeological sites, were treated with hydrofluoric acid. This process was incorporated into the standard preparation, after sodium hydroxide treatment, and carried out thus:

- (i) The sample was taken up in 10% HCl and centrifuged.
- (ii) The residue was transferred to a nickel crucible using a small quantity of 10% HCl and 40% HF was added.
- (iii) This mixture was boiled very carefully for 3-4 minutes.
- (iv) The contents of the crucible were poured into 10 ml. of 10% HCl and centrifuged.
- (v) If a white precipitate remained, it was removed by heating with 10% HCl.

If any mineral matter remained, the whole process was repeated until all had been removed. Normal acetolysis treatment was then carried out. After completion of chemical treatment, samples were mounted on glass slides

in a medium of glycerol jelly stained with safranin. This method provides semi-permanent slides with the advantage that pollen grains can be turned, if necessary, by carefully remelting the glycerol and moving the cover slip.

2.3 Pollen analysis

A standard method of counting was employed in which each count was terminated after either 150 tree pollen grains, excluding Corylus and Salix, or 500 land pollen grains, excluding aquatic pollen and pteridophyte or bryophyte spores, had been counted. The whole slide was scanned and a note made of any pollen or spore types present that were not included in the pollen sum. Pollen percentages are expressed on the diagrams as percentage of total tree pollen, excluding Corylus and Salix. The tree/shrub/herb ratios are expressed as percentage of total land pollen, excluding Eriophorum, Calluna and Erica which colonize the bog surfaces. In the case of diagrams from Vindolanda, however, it was considered more appropriate to express pollen percentages as percentage of total land pollen.

Cereal pollen grains were identified using phase contrast techniques.

CHAPTER 3

THE ENVIRONMENTAL BACKGROUND

3.1 Geology

Geology is one of the basic factors which affect the natural vegetation and how it responds to human interference. Both the general topography of Northumberland, and the form and disposition of its soils are directly related to the geology of the region (Johnson, 1958). The soils of the area are complex and will be mentioned later in the chapter.

The rocks of Northumberland are arranged concentrically around the great dome of the Cheviot Hills in the north and the smaller dome of the Bewcastle Fells in the extreme south-west (Robson, 1954). Between these, in the middle of the county, lies the structural depression of Upper Redesdale and to the south is the transverse depression of the Tyne Valley. In nearly all parts of the county the dip is substantial, and "dip and scarp" topography is a general feature (Hickling, 1931).

Almost the whole of the present land surface is composed of rocks laid down during the Carboniferous period (see Fig. 1), especially sandstones and grits belonging to the Bernician and Tuedian series. The notable exception is the Cheviot massif, which is derived from volcanic activity in the Old Red Sandstone (Devonian) period, prior to the Carboniferous. The solid geology is, however, often overlain by superficial deposits of Pleistocene and Holocene age, and the present form of the landscape owes much to Pleistocene glaciation. The geology of the study area will, therefore, be considered in terms of pre-Carboniferous, Carboniferous, and Quaternary history, and specific reference will be made to the vicinity of sites chosen for pollen analysis.

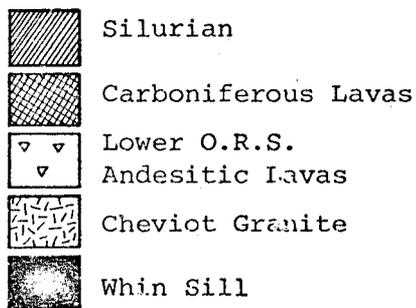
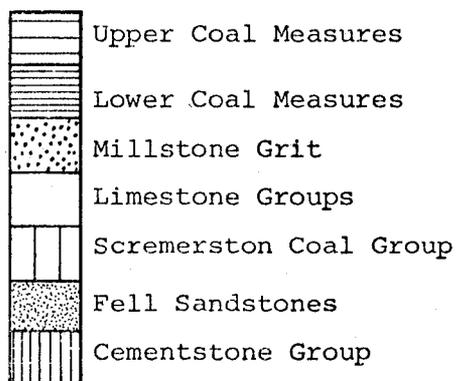
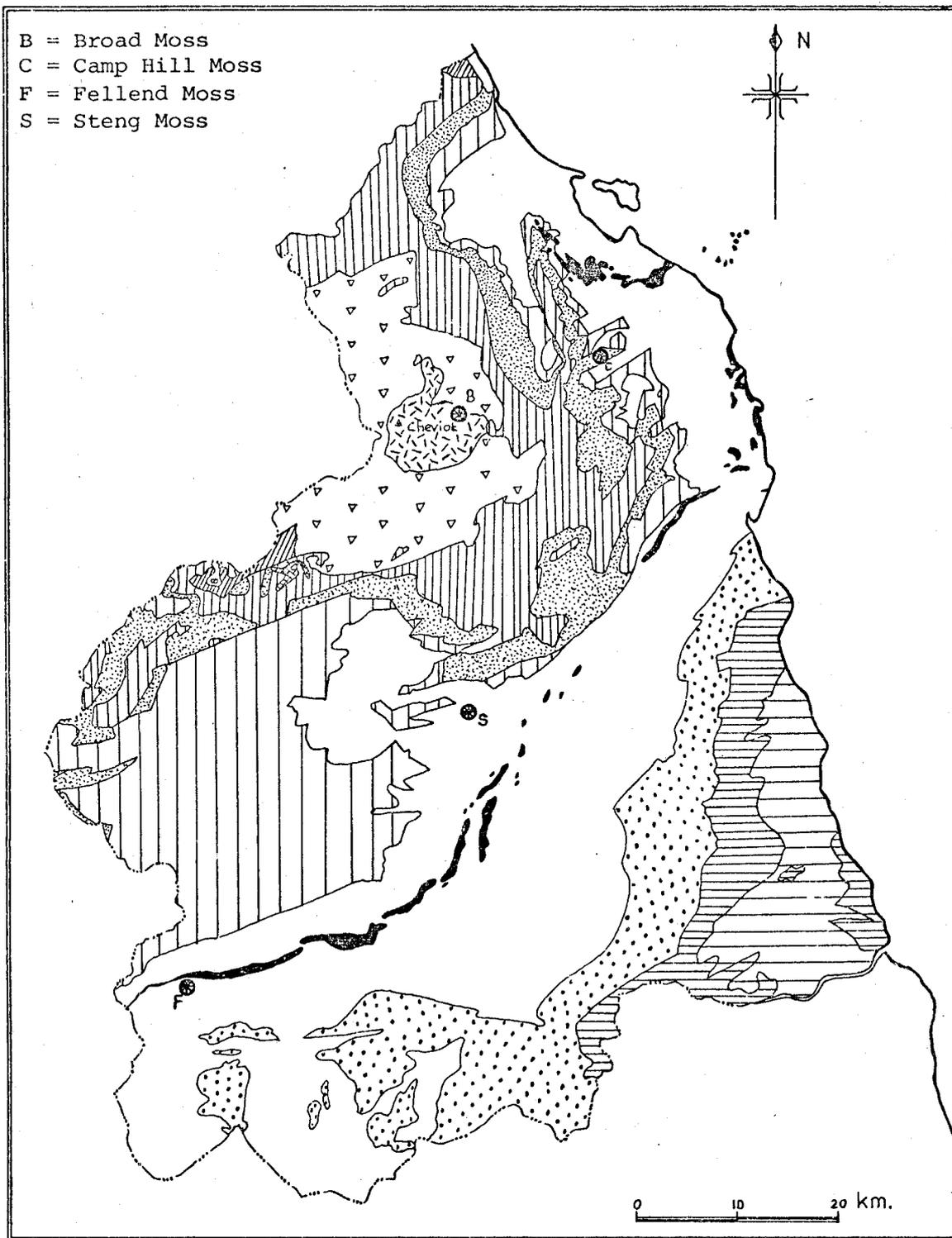


Fig. 1. Geological Map of Northumberland

3.1(i) Pre-Carboniferous Geological History

The oldest outcrops of rock in the county belong to the Silurian period, and consist of alternating series of grey-green shales and grey-wackes mixed with occasional coarser bands and conglomerates (Clough, 1888). Silurian rocks probably form the floor which all the younger rocks of Northumberland now overlies, but they are seldom visible. In the upper reaches of the Redewater about Whitelee, in the upper Coquet at Makendon, and a little south of Ingram, vertical and contorted clay-slates and grey-wackes are exposed as inliers. From their resemblance to beds in the adjoining districts of Roxburgh and Berwickshire they have been referred to the Upper Silurian (Lebour, 1886); but in the absence of fossils, it is impossible to be certain.

The igneous complex of the Cheviot Hills consists of the deeply dissected remains of a volcano of Lower Old Red Sandstone age (Carruthers, 1931; Eastwood, 1953). The early investigations were largely petrographical, and Teall (1883, 1885) was the first to show that the lava flows were mainly andesites, in the heart of which a considerable mass of granite was intruded, the whole being traversed by numerous felsite and porphyrite dykes. His work was confirmed and added to by Kynaston (1899, 1905), who, in particular, studied the contact alterations around the granite.

The first stages of vulcanicity were of explosive character and gave rise to the coarse ashes and agglomerates which rest upon the folded Silurian rocks. This episode was quickly followed by an immense outpouring of lavas which even at the present time, after extensive denudation, cover an area of 595 square kilometres. The lavas gradually became more basic in character and the full sequence given by Carruthers (1931) is:-

	Augite - hypersthene - andesite
Pyroxene-andesite....	Oligoclase - trachyte
	Glassy or pitchstone andesite
Rhyolitic lava	Mica-felsite
Basal agglomerate	

Into this sequence of lavas, the large mass of granite was intruded which now, after profound erosion, appears as a core of plutonic rock surrounded by the lavas and tuffs which dip gently away from it. The concluding stages of this cycle of igneous activity were marked first by the intrusion of a series of dykes cutting both lavas and granite, and then by pneumatolytic action, especially tourmalization (Eastwood, 1953).

3.1(ii) Carboniferous Period

The transgression of the Carboniferous rocks across pre-existing formations is one of the major features in the geological history of northern England. The Carboniferous rocks of the country as a whole are usually divided as follows:-

	Coal measures
Upper Carboniferous	Millstone Grit
Lower Carboniferous	Carboniferous Limestone Series

This threefold arrangement based on lithology is particularly well marked in Lancashire, where massive limestones are succeeded by thick grits that are followed by coal-bearing rocks. Further north, however, in the Yorkshire Dales, a change sets in which becomes increasingly marked in a northerly direction. First, the upper part of the Limestone Series splits into the individual limestones, separated by shales and sandstones, that constitute the so-called Yoredale rocks. A similar change then

affects the lower part of the formation, and these measures, as the Border is approached, lose their limestones almost entirely and consist largely of sandstone and coal-bearing shales, so that in Northumberland the name 'Carboniferous Limestone' is a misleading title for rocks of Lower Carboniferous age (Rayner, 1967). Rivers draining a large land mass, lying across what is now the north-east Atlantic, gave rise to deltaic conditions which predominated almost from the beginning to the end of Carboniferous times in Northumberland, while in Lancashire they succeeded a clear sea period.

The classification of Lower Carboniferous rocks devised for Northumberland is as follows:-

	<u>Central and N. Northumberland</u>	<u>S.W. Northumberland/ N.E. Cumbria</u>
BERNICIAN	Limestone Group Scremerston Coal Group	Limestone Group Birdoswald Limestone Group Craighill Sandstone Group
TUEDIAN	Fell Sandstone Group Cementstone Group	Fell Sandstone Group Cementstone Group

The Cementstone Group is mainly of freshwater or estuarine origin, although in the southern parts of Northumberland occasional beds of true marine type occur. The cementstones characteristic of the group are muddy, impure limestones rarely more than 30 cm. thick. These are divided by grey shales and massive pale-coloured sandstones. True coals are absent, but thin carbonaceous bands and impure fireclays are common (Hedley, 1931). On the south side of the Cheviots the group is relatively thin, but increases northwards to perhaps 915 m. thick in the Tweed Valley and probably to a like amount along the Border to the south-west. East of the Cheviots, the Roddamdene Conglomerate forms the local base of the group.

The Fell Sandstones are composed of pink, coarse, false-bedded, and massive sandstones from 180 m. to 610 m. in thickness (Rayner, 1953). Individual beds may occasionally exceed 30 m. or even 45 m. in thickness, and the group altogether is a marked feature of the countryside, generally forming an elevated, desolate moorland region with bold escarpments and broken crags (Miller and Clough, 1887). Limestones and shales occur very occasionally within the sandstone, but coals are almost entirely absent (Clough, 1888; Hedley, 1931).

Though well-defined and almost wholly of estuarine or fresh-water character in Northumberland, the Scremerston Coal Group undergoes much change towards the south-west (Eastwood, 1953). Typical Scremerston strata exhibit a recurrence of Cementstone conditions - shales with bands of impure limestone - but accompanied in this case by coal seams. At Berwick the group attains its maximum thickness of 305 m. and has at least ten workable coals (some over 2 m. thick). At Alwick, the thickness has dwindled to 90 m. and there are only four thin seams.

The changes in lithology in a south-westerly direction begin with the appearance of marine limestones: first the Redesdale Limestones in the upper part of the group, and then others at lower levels. In south-west Northumberland and north-east Cumbria the changes are more marked and it would be misleading to refer to this belt of strata as the Scremerston Coal Group. There the lower portion, some 215 m. thick, consists mainly of sandstone resembling those of the Fell Sandstone Group below, but separated from it by strata containing four thin limestones (the Kingwater Limestones). To this group the name Craighill Sandstones has been given. It is succeeded by the Birdoswald Limestone Group in which, while sandstones are still abundant, limestones are common and the strata exhibit the typical Yoredale 'rhythm', i.e. a manifold repetition of the sequence: limestone, shale, sandstone, frequently topped by a thin coal seam (Robson, 1966).

This rhythmic sequence continues in the overlying Limestone Group of rocks. Within this group sandstones and shales still predominate, but limestones now occur at intervals of 30 m. or so, varying in thickness from 1 to 18 m. The group is subdivided into Lower, Middle and Upper Groups which have their own lithological and palaeontological characteristics. The base of the Lower division is marked by the Redesdale or Dun Limestone, that of the Middle division is the Oxford Limestone, while the Great Limestone is assigned to the base of the Upper division. Some of the limestones can be traced right across Northumberland, but there are several good examples of sandstones in the Limestone Groups which lack this lateral persistence. Each was laid down by a river which formed a local delta in that area. The whole sequence has been well documented for western Northumberland by Johnson (1959).

The sequence of rocks laid down on top of the Upper Limestone Group consists mainly of shales and sandstones with subsidiary coal seams. These Millstone Grit and Coal Measure deposits outcrop only in the south-east of Northumberland, and as such are of little importance in the context of this thesis. They will not therefore be described in any detail.

Lower Carboniferous igneous rocks occur in two small areas of Northumberland. In Upper Redesdale, the olivine-basalt Cottonshope Lava and the Carter Fell - Lumsdon Law intrusive basalt outcrop. The Kelso 'Traps' constitute another important and extensive group of Lower Carboniferous lavas, of which only a small portion is to be seen in Northumberland, near Carham-on-Tweed (Tomkeieff, 1931).

The Late Carboniferous intrusive rocks of Northumberland have been divided into three groups by Holmes and Mockler (1931):-

- (a) The quartz-dolerite sills which have long been known as the Great Whin Sill.

- (b) A suite of dykes having a general E.N.E. trend and the same petrographical characters as the Whin Sill.
- (c) A suite of tholeiitic dykes having a general E.S.E. trend which, together with their other characters, relates them to the Tertiary dyke-swarm of Mull.

The Whin Sill forms the most striking feature of the igneous geology of the north of England. It runs across almost the whole of Northumberland from north-east to south-west. In the south-western part of the county, its tilted and weathered scarp faces north, and here, with an eye to the best defensive position, the Romans built their great wall along its crest. Petrographically, the rocks of the Whin Sill have been investigated with exceptional thoroughness (Teall, 1884; Holmes and Harwood, 1928; Holmes and Harwood, 1929; Tomkeieff, 1929; Smythe, 1930). It is singularly uniform in composition, being a typically dark, blue-grey quartz-dolerite. Departures from the normal type are developed locally and on a very minor scale and are related to the rate of cooling (Trotter and Hollingworth, 1932a).

Apart from the Tertiary dykes mentioned above, rocks younger than Carboniferous age do not outcrop in Northumberland. However, it is worth noting that New Red Sandstone rocks of Permian and Triassic age are exposed in north-east Cumbria on the downthrow (western) side of the Pennine fault, which runs in a north-south direction, some 13 km. to the west of the core site at Fellend Moss.

3.1(iii) Quaternary Geology

The present hills and river systems of Northumberland were roughly carved out during the Tertiary era, before the cooling of the climate, which led to the gradual development of glaciers and snowfields,

culminated in the Pleistocene Ice Age.

Deposits of glacial origin are widespread over all parts of Northumberland, but clear exposures of any depth are rare so that differentiation of the drift into separate members, and the tracing of the extent of these subdivisions is difficult (Raistrick, 1931). Despite the complexity Woolacott (1921) compared the results of his own work with those of Trechmann (1915), Merrick (1909), Herdman (1909), Smythe (1912), and Dwerryhouse (1902) and was able to portray the glacial history of Northumberland, recognizing four boulder-clays, separated in places by 'interval-deposits'. Trotter and Hollingworth (1932b) took up Woolacott's ideas and considered that the four boulder-clays represented four distinct glaciations.

During this epoch, the coastal area of Northumberland and Durham was invaded by ice from several regions. The first ice to reach the Durham coast was that from Norway. Subsequently there were four main ice streams from the west, all of which received a southerly trend near the east coast, due to the pressure of invading ice from the continent. These four western flows were:-

- (a) One down the Firth of Forth.
- (b) One down the Tweed which swept around the Cheviots.
- (c) A broad stream from the south-west of Scotland and the Lake District, which came over the Northumberland moors, was confluent with a small Alpine glacier down the South Tyne valley, and filled up the Tyne valley.
- (d) One from the Lake District over Stainmoor and confluent with a glacier down the Tees valley.

The direction of ice movements is indicated by the presence of erratics from the source areas, e.g. Shap Granite in south Northumberland

(Johnson, 1952) and by the alignment of glacial striations. Using this and other evidence, Clapperton (1970) has suggested that the Cheviot massif and much of the Cheviot Hills range acted as independent centres of glacier dispersion during the last period of maximum glaciation in the eastern Borders.

The boulder-clays, sands and gravels laid down during the glacial period are too variable to be described in any detail, each type reflecting the source area of material and the local environment in which it was laid down. Generally, the topography of the country occupied by sands and gravels is much more diversified than that shown by boulder-clay.

In Post-glacial times, erosion by streams resumed (often along their old valley courses), with deposition of alluvium on the valley floors.

The formation of Post-glacial peat deposits in Northumberland has been discussed by Raistrick and Blackburn (1932a).

3.1(iv) Geology of the area around Fellend Moss

The deep peat deposit of Fellend Moss lies in a depression between two parallel ridges and in part overlies boulder-clay deposits from the Pleistocene, and in part the rocks of the Middle Limestone Group. It lies at the western end of a stretch of countryside often known as the 'Roman Wall Country', which is made up of a series of more or less parallel ridges running in an east-west direction. Here the Carboniferous strata dip southwards at angles between 10° and 15° , so that the ground rises steeply from the South Tyne valley in a succession of broad-backed dip slopes. Each scarp rises above the last until the series culminates in the Whin Sill.

During the Pleistocene glaciation ice sheets moving in an easterly direction, scooped out the softer strata, leaving a series of

deep depressions separated by prominent ridges. Where the underlying strata are impervious, tarns (e.g. Crag Lough) or mosses, such as Fellend Moss, have formed (Raistrick, 1931). The drift (or till) of the Lake District-Tyne ice contains numerous pebbles of the Lake District igneous rocks, and erratics of the easily recognized Penrith Sandstone from the Vale of Eden. It covers much of the land around Fellend Moss.

Rocks of the Upper Limestone Group outcrop in the ridge to the south of the moss, whilst immediately to the north of the peat deposit, the Middle Limestone occurs, and the Whin Sill, upon which Hadrian's Wall is built, forms the northern ridge of the depression.

3.1(v) Geology of the area around Steng Moss

The peat of Steng Moss lies at the western side of a gently inclined plateau overlooking the Elsdon Burn, a tributary of the Rede. The moss overlies sandstones and shales of the Lower Limestone Group, which dip away gently in a S.S.E. direction. The area is, however, traversed by numerous small faults so that the direction and amount of dip can vary considerably.

Boulder-clays occur widely in the valleys and on the lower slopes, but are less frequent on the exposed western part of this plateau area. Nevertheless, boulder-clay covers the bedrock to the east of Steng Moss, and a small amount is present to the north-west. The boulder-clay of this district takes its composition and colour from the strata from which its materials have been scoured. All types are found to have been spread more or less to the east side of the rocks which yielded them (Miller and Clough, 1887), but are generally of comparatively local origin.

Peat mosses, such as Steng Moss, occur frequently at 1000-1500 ft. on the western side of the plateau area, but blanket peat is sparse.

3.1(vi) Geology of the area around Broad Moss

The peat of Broad Moss has formed on a flattish col site between the headwaters of the Threestone Burn and the valley of the Harthope Burn, on the eastern side of the Cheviot Hills. The local topography has a decidedly hilly aspect; not so much because of the height the hills attain, but because the valleys are usually near together and deeply cut.

Geologically, the moss lies at the contact point of the intruded granite and the andesitic lavas. The larger part of the bedrock underlying the moss is in fact granite, but the crags surrounding the moss are outcrops of lava. In this area glacial deposits are sparse, there being some boulder-clay at the head of the Threestone Burn and on the lower slopes of the Harthope valley, but little else. The higher summits of the Cheviots seem to have acted as independent centres of glaciation (Clapperton, 1970), so that where boulder-clay is present, it is usually derived from local rocks, is not very impervious to water, and forms a comparatively light soil (Clough, 1888).

Blanket peat has formed on many parts of the higher hills during Post-glacial times, particularly on the south and west sides of Cheviot and Hedgehope Hills. However, subsequent erosion of the peat has led to some areas becoming denuded again.

3.1(vii) Geology of the area around Camp Hill Moss

Camp Hill Moss lies in a depression between Camp Hill and Willie Law, which form part of a broad ridge, nearly everywhere above 150 m. above sea-level, and running roughly north-south. The principal rocks are the Fell Sandstone Group, although outcrops of the Scremerston Coal Group and the Lower Limestone Group are frequent. The area is heavily faulted; the faults having a general N.E.-S.W. trend. Consequently,

the dip of the strata is variable.

Glacial drift is abundant and covers much of the bedrock, boulder-clay being the principal deposit on this upland area. It is commonly a stiff, bluish or grey clay interspersed with many glaciated boulders of various kinds (Gunn, 1900).

Small peat deposits (c. 2 m. thick) are occasionally found in some depressions on the higher parts of the Fell Sandstone ridge.

3.2 Soils

Northumberland embraces a considerable variation in soil types, many of which are derived from boulder-clay and other drift deposits. Soils derived directly from the underlying solid formations are much less common. Only in the lowlands of the east coast do the soils have a significant summer moisture deficit (average maximum potential soil moisture deficit > 100 mm.). The soils of the uplands are generally without a significant summer soil moisture deficit (Avery *et al*, 1974).

In the valley of the South Tyne light sands and sandy loams of the river terraces and glacial outwash moraines furnish arable land, whereas the heavy loams of the boulder-clay and Carboniferous strata lie under grass in the lower reaches, and rough pasture in the upper parts of the valley (Trotter and Hollingworth, 1932a).

The uplands of the Roman Wall Country carry deep to shallow loamy or clayey soils with a wet, peaty surface and impeded drainage or continuous flushing. These are associated with deeper peat soils and peaty-topped soils overlying more pervious strata.

Over much of the Cheviots, the Border hills and the hill country east of Redesdale, humic gleys, brown podzolic soils, rankers and peat soils are to be found. The parent material includes shales, sandstones,

slates and igneous rocks and associated drift deposits. The association embraces moderately deep to shallow, stony, loamy soils with a wet peaty surface, often over a thin iron pan; peaty-topped soils with impeded drainage, thin peaty soils over rock, and locally much bare rock or scree.

On the higher parts of the Cheviot Hills and the hills of the Border, upland peat (blanket bog) soils are to be found in association with peaty-topped mineral soils which are often shallow and stony.

The Fell Sandstone hills, east of the Wooler Water, carry brown earths, argillitic brown earths, brown podzolic soils and stagnohumic gley soils. These are mainly derived from glacial drift, chiefly boulder-clay and consist of loamy, loamy-over-clayey or clayey soils, often stony and with impeded drainage. The same association includes peaty-topped soils and better drained soils, mainly stony, loamy soils.

Soils of the Fell Sandstone outcrops are usually distinctly podzolized, frequently having a well-developed iron pan.

In the valleys of the Till and Wooler Water, podzols and brown earths have developed on fluvio-glacial drift. Included in the association are moderately deep or deep, well-drained, stony, coarse, loamy and sandy soils, and a subsurface pan may be present locally.

The uplands of Northumberland are principally used for sheep farming, forestry and stock rearing, with dairying and limited arable farming in the valleys.

3.3 Climate

That part of the Pennines which lies between the Stainmore depression and the Tyne gap, and is known as the 'Alston Block' has been described (Manley, 1936) as the most consistently elevated and chilly part of England.' However, with the exception of the Cheviots, the Northumberland

hills are generally of lower elevation, and comparison of the rainfall (Meteorological Office, 1961-68) and temperature (Meteorological Office, 1953) records suggests that the climate is less severe. The climate of the Northumberland uplands does not vary greatly, although rainfall is slightly higher in the more elevated and western parts of the county.

Fig. 2 gives the mean monthly and annual rainfall figures for the period 1961-68 for the following stations:

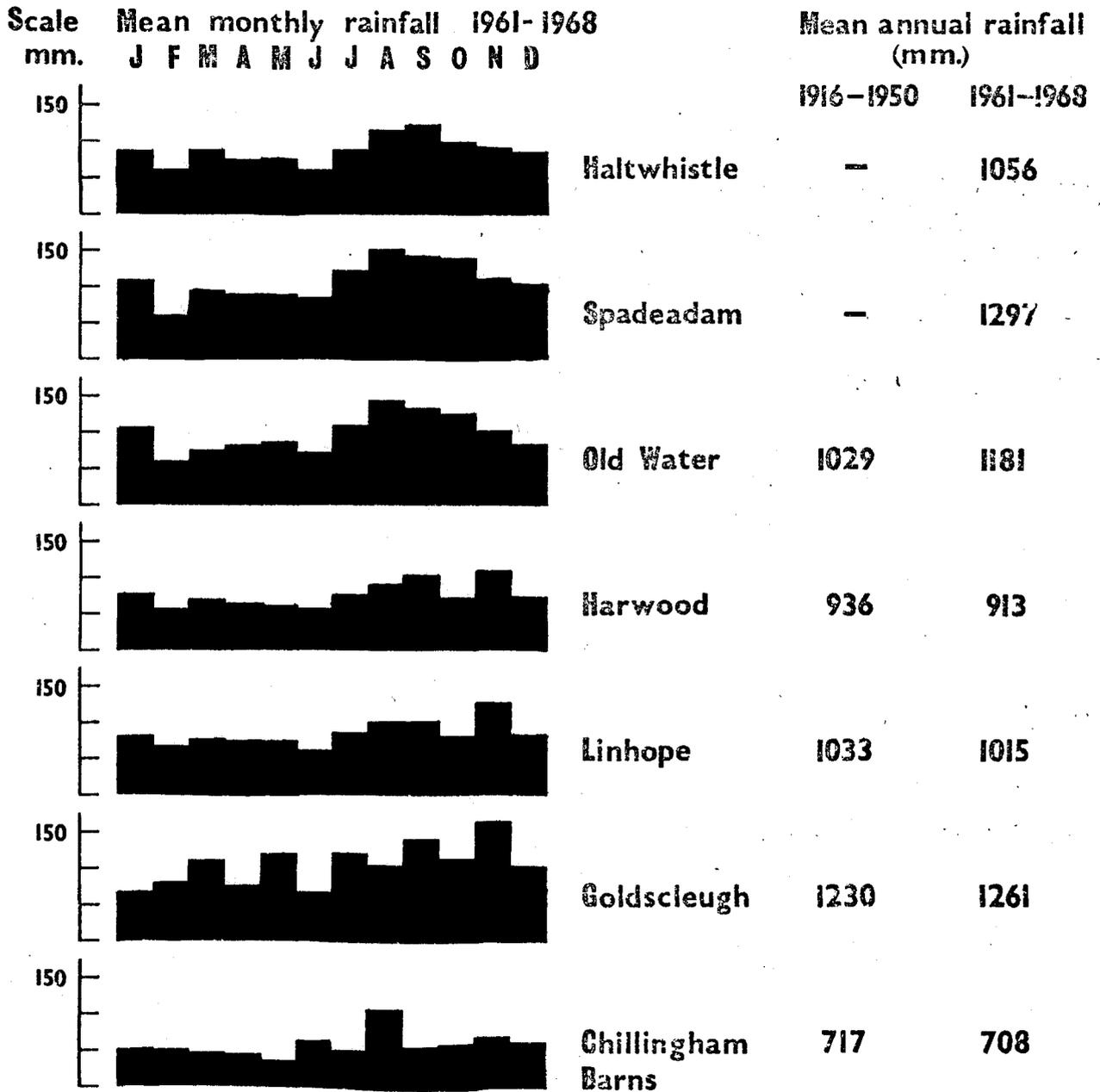
<u>Station</u>	<u>N.G.R.</u>	<u>Altitude (m.)</u>
Haltwhistle	NY 681640	122
Spadeadam	NY 599720	274
Old Water	NY 590533	302
Harwood	NZ 000903	235
Goldscleugh	NT 913233	305
Linhope	NT 963160	226
Chillingham Barns	NU 052262	70

Where records are available, the mean annual rainfall for the thirty-five year period ending in 1950 is also given.

Haltwhistle is the nearest rainfall station to Fellend Moss (1.5 km. to the south), but is some 108 m. lower in altitude. Spadeadam and Old Water are the next nearest stations, both being slightly higher above sea level. All three are thus shown for comparison and it may be safely assumed that the rainfall for Fellend Moss lies somewhere between the Haltwhistle and Spadeadam figures.

Harwood station, on the other hand, is 3.7 km. to the east of Steng Moss and only 64 m. lower in altitude, so that the rainfall for Steng Moss is likely to be fairly similar. The nearest stations to Broad Moss are Goldscleugh (5.3 km north-west, 90 m. lower) and Linhope (5.3 km. south, 170 m. lower). It might therefore be concluded that Broad Moss

Fig. 2 Rainfall figures for selected stations.



should be a little wetter than these two stations, because of its greater altitude, but it lies in the rain shadow of Hedgehope Hill and The Cheviot which might offset the altitudinal effect somewhat.

Unfortunately, rainfall figures for the Fell Sandstone hills, between the Wooler Water and the coast, are not available. Consequently the figures for Chillingham Barns are shown, but are almost certainly lower than true figures for Camphill Moss, because of the altitude difference (134 m.).

Averages of temperature for the uplands of Northumberland, as represented by the record for Bellingham, are given below in Table 1.

Table 1: Mean monthly temperature ($^{\circ}\text{C}$) for 1921-50 at

Bellingham. N.G.R. NY 803919 . 259 m.O.D. (Met. office, 1953).

<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>	<u>Year</u>
1.7	2.1	3.9	6.0	9.1	12.1	13.9	13.3	11.1	7.8	4.3	2.5	7.3

The average duration of the growing season in the Northumberland uplands is given as 200 days; from 21st April to 7th November (Ministry of Agriculture, Fisheries and Food, 1976).

CHAPTER 4

THE HISTORICAL BACKGROUND

Man's arrival in Northumberland was comparatively late. During the Mesolithic period small groups of people possessing a technology associated with the Tardenoisian stone industry (Buckley, 1925) moved up from the eastern flanks of the Pennines, by the coastal grounds at Newbiggin, Bamburgh, and Budle Bay, to establish themselves in the Tweed valley, probably by the fifth millenium B.C. No penetration of the Northumberland uplands by these hunter-fishers is known at the moment, and in any event such sparse and small communities would have had but little impact upon the upland environment.

Scattered finds indicate the northward spread of Neolithic cultures into Northumberland, perhaps as early as 4000 B.C. These immigrants brought with them a knowledge of mixed farming and thus the potential for a more settled way of life. However, they do not appear to have penetrated the uplands to any great degree. Most of their remains, particularly of stone axe-heads, some of which are of the type manufactured in Great Langdale, Cumbria, are to be found in the coastal lowlands or in the central and lower reaches of the river valleys (Stone and Wallis, 1951; Jobey, 1961a; Fell, 1964).

The practice of raising large sepulchral monuments over collective burials or cremations is, in Northumberland, a feature of the Neolithic cultures (Piggott, 1954). Although only one has been confirmed as Neolithic by excavation (near Ford in the north-west of the county), there are a number of long stone-built cairns forming part of a small series stretching from Yorkshire to Banffshire, which may be related to the unchambered long barrows of England and thus assigned to the Neolithic period. The scarcity of relics (other than stone-axes and flints) left behind by Neolithic

cultures in Northumberland suggests that, in their time, the county was sparsely populated.

Shortly after the beginning of the second millenium B.C. the so-called 'Beaker folk' began to colonise the area. They can be traced in the archaeological record by the different burial rites which, in the absence of clearly related habitation sites, continue to form a considerable proportion of the evidence for their presence. Their individual inhumations are contained within simple graves or stone-lined cists, covered by a large capstone and sometimes with the addition of a round mound or cairn. Such burials are occasionally accompanied by a characteristic vessel known as a Beaker. In other instances the burials are accompanied by a pot of different form known as a Food Vessel (e.g. Jobey, 1961b, 1975). Eventually the rite of cremation became the common practice, the remains being deposited in Cinerary Urns or simple pits in the ground and occurring as interments in burial mounds with low stone rings, or grouped into cemeteries (Feachem, 1965).

Although a stone-using economy was still dominant during the initial period of Beaker folk immigration, innovations from abroad led to the adoption of bronze as the principal material for tools and weapons, and gave rise to the term 'Bronze Age' to describe the period.

A small number of cist burials in the county have had ritual cups or rings inscribed on the stone slabs themselves or on a votive slab deposited with the burial, thus giving, in agreement with evidence from elsewhere (Haddingham, 1974) a general context for the 'cup and ring' markings that appear in numbers on the more easily worked rocks of the area, by the second millenium B.C. Such markings are virtually absent from the less workable rocks of the Cheviots, but occur at intervals along the arc of the Fell Sandstone.

Whilst the precise origin and purpose of some of the standing stone

circles to be found in this country remains uncertain, it is likely that the unembanked stone circles belong to the Bronze Age, and the second millenium B.C. in general. (Feachem, 1965; Burl, 1976). Two circles of large diameter may be found in Northumberland. That at the Threestone Burn in the Cheviots consists of a circle of thirteen stones, is approximately 31 metres in diameter, and just over one kilometre to the south-east of Broad Moss. Another large circle may be found beyond Hethpool in the College valley.

At this point it may be worth making a special note of the remains known as 'cairnfields', since they occur in close proximity to at least one pollen analysis site, Camp Hill Moss.

Typically they are assemblages of small stone mounds, and occur in many upland areas (Ashbee, 1957; Graham, 1957; Feachem, 1973). In Northumberland there are many instances where one or more large cairns, established as sepulchral monuments by form or excavation, lie adjacent to or are situated within cairnfields (Jobey and Tait, 1966; Jobey, 1968). However, smaller cairns, c. 2½-5 metres diameter, commonly lack grave goods or skeletal remains, and increasing numbers have been ascribed to stone clearance during the process of cultivation. Even if this proves to be the case, the problem of their age still remains.

Carbonized material from a large cairn on Sandyford Moor, containing Beaker burials, yielded a radiocarbon date of 1670 ± 50 b.c. This cairn is situated amongst a large number of small cairns which were not of sepulchral origin. Carbonized material from a smaller cairn, apparently covering a grave earlier than the Beaker period, yielded a date of 2890 ± 90 b.c. (Jobey, 1968). One cannot be certain, however, that the sepulchral cairns were contemporaneous with cairns attributed to field clearance activities.

Although cairnfields may sometimes be located in close proximity to known settlement sites of presumed Iron Age and Romano-British context, as at Witchy Neuk (Wake, 1939) or on Brough Law (Jobey, 1971), this cannot be shown to be a regular occurrence. Indeed, on the distribution as at present known, the major concentration and certainly the largest groups are to be found on the poorer soils of the Fell Sandstone Group to the east of the Till, where, as compared with the Cheviot foothills, Romano-British settlements are thin on the ground and known Iron-Age sites are confined to the scarps suitable for defence (Jobey, 1964; 1965). It should be noted that these are areas where surface land stones are probably more prolific in the first instance and there are numbers of modern clearance mounds of considerable size.

Camp Hill Moss was chosen as a site for a pollen analysis study, partly because it is encircled by cairnfields of the type in question. By sampling the soil beneath cairns and producing a dated pollen diagram from the peat deposit, it was hoped to throw some light upon their origins. The results of this investigation are discussed in Chapter 8. Carbonized material obtained from beneath one of the cairns by Mr. G. Jobey of Newcastle University was radiocarbon dated to 1690 ± 90 b.c.

By the middle of the first millenium B.C. Celtic immigrants from the continent had brought a knowledge of iron-working to this country. Although the precise stages of their arrival in Northumberland have yet to be established, there are a large number of settlements and fortified sites in the county which may be placed in the Pre-Roman Iron Age of the last few centuries B.C. and before the arrival of the Romans around A.D.80.

The earliest of these settlements, which may perhaps date back to the seventh century B.C., are the timber built homesteads and settlements in which the traditional round stone houses are enclosed within timber palisades. Such sites have a widespread distribution and in the Cheviot

foothills extend up to and over the 350 m. contour (Jobey, 1966a).

Occasionally palisaded enclosures are superseded by more substantially constructed settlements and hillforts. In some instances, such as the settlement on Ingram Hill in the Breamish valley (Jobey, 1971), palisades were replaced by ditch and wall or rampart, possibly by the fifth century B.C. Sometimes additional defences in the form of a series of walls or ramparts and ditches were constructed. Generally, these settlements and hillforts, whether possessing univallate or multivallate defences, seldom exceed an acre in internal area, and in terms of internal accommodation are comparable with the larger palisaded settlements. A notable exception is the hillfort on Yeavering Bell, on the north side of the Cheviots. This is the largest hillfort in Northumberland, and must have served as a centre for the immediate area. A strong stone wall encloses an area of thirteen acres, within which one hundred and thirty hut sites have been noted (Jobey, 1965).

The majority of hillforts and palisaded settlements of Northumberland are situated around the foothills of the Cheviots and along the scarp of the Fell Sandstone hills.

Pastoral activities must have played a significant part in the economy, but the general absence of faunal material renders any assessment of the composition of flocks and herds impossible (Cunliffe, 1974). Cultivation was by no means neglected as saddle and rotary querns found at many sites between West Brandon, Durham to the south (Jobey, 1962), and Harehope, Peeblesshire to the north (Feachem, 1962), have shown. A site at Huckhoe, Northumberland (Jobey, 1959) has also provided evidence of what could be interpreted as a four-post granary. Nevertheless, the economy seems to have been more pastorally orientated than contemporaneous economies in southern Britain.

The Roman conquest, which overwhelmed southern Britain in A.D.43, did not reach the north until about thirty years later, and only in A.D.79 - 80 was Northumberland conquered. The garrisoning of the north was based upon roads running from York to the Tyne, and from Chester to the Solway, i.e. to the east and west of the Pennines respectively. Transverse roads crossed the Pennines with the object of controlling movement and isolating or immobilising the tribes and their sub-divisions (Frere, 1974). Of the cross-routes, the Tyne Gap was the easiest and shortest and also the last to the south of the trackless moorlands of the Cheviots and southern Scotland. The Stanegate was thus of special strategic value and was from the first, well defended by terminal forts at Corbridge and Carlisle and intermediates at Chesterholm (Vindolanda) and Nether Denton.

In the years between A.D. c.80 - c.125 timber buildings were constructed at Vindolanda, occupying at least four acres and probably housed an infantry battalion one thousand strong, serving on the Stanegate frontier. There has been no trace of Hadrianic occupation at Vindolanda, which suggests that the garrison moved to Housesteads when the Wall was built, leaving the site deserted. A new fort was constructed early in the third century, and thenceforward the site was continuously occupied and an extensive civilian settlement grew up on the west side. The growth of civilian settlements outside Roman forts seems to have been the norm and, in addition to the large military garrison, the presence of a substantial civilian population must be taken into account when considering the history of the northern frontier (Richmond, 1958).

In the years between A.D.80 - 84, Roman armies under the governorship of Gnaeus Julius Agricola pressed on into Scotland and established a legionary fortress as far north as Inchtuthill. Shortly afterwards, more vital Roman interests on the continent compelled the reduction of the garrison of Britain, and this in turn meant that insufficient troops

remained to encompass the occupation of Scotland. The evacuation took place in several stages until finally the Emperor Hadrian established a new frontier along the Tyne-Solway isthmus and marked it by the building of the Wall, begun in A.D.122. It stretched from Wallsend in the east to Bowness on the Solway estuary, in the west and for much of its length ran along the ridges to the north of the Tyne Gap. Positioned along it are forts, milecastles (fortlets evenly spaced along the Wall, a Roman mile apart) and turrets, two between each milecastle. A road, the Military Way, runs along behind the Wall and is guarded to the south by a wide ditch, flanked by mounds, known as the Vallum.

While one of the purposes of the Wall was to define the frontier of the province and debar raids from the north, and in the long run to provide peaceful conditions for economic development in the region behind it, another was certainly to prevent joint activity by the Brigantians and the tribes to the north (Birley, 1961; Frere, 1974).

Roman military occupation of Northumberland seems to have seen an end to the strong hillfort defences of the Celtic tribes. Stone-walled settlements of round stone houses, dated from the second to fourth centuries A.D. became widespread (Jobey, 1966b). Although these are normally situated in non-defensive positions, they may be found overlying earlier abandoned defences such as at Greaves Ash (Jobey, 1964) or Alnham Castle Hill (Jobey, 1965). Though the number of quernstones found on such settlements testifies to some arable farming, the pattern of agriculture has not survived in this area, but an indication of the economic base is given by the small paddocks and stockyards of these settlements.

On the death of Hadrian in July 138 the succession passed to Antoninus Pius (138 - 161). The change of emperor initiated a change of frontier policy in Britain. Hadrian's Wall was abandoned and, after the reconquest of the Lowlands, a new barrier built of turf was erected across

the Clyde-Forth isthmus. Forts at Risingham and High Rochester, together with a number of other fortlets along Dere Street were occupied, whilst the forts of Hadrian's Wall were left under care and maintenance.

The Antonine Wall was destroyed around A.D.182 - 183 after an uprising of the northern tribes and ten years later Hadrian's Wall was abandoned and partly destroyed, only to be rebuilt by Severus between A.D.205 - 208. There was a further uprising in A.D.367 when outposts and Wall forts were overwhelmed, but the legionary forts were held. Order quickly returned, but by A.D.410 the troops had gone to defend Rome and there followed a period of political confusion.

The withdrawal of the Roman military and civil control of Britain by the early fifth century opened the way for new immigrants of Germanic origin, known as Angles or Saxons or later, English. They seem to have occupied first the east coastal areas, and then penetrated and settled along the fertile river valleys. The upland areas of Northumberland were not immediately desirable since they were unsuited to arable farming, and throughout the Anglo-Saxon period, from the sixth to the mid-eleventh centuries, seem to have been thinly settled and to have contained a largely Celtic-speaking population.

In the late ninth century Viking settlers from Scandinavia began to colonise Northumberland, and from the end of the ninth century to the Norman conquest, the uplands were politically debatable land fought over by the Scots and the Vikings.

Under Henry I (1100 - 1135), Norman families began to acquire lands in Northumberland and to build castles and found boroughs and religious houses. For much of the first half of the Middle Ages the southern two-thirds of the county lay within the semi-autonomous liberties of Redesdale and Tynedale where the king's writ did not run. From early in the twelfth century until 1296 when it was acquired by the crown, Redesdale was in the

possession of the de Umfravilles, who administered it from their castle at Elsdon and later from Harbottle Castle.

Tynedale, of which the administrative centre was Wark-on-Tyne, was granted to the Scottish kings in 1157, and remained in Scottish hands until the deposition of John Balliol by Edward I in 1296 (N.C.H.XV,1940). In that year, after a long spell of peace on the Border, Edward I declared war against Scotland which was to continue intermittently until 1603, and in effect the extreme north of England became a military zone, with frequent raiding taking place on both sides of the border, which can hardly have aided economic and social development. Indeed, some villages were reduced in size.

By contrast, more settled political conditions developed during the seventeenth century, and with the advent of the agricultural revolution in the eighteenth, the rural economy of Northumberland saw a good deal of improvement.

CHAPTER 5

STENG MOSS

5.1 Introduction

Steng Moss (N.G.R. NY 965913) lies at c. 305 m. O.D., is approximately 3.5 km. to the south east of the village of Elsdon, and overlooks the Elsdon Burn, a tributary of the Rede. At its largest extent it measures c. 1.2 km. x 0.9 km., but the south-eastern part has been disturbed by afforestation (see Fig. 4) and the stratigraphy of this part was not examined. The surface vegetation is dominated by Eriophorum vaginatum, Calluna vulgaris and Sphagnum spp., with Polytrichum commune, Erica tetralix, Drosera rotundifolia, Andromeda polifolia, and Dactylorhiza fuchsii present.

Bronze Age, Iron Age and Romano-British remains are abundant in the surrounding area, the closest site being the Iron Age/Romano-British settlement at Manside Cross (Jobey, 1965) 2.1 km. to the north-east.

5.2 Stratigraphy

Two line transects were laid out across the moss; transect A along a direction 135° from grid north, and transect B at 55.5° , using stakes at 40 m. and 20 m. intervals respectively. The two transects intersected at a point 180 m. from the north-west end of transect A, and 140 m. from the north-east end of transect B (Fig. 4). A Dumpy level was used to determine the surface profile of the moss along the transects and the stratigraphy was investigated using a Russian-type of peat borer. The deepest part of the moss (7.35 m.) was found to be at 180 m. along transect B.

The bottom of the moss was difficult to penetrate with the peat borer, and consisted mostly of grey-brown sandy material, possibly the weathered upper part of the sandstones of the Lower Limestone Group which underlie the moss. Above this there is a considerable depth of peat containing abundant remains of Phragmites communis with occasional fragments

of wood and Equisetum stems, and seeds of Menyanthes trifoliata.

It would appear that a fen carr stage of development persisted for some time before truly ombrogenous growth of peat occurred. At the top of the Phragmites peat there is commonly a thin band of amorphous peat, above which Sphagnum/Eriophorum peat predominates. Small pieces of wood and Calluna are present in this level, although the wood is absent above about 1.2 m. below the surface. The top metre of peat is largely composed of Eriophorum with some Sphagnum.

Fig. 6a shows that the moss rests in two depressions on either side of a low sub-surface ridge and, although the fen peat extends over the ridge from one to the other, it is possible that peat growth may have been initiated independently in each, and that as peat growth progressed the two areas coalesced to form one bog.

The stratigraphy of the core site was as follows:-

Depth of Peat (cm.)

0 - 107	Medium-brown <u>Eriophorum</u> peat. H ₄
108 - 136	Light-brown <u>Eriophorum</u> peat with <u>Sphagnum</u> . H ₄
137 - 320	Medium-brown <u>Eriophorum/Sphagnum</u> peat with some <u>Calluna</u> fragments and small pieces of wood. H ₅
321 - 340	Undifferentiated, slightly fibrous peat.
341 - 544	Light-medium grey-brown <u>Phragmites</u> peat with pieces of wood and abundant <u>Menyanthes</u> seeds. H ₅
545 - 710	Dark-brown <u>Phragmites</u> peat with some small fragments of wood. H ₇
711 - 735	Khaki-coloured <u>Phragmites</u> peat with some small pieces of wood and a small amount of mineral matter.
736	Sandy mineral material.

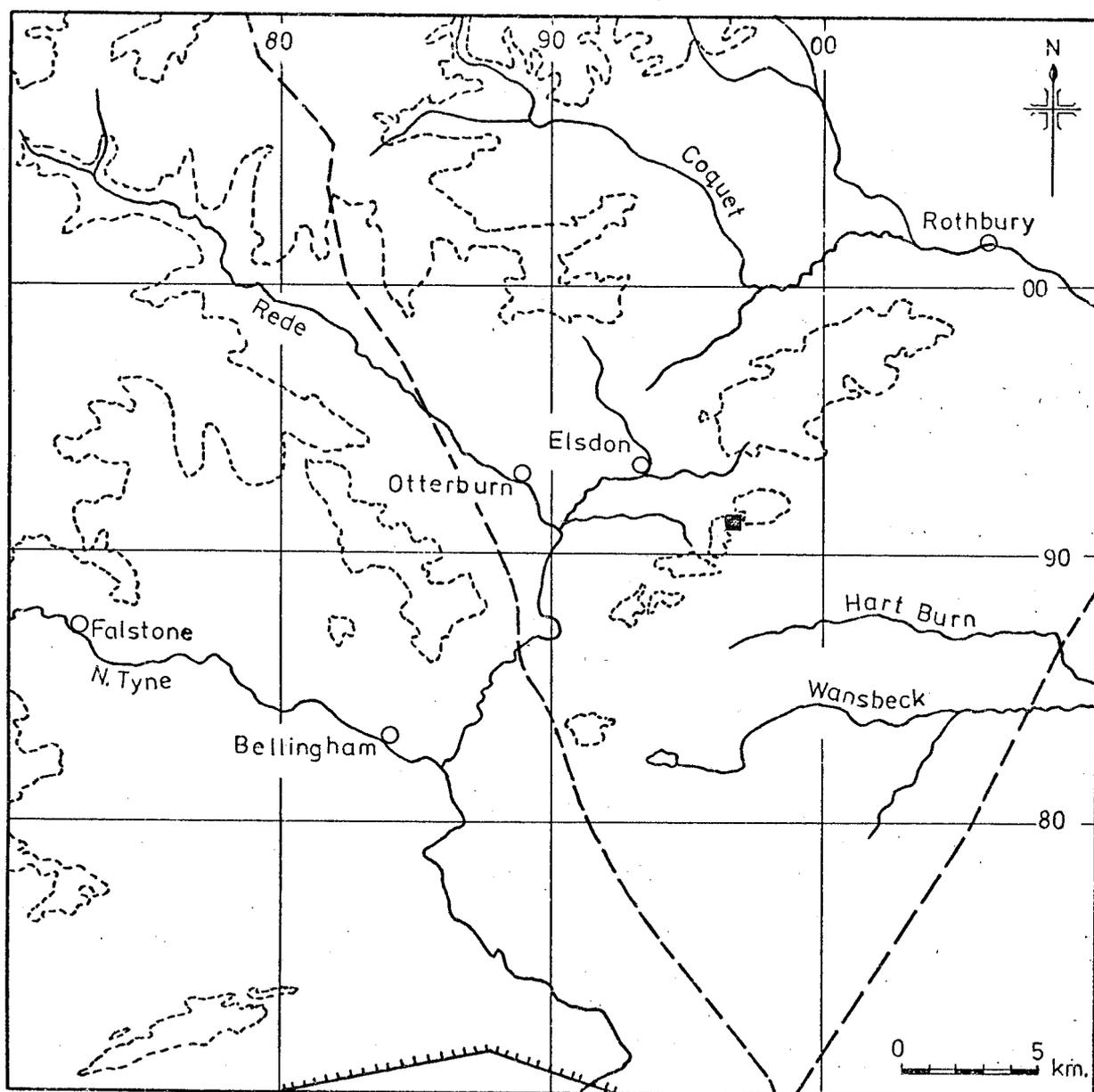
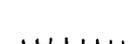


Fig. 3 Map of Steng Moss locality

Key

-  Major rivers
-  Contour - 305m. O.D.
-  Hadrian's Wall
-  Roman roads
-  Steng Moss

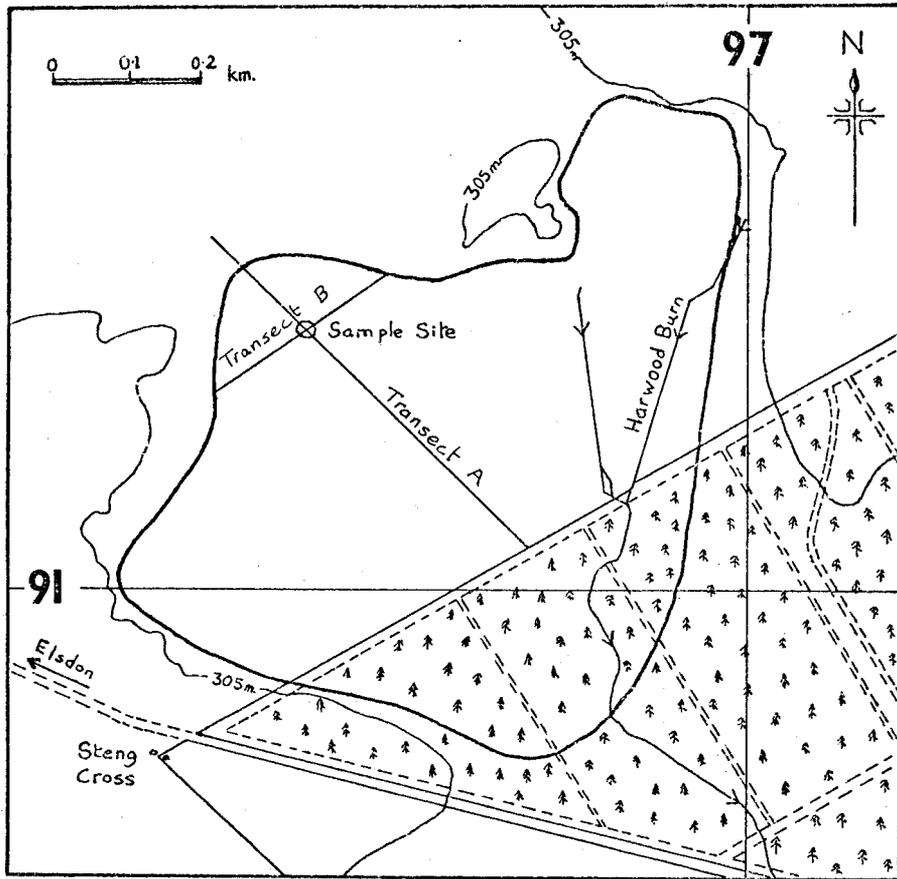


Fig. 4 Map of Steng Moss

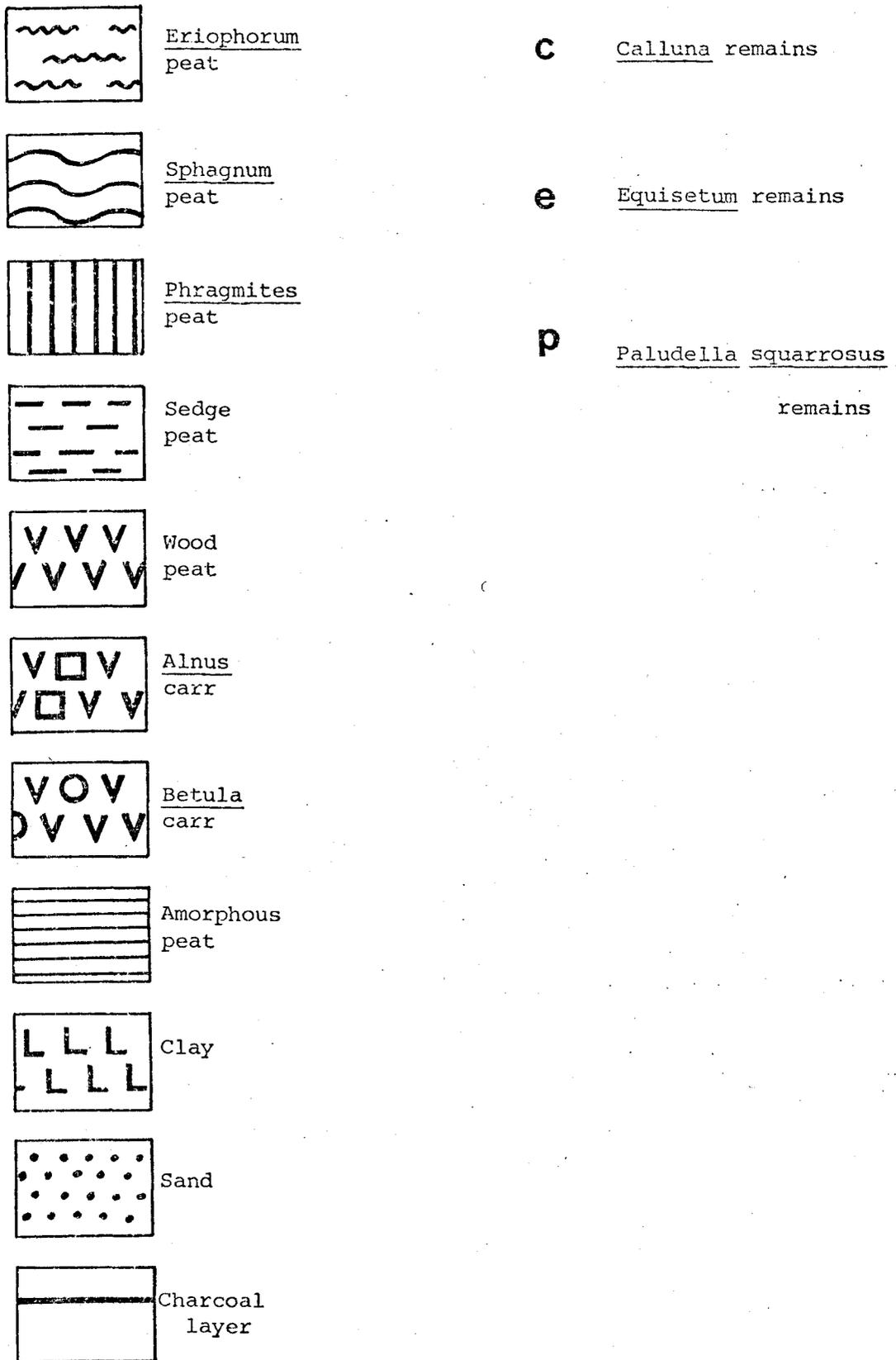


Fig. 5 Key to Stratigraphic symbols

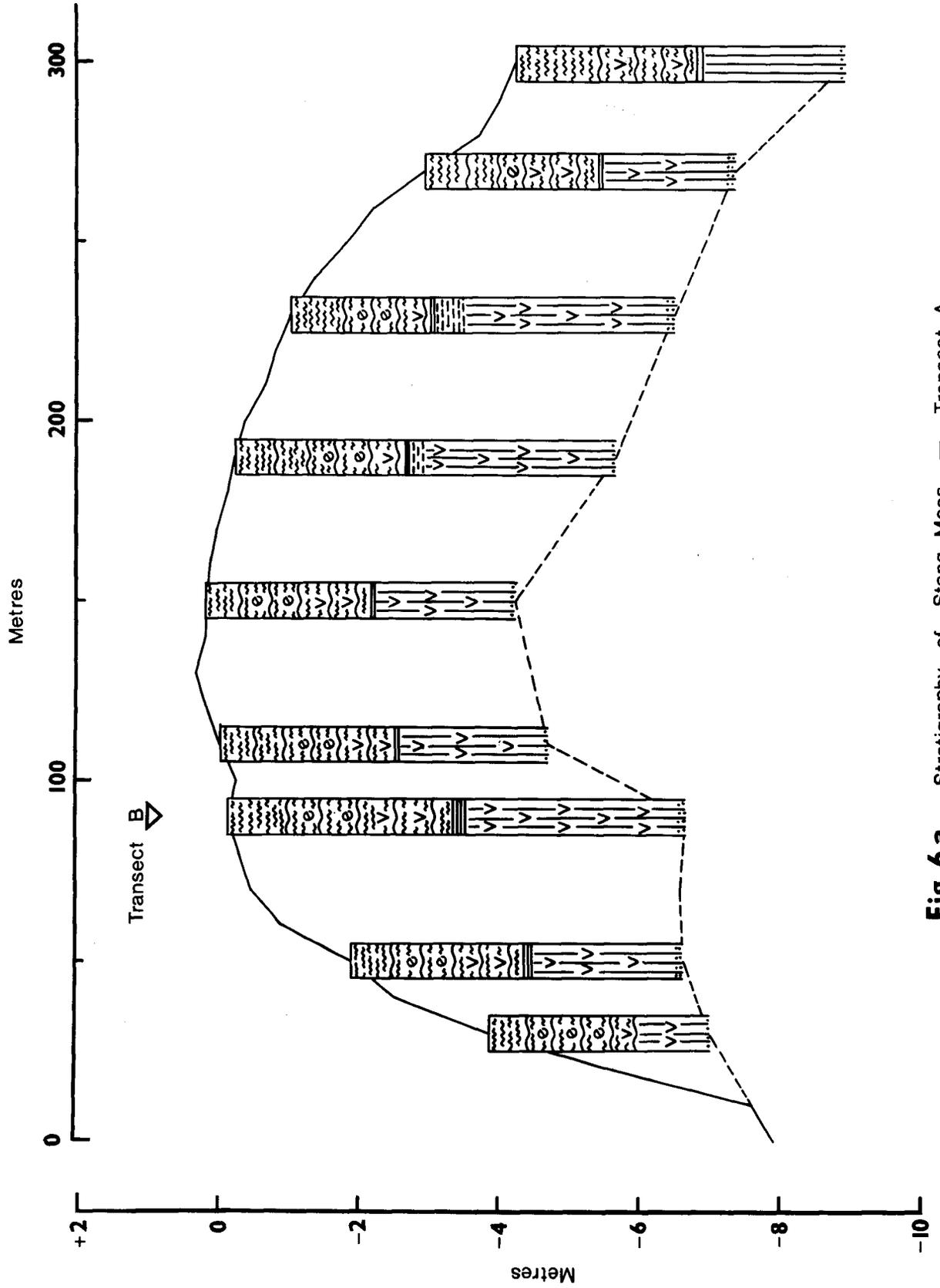


Fig. 6 a Stratigraphy of Steng Moss — Transect A

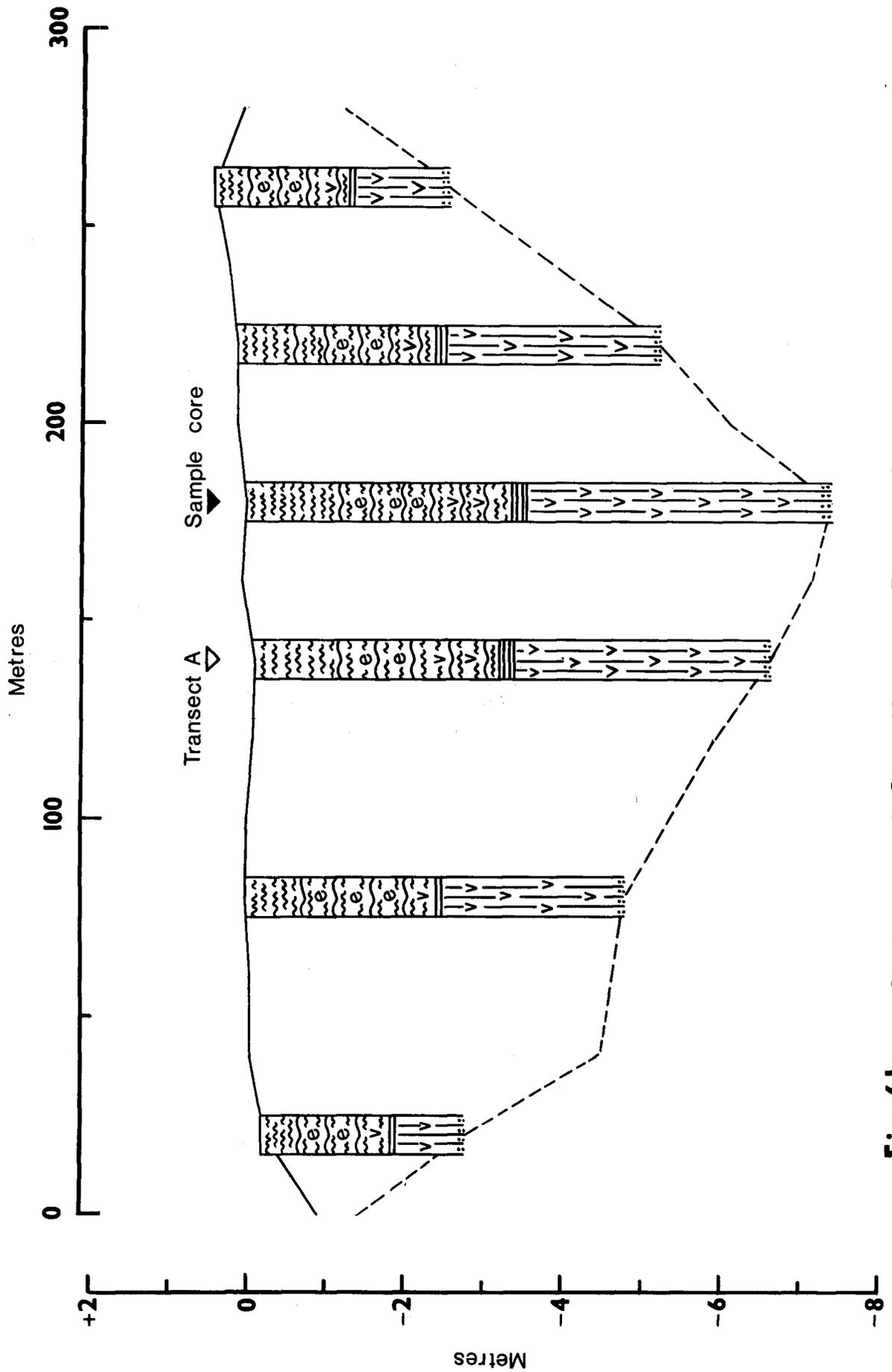


Fig. 6b Stratigraphy of Steng Moss — Transect B

5.3 Collection of Pollen and Radiocarbon Samples

It was decided to sample the peat in monolith form by digging a pit at the selected site (stake B180) and cutting samples from the side. This proved to be possible for 1.55 m. of peat before seepage of water from the sides of the pit prevented further progress. The peat was taken in overlapping blocks approximately 25 x 25 x 25 cm., returned to the laboratory, and cut into slices one centimetre thick, from which a one cubic centimetre sample was taken for pollen analysis. This left enough material in each one centimetre level for a radiocarbon assay should it be required.

The remaining section of peat was sampled with the Russian borer using multiple shot borings down to 4 m. and single shot from 4 m. to 7.35 m. Four cores were taken at each 50 cm. interval from 1.5 m. to 4.0 m. One of each four was used for the pollen analysis, whilst the other three were stored in half-cylindrical plastic containers. These containers, each 51 cm. long, were sealed in polythene bags and stored at 4°C to prevent bacterial and fungal contamination, until they should be required. The monolith slices of peat from 0 - 1.55 m. were stored in boxes, also at 4°C.

The laboratory techniques used to prepare and count the samples are described in Chapter 2. The macro remains, retained after sodium hydroxide treatment, were examined using a low power binocular microscope (x 10 - x 70 magnification). This examination allowed a more detailed description of the stratigraphy, as follows:-

Depth (cm.)

0 - 72	<u>Sphagnum/Eriophorum</u> peat with occasional <u>Calluna</u> remains.
73 - 98	<u>Sphagnum/Eriophorum</u> peat.
99 - 108	<u>Sphagnum/Eriophorum</u> peat with occasional <u>Calluna</u> remains.

109 - 162	<u>Sphagnum/Eriophorum</u> peat
163 - 182	<u>Sphagnum/Eriophorum</u> peat with occasional <u>Calluna</u> remains.
183 - 194	<u>Sphagnum</u> peat.
195 - 346	<u>Sphagnum/Eriophorum</u> peat with occasional <u>Calluna</u> remains.
347 - 576	Highly humified peat with monocotyledon and wood remains.
Below 576	No samples prepared.

The completed pollen diagram (Figs. 7a, 7b and 7c) was examined and ten levels were selected for radiocarbon dating. 25 x 25 x 1 cm. samples were available for seven of these levels, but the remaining three had to be taken from multiple shot cores by carefully matching up the pollen spectra in each one with the equivalent level on the pollen diagram. Three samples, five centimetres thick, were used for each level concerned, to provide enough material for a radiocarbon assay.

All the peat samples used for radiocarbon dating were dried in an oven at 100°C for 24 hours before being sent for dating. Levels 63, 153, 182, 214 and 258 cm. were sent to the Scottish Research and Reactor Centre at East Kilbride, whilst levels 33, 66, 84, 92 and 118 cm. were sent to the Radiocarbon Dating Laboratory at Cambridge University.

Radiocarbon dates for seven samples have so far been obtained. Peat from the five levels assayed at the Scottish Research and Reactor Centre were given an acid pre-treatment. The Cambridge Radiocarbon Dating Laboratory estimated three dates each for levels 84 cm. and 118 cm. using acid, alkali and water pre-treatments. The dates used in the text are those from samples which were given an acid pre-treatment.

Results of the radiocarbon assays are shown in Table 2. The assay

dates have been corrected using tables given by McKerrell (1975), in which standard 5568 C₁₄ dates are converted to tree-ring calendar years. To facilitate comparison with other diagrams and archaeological data, the dates shown on the pollen diagrams are conventional 5568 C₁₄ dates. The range given for all dates is that of one standard deviation. Uncorrected dates are given in the discussion, but where the dates fall within the historical period, tree-ring calendar dates are shown in brackets.

In order to calculate the rates of peat formation, the corrected dates have been used (Table 3).

5.4 Interpretation of the Pollen Diagram

It has been common practice to describe pollen diagrams in terms of Godwin's (1940) sequence of pollen assemblage zones. West (1970) pointed out that detailed correlation based on pollen assemblage zones between distant areas is not always possible because of the differing expression of vegetational history in different geographical provinces, and suggested the use of chronozones as a basis for correlation. In the Flandrian of England and Wales though, the chronozone sequence relates to the sequence of Godwin's pollen assemblage zones. In Chronozone III which begins with the elm-decline (zone boundary VIIa/VIIb), local variations in vegetational history result from human activity and local pollen assemblage zones are normally constructed to describe these changes. However, the number of radiocarbon dates available for this and other sites means that the forest clearance episodes can be fairly accurately related to historical periods for which a widely used terminology is available. It therefore seems more appropriate to use these terms than to devise a local zonation scheme for the site.

In the lowermost part of the profile, Betula, Pinus and Corylus pollen values are all high and Ulmus and Quercus pollen are present, but

there is only a very small amount of Alnus pollen. Such an assemblage is suggestive of Godwin's Zone VIb. At 512 cm. Pinus and Corylus are declining but Alnus values are slightly higher. Closer sampling would be required for confirmation, but it seems likely that this level represent Zone VIc at this site. At 448 cm. Alnus has risen to high values, the Corylus curve has fallen considerably and Pinus is no longer significant. The zone boundary VIc/VIIa must therefore fall between 512 cm. and 448 cm. Between 416 cm. and 378 cm. the Ulmus curve shows a sharp decline, thus the zone boundary VIIa/VIIb is placed between these two levels and marked 'E.D.' on the pollen diagram. Throughout the whole of this part of the diagram, herb pollen percentages are very low.

The elm decline has been shown to be synchronous across much of north-west Europe (Hibbert, Switsur and West, 1971; Smith and Pilcher, 1973) and occurs in the centuries on either side of 3,000 b.c. Consequently it can be used as a dated horizon in the correlation of pollen sequences from undated profiles. Its importance to the consideration of human interference with the vegetation of Northumberland will be discussed in the final chapter.

Between 262 cm. and 234 cm. there is a rise in the percentage of Gramineae pollen and the appearance, in small amounts, of that of species often associated with more open areas or forest clearance, such as Plantago lanceolata, Rumex acetosa/acetosella, and Pteridium. At the same time Fraxinus becomes a permanent member of the forest community, although small amounts of its pollen were intermittently recorded at lower levels. Pennington (1969) points out that Fraxinus is a pioneer tree in ecological successions and rather light-demanding, so it is possible that although present, it was not able to penetrate the forests of Northumberland to any extent until some opening out of the forest canopy had occurred.

Similarly the pollen of Salix spp., normally present as a shrub constituent of open woodland, is absent from 448 cm. to 280 cm., but exhibits a more or less continuous curve thereafter. The curve for Corylus, another important shrub, shows an initial depression before rising again to slightly higher values at about the maximum of this initial phase of clearance activity.

The maximum of the first rise in Gramineae pollen (258 cm.) was radiocarbon dated to 1644 ± 45 b.c., placing this period in the Early Bronze Age of Northumberland.

It is suggested that this opening out of the forest canopy was a result of grazing pressure created by domestic stock which affected the regeneration of trees. The increase in herbaceous pollen comes at a time for which there is no evidence for widespread climate change.

From 226 cm. to 210 cm. and 190 cm. to 174 cm., the Gramineae, Plantago spp., Rumex and Pteridium curves all show a marked increase and Artemisia pollen is present. At the same time, the tree pollen frequency decreases and Corylus shows a distinct increase. Cereal pollen was recorded at 210 cm. and 182 cm.

These changes in the pollen spectra are indicative of the kind of human interference with the forest first described by Iversen (1941, 1949) as 'Landnam' clearances and examined in more detail by Turner (1964). Turner (1965), pointed out that the term 'Landnam' has subsequently been adopted to describe many different types of interference with the vegetation, and so used the term 'small temporary clearance' to refer to that which Iversen described. The same term will be used in this thesis.

The maxima of herb pollen values during these two clearance periods were radiocarbon dated and gave dates of 1065 ± 45 b.c. and 636 ± 45 b.c. i.e. Mid and Late Bronze Age respectively.

If the estimate of approximately 1 cm./15.25 years for the rate of peat accumulation is accepted (Table 3), then the time span represented by each of these two periods of small scale forest clearance must be about 260 years. This is clearly too long a time for just one of the small temporary clearances suggested by Iversen. More likely, this pollen diagram has recorded the composite effect of many small temporary clearances created by the practice of shifting agriculture. As the density of these clearances in the pollen catchment area increased, then the Gramineae, Plantago spp., Rumex, Artemisia and Pteridium percentages rose, and as the density decreased, the proportion of pollen or spores of these species also decreased.

Thus, in this part of Northumberland, there must have been two periods of relatively dense small temporary clearances, each lasting about 260 years, during the middle and latter parts of the Bronze Age. Separating and following these were periods when small temporary clearances in the pollen catchment area must have been sparsely distributed or absent. The low amount of cereal pollen recorded, together with the general absence of herbaceous pollen other than those types mentioned, suggests that much of the cleared land was used as rough pasture, and that cultivation was only of minor importance.

Godwin's zonation of the Post-glacial profiles from Britain is based on the conception that a zone boundary should indicate a synchronous climatic change from one site to another (Godwin, 1940). Originally the zone boundary VIIb/VIII was drawn, for south-eastern England, where Fagus and Carpinus first appear as a continuous curve in the pollen diagram. It was soon found that this basis of zonation could not be used in northern and western Britain because these two trees did not penetrate very far northwards or westwards as native species. Other trees which were at one

time considered to have responded to climatic deterioration of the zone boundary VIIb/VIII are Betula and Tilia, but it now seems probable that both the increase in Betula and the decrease or disappearance of Tilia at this horizon depend largely on the human history of the area, and are not so nearly synchronous from place to place as they would be if the cause had been primarily climatic (Turner, 1962).

At Steng Moss, Tilia is never present in large enough quantities to be used as an indicator either of climatic change or of human interference. Betula pollen on the other hand, increases in quantity from 170 cm. upwards. The average amount from 362 cm. to 170 cm. is 31.1% of total tree pollen, whilst from 170 cm. to the top of the profile, the average is 42.3%. The sudden increase at 170 cm. occurs between 636 ± 45 b.c. and 578 ± 35 b.c., i.e. at the end of the Bronze Age. At the same time as the Betula rise, the rate of peat accumulation at the site apparently became much more rapid, although it returned to former rates during the pre-Roman Iron Age (Table 3). Over much of the Pennines, a great acceleration in the rate of growth of blanket peat has been attributed by Conway (1954) to climatic deterioration at the opening of the Sub-Atlantic period, c. 500-600 b.c. Betula species will tolerate soils which have been either impoverished by primitive agriculture or podzolized by the effect of a wet climate at higher altitudes. In the absence of any evidence for intensified forest clearance at the level concerned, it is suggested that the increase in Betula pollen is a manifestation of climatic deterioration in the uplands around Steng Moss.

At 152 cm. the Gramineae, Plantago spp., Rumex and Pteridium curves all begin to rise again, and there is a corresponding fall in the proportion of tree pollen present. Gramineae pollen reaches a value of 51% of total tree pollen at 144 cm., then falls off slightly before levelling at

around 32% until 118 cm., when it begins to rise very sharply to high values. The Plantago lanceolata and Rumex curves show a similar trend. During this period, from 152 cm. to 118 cm., cereal pollen occurs at several levels, and small amounts of that of other herbs such as Artemisia, Plantago major/media, and members of the Chenopodiaceae are present. Herb species indicative of pastoral rather than arable agricultural practices (Godwin, 1968) are thus still predominant, although a small amount of cereal cultivation is suggested by the pollen assemblage.

A sample of peat from 152 cm. gave a radiocarbon date of 578 ± 60 b.c., whilst samples from 118 cm., at which level pollen of Gramineae and other herb species rises to high values, gave a date of 20 ± 60 b.c. The period concerned therefore may be placed between the end of the Bronze Age and the late Pre-Roman Iron Age of Northumberland. Iron Age settlement sites are scattered throughout the area around Steng Moss (Jobey, 1966a), so the evidence from the pollen diagram accords well with the results of archaeological excavation.

Human activity during most of the Iron Age does not appear to have been very much different from that in the latter part of the Bronze Age, with the exception that the extent of human pressure on the vegetation and, by deduction, the density of settlements, appears to have been more or less constant rather than fluctuating.

A rapid and substantial increase in the pollen curves for a number of herbaceous species begins at 118 cm. at Steng Moss. Between 120 cm. and 116 cm., Gramineae rises from 35% of total tree pollen to 138%. Plantago lanceolata from 8% to 42%, and Rumex from 3% to 12%. Plantago major/media, Ranunculaceae and Pteridium all show a slight rise at the same level, for which the radiocarbon data of 20 ± 60 b.c. was obtained. High values for all these species were maintained until 84 cm., by which

time an increase in the proportion of tree pollen had begun. This level gave a radiocarbon date of a.d. 460 ± 60 (A.D. 500). Such high amounts of herbaceous pollen are taken to be suggestive of intensive forest clearance, and the radiocarbon dates indicate that the time concerned was from the end of the pre-Roman Iron Age until the beginning of the Anglo-Saxon period. For convenience this is henceforward referred to as the Britanno-Roman period, since it begins before and ends after the Romano-British period proper.

It is during this phase that cereal cultivation begins to assume some importance, with pollen of Hordeum and Secale recorded in the pollen diagram (Fig. 6d). In addition, herbaceous species often associated with cultivation, appear in significant amounts between 100 cm. and 90 cm. These include plants such as Chenopodiaceae, Cruciferae, Compositae (Liguliflorae) and Urtica. From 98 cm. to 94 cm. Gramineae, Plantago lanceolata, Rumex, Pteridium and Artemisia rise to very high percentages, all of which suggests that land use intensity was greatly increased. Assuming a uniform rate of peat accumulation between the two radiocarbon dates (Table 3), this is likely to have occurred at sometime between A.D. 270 and A.D. 400 tree-ring calendar years, and lasted perhaps a hundred years.

Changes in the agricultural economy around Hadrian's Wall have been the subject of much speculation by archaeologists. In this part of Northumberland at least, the pollen record suggests an increase in the amount of both arable and pastoral farming during the latter half of the Roman occupation.

Whilst all tree species suffer a decline in the Britanno-Roman period, Betula also declines with respect to other trees, although it recovers towards the close of the period. It may be that the more open

birch woodlands, presumably created by earlier clearances, became preferred sites for agriculturalists because of the ease of felling compared to denser mixed oakwoods. Alternatively, the relative decrease of Betula may be due to the removal of birchwoods at higher altitudes, where other species are likely to have been less frequent.

Corylus percentages are generally higher, reaching 139% of tree pollen at 98 cm. Presumably this means that a good deal of coppicing was taking place.

Whilst it seems certain that the maximum extent of clearance, and of arable land-use during this phase occurs in the latter part of the Roman occupation, it is also apparent that there is a period of comparative prosperity continuing through and after the official withdrawal of the Romans in A.D. 410. A similar period of post-Roman prosperity was concluded from the results of pollen analysis at Hallowell Moss, Co. Durham (Donaldson and Turner, 1977).

It has been suggested (Hunter Blair, 1956) that there was a renaissance of British military strength in the north after the overthrow of Hadrian's Wall in A.D. 367, and Bede mentions a period of great material prosperity after the separation from Rome (Bede, 1955).

However, after a.d. 460 (A.D. 500) the proportion of tree pollen rises very rapidly, and there is a corresponding decrease in Gramineae, Plantago lanceolata, Rumex and other herbs. Cereal pollen is absent between 92 cm. and 62 cm. High amounts of Betula pollen are present during the initial rise of tree pollen, but steadily diminish largely in favour of Quercus pollen. This probably reflects the succession towards mixed oak forest that would take place during forest regeneration.

At 66 cm. the proportion of herb pollen rises rapidly once more, reaching a peak at 62 cm., when Gramineae is 186% of tree pollen,

Plantago lanceolata is 50% and cereals, reappearing at this level, are 14%. Peat from 62 cm. gave a radiocarbon date of a.d. 865 \pm 35 (A.D. 900).

During the Anglo-Saxon period forest regeneration was apparently allowed to take place in the uplands of Northumberland that surround Steng Moss. Agricultural activity seems to have been abandoned rather suddenly just after a.d. 460 (A.D. 500) and was not re-introduced on anything like the same scale until shortly before a.d. 865 (A.D. 900). Small amounts of pollen of Plantago lanceolata, Rumex and members of the Umbelliferae family and spores of Pteridium testify that some openings or open woodland were maintained during this time, probably by grazing pressure. It is possible that the changes in vegetation recorded by the pollen diagram for the Anglo-Saxon period reflect a movement of agricultural activity from the uplands to the more fertile lowlands to the east, rather than a general economic decline. The heavier plough introduced by the Anglo-Saxons was capable of breaking up the fertile lowland soils and would have facilitated such a move.

The new phase of activity started at 66 cm. and reached its culmination at 62 cm. (A.D. 900), when Gramineae pollen is 186% of tree pollen and Plantago lanceolata is 50%. After declining the Gramineae curve levels off at 70 - 90% of tree pollen and Plantago lanceolata at 10 - 14%, until a further decline between 40 cm. and 32 cm. At 32 cm. herb pollen is only 7% of total dry land pollen. If a uniform rate of peat accumulation between 62 cm. (A.D. 900) and the surface of the profile is assumed, the minimum of herb pollen would have occurred at the beginning of the fifteenth century.

The sharp rise of herb pollen, including cereals, which occurred around a.d. 865 (A.D. 900) and marked the beginning of a new phase of agricultural activity, is difficult to explain using the historical record.

The date suggests that Scandanavian settlers might have been responsible for the expansion, but known settlement sites in the uplands are scarce.

For two centuries during early Medieval times, the liberty of Redesdale was in the possession of the de Umfravilles (see Chapter 4) and it is during this time that the pollen diagram indicates the existence of a fairly substantial amount of cleared land. Although the presence of cereal pollen in small amounts confirms that there was some cultivation, the abundance of Plantago spp., Rumex, Artemisia and Ranunculaceae, as opposed to species more often associated with arable land, suggests that pastoral farming was predominant.

Between 40 cm. and 32 cm. a decline of agricultural activity and a good deal of forest regeneration is indicated by a decrease in the curves for Gramineae, Plantago lanceolata, Rumex and other herbaceous species, and an increase in the proportion of tree pollen. It is suggested that this represents the typical pattern of events in northern England during the fourteenth century, and that several factors were responsible for the decline. First, the great depression of the fourteenth century began in the second decade, and throughout the whole of western Europe a widespread economic recession occurred, reinforced by the famine years of 1316-17 and the plague years of 1347-49. In addition, the extreme north of England was subjected to frequent raiding by the Scottish armies which no doubt encouraged the desertion of more remote farmsteads. A third factor may have been the onset of colder, wetter conditions during the first part of the 14th century (Lamb, 1966). A similar decline has been recorded in Weardale, Co. Durham (Roberts et al, 1973) for which the same causal factors have been offered.

Above 32 cm. the Gramineae, Plantago spp., Rumex and Pteridium curves all rise very sharply and there is a corresponding decrease of

tree pollen. Cereal pollen is present at most levels and herbaceous species often associated with disturbance of land by arable farming are evident. These include Chenopodiaceae, Cruciferae, Compositae (Liguliflorae) and Urtica. The maximum extent of arable land seems to have occurred at 8 cm. (A.D. 1825?) at which time cereal pollen is 12% of tree pollen, that of members of the Chenopodiaceae and Cruciferae families reaches comparatively high values, and Centaurea cyanus and Polygonum bistorta pollen are present.

By comparison the surface sample indicates that arable farming has become much less significant. The decrease in the pollen curves for Plantago spp. and Rumex might be related to the rise of the Pinus curve, which is attributable to afforestation schemes in recent years. Corylus pollen decreases significantly above 16 cm., probably a result of the diminishing importance of coppicing.

5.5 Summary of Events

Throughout the Bronze Age and for much of the pre-Roman Iron Age, forest clearance took place on a relatively small scale and where it did, a pastoral economy was dominant. Shortly before or perhaps about the time that the Romans arrived, the forest was removed on a scale hitherto unknown in the area. This clearance lasted for the whole of the Romano-British period and seems likely to have persisted until early Anglo-Saxon times. The indications are that agriculture was still pastorally orientated, but cultivation, particularly during the latter half of the Roman occupation was of some importance.

In the pollen catchment area, the larger part of the Anglo-Saxon period was a time of abandonment of the land and regeneration of the forest. There is then a further extensive clearance which may have been

associated with incursions by Scandanavian settlers. This is followed by a period of diminished activity which gradually gives way to forest regeneration. The final phase of clearance probably began in Mid to Late Medieval times and has continued up to the present day. Cultivation was practiced in each of the three major phases of forest clearance, but the pollen diagram suggests that the economy had an essentially pastoral base.

Table 2: RESULTS OF RADIOCARBON ASSAY ON PEAT SAMPLES FROM STENG MOSS

Laboratory Reference Number	Depth (cm.)	Significance	Pre-Treatment	(5568 Radiocarbon Years)	Corrected Date (Tree-ring Range)	Average of Tree-ring Range (Tree-ring Calendar Yrs.)
SSR-1041	61.5 - 63.0	Dates maximum of a comparatively short but extensive forest clearance	Acid	a.d. 865 ± 35	A.D. 875 - 925	A.D. 900
Q-1521	83.0 - 84.0	Dates the end of a comparatively long and extensive clearance period	Water	a.d. 530 ± 60	A.D. 560 - 600	A.D. 580
Q-1519	"	"	Acid	a.d. 460 ± 60	A.D. 480 - 520	A.D. 500
Q-1523	"	"	Alkali	a.d. 385 ± 60	A.D. 400 - 435	A.D. 418
Q-1522	117.0 - 118.0	Dates the beginning of a comparatively long and extensive clearance period	Water	a.d. 5 ± 60	A.D. 20 - 60	A.D. 40
Q-1520	"	"	Acid	20 ± 60 b.c.	40 B.C. - A.D. 40	0
Q-1524	"	"	Alkali	140 ± 60 b.c.	230 - 150 B.C.	190 B.C.
SRR-1042	151.5 - 153.0	Dates the beginning of a period of limited but continuous forest clearance	Acid	578 ± 35 b.c.	830 - 700 B.C.	765 B.C.
SRR-1043	179.0 - 184.0	Dates the maximum of a period of small temporary clearances	Acid	636 ± 45 b.c.	855 - 810 B.C.	832 B.C.
SRR-1044	211.0 - 216.0	"	Acid	1065 ± 45 b.c.	1375 - 1265 B.C.	1320 B.C.
SRR-1045	255.0 - 260.0	Dates the maximum of a period of small scale clearance activity	Acid	1644 ± 45 b.c.	2110 - 2080 B.C.	2095 B.C.

Table 3: RATES OF PEAT FORMATION AT STENG MOSS

ESTIMATED FROM CORRECTED RADIOCARBON DATES

Depth(cm.)	Date (Tree-ring Calendar yrs.)	Average rate of Accumulation (No. of yrs. to accumulate 1 cm. of peat
0	A.D. 1950	16.94
62	A.D. 900	18.19
84	A.D. 500	14.70
118	0	22.50
152	765 B.C.	2.23
182	832 B.C.	15.25
214	1320 B.C.	17.61
258	2095 B.C.	

STENG MOSS

Tree and shrub species as % total tree pollen

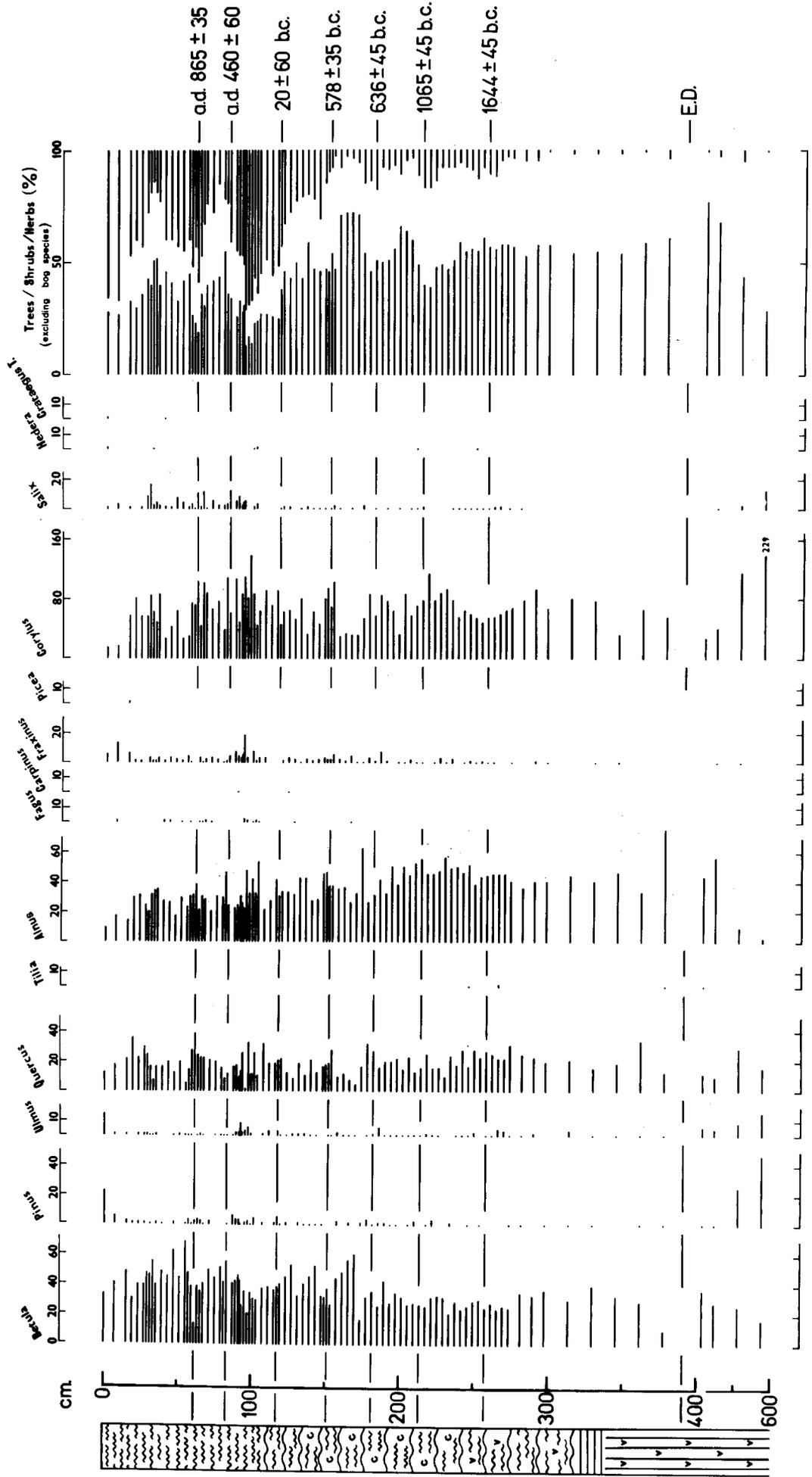


FIG. 7a Note: Change of scale for lower part of diagram

STENG MOSS

Dry land herbaceous species as % total tree pollen

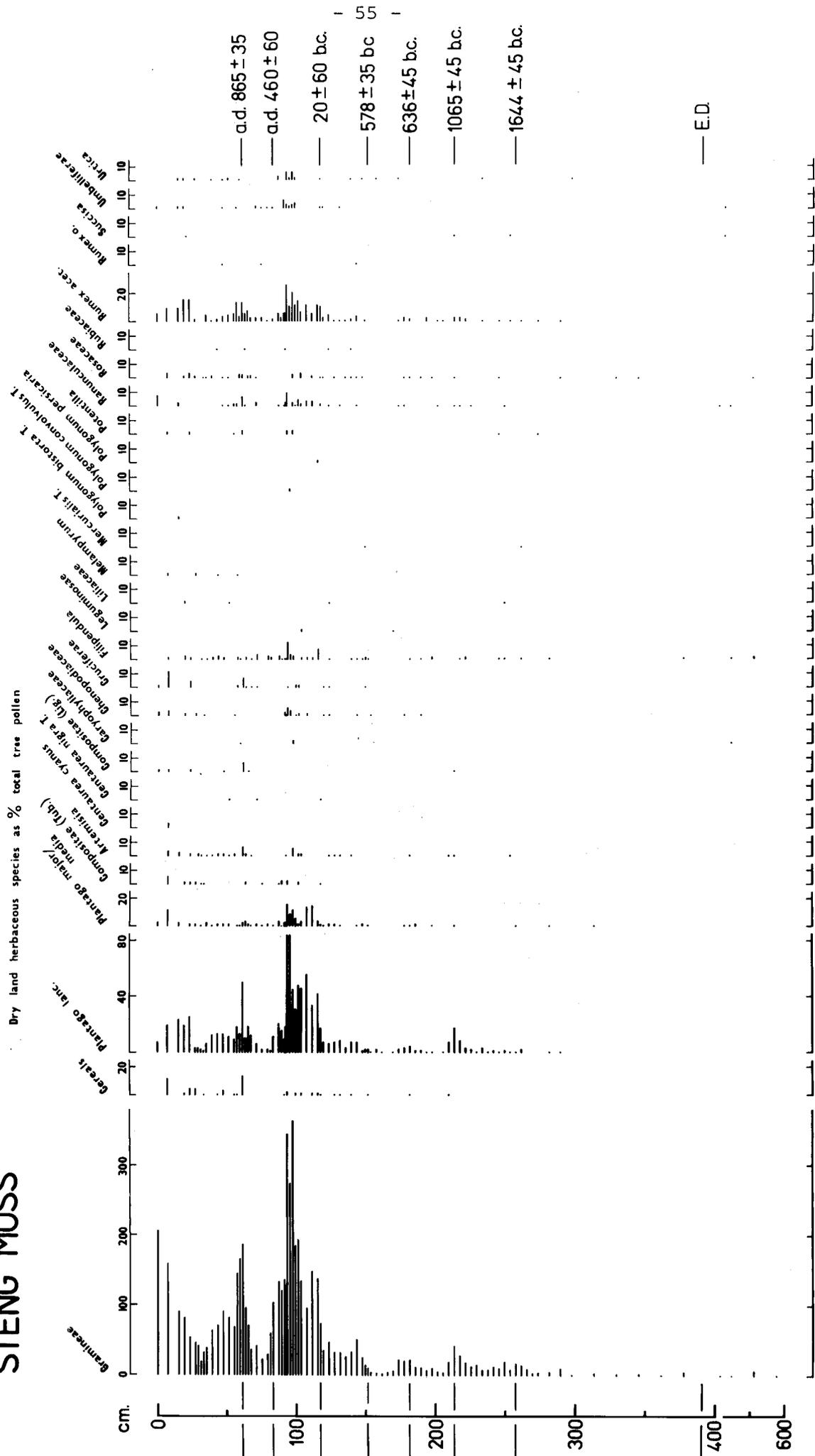


FIG. 7b Note: Change of scale for lower part of diagram

STENG MOSS

Bog species and spores as % total tree pollen

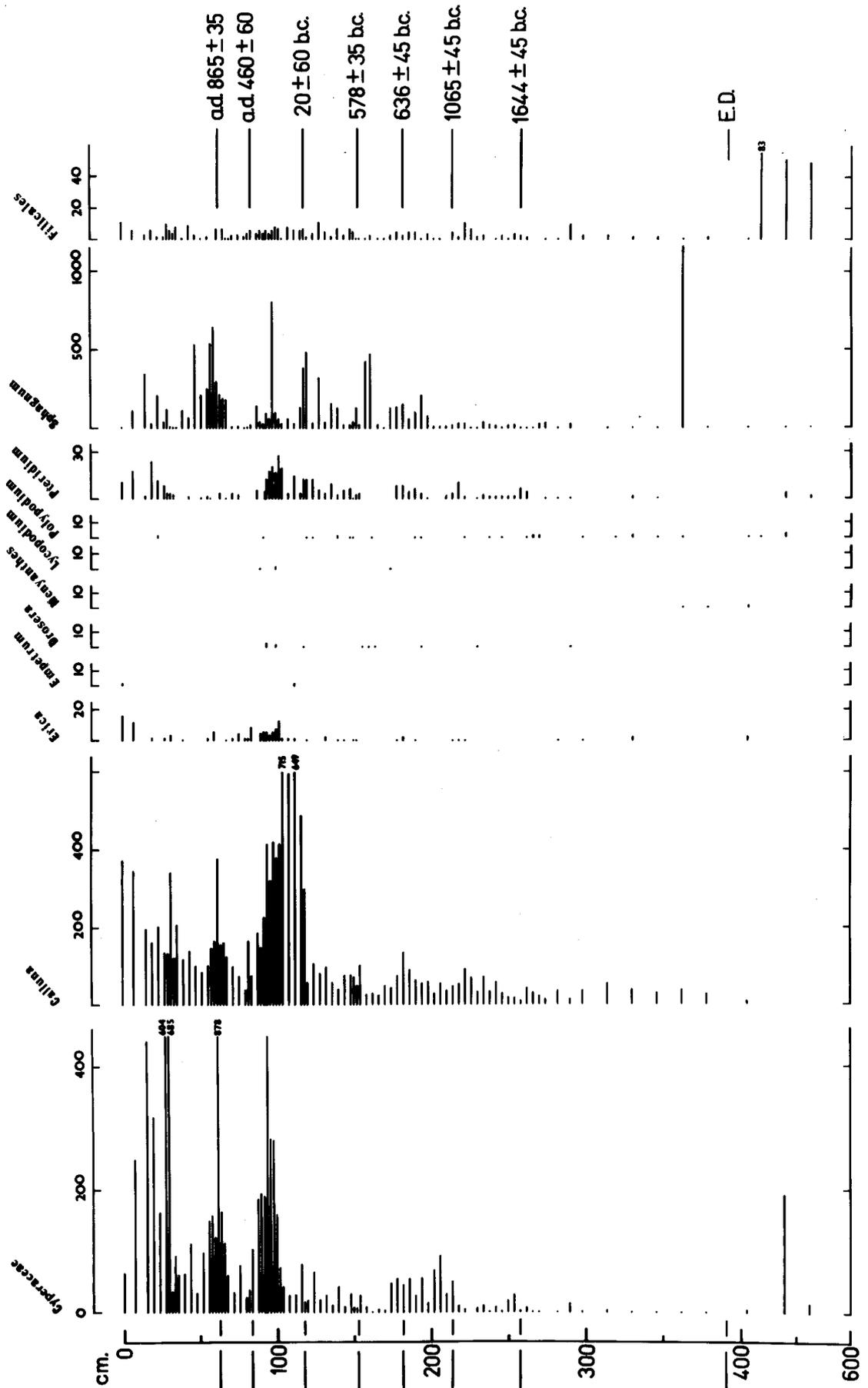


FIG. 7c Note: Change of scale for lower part of diagram

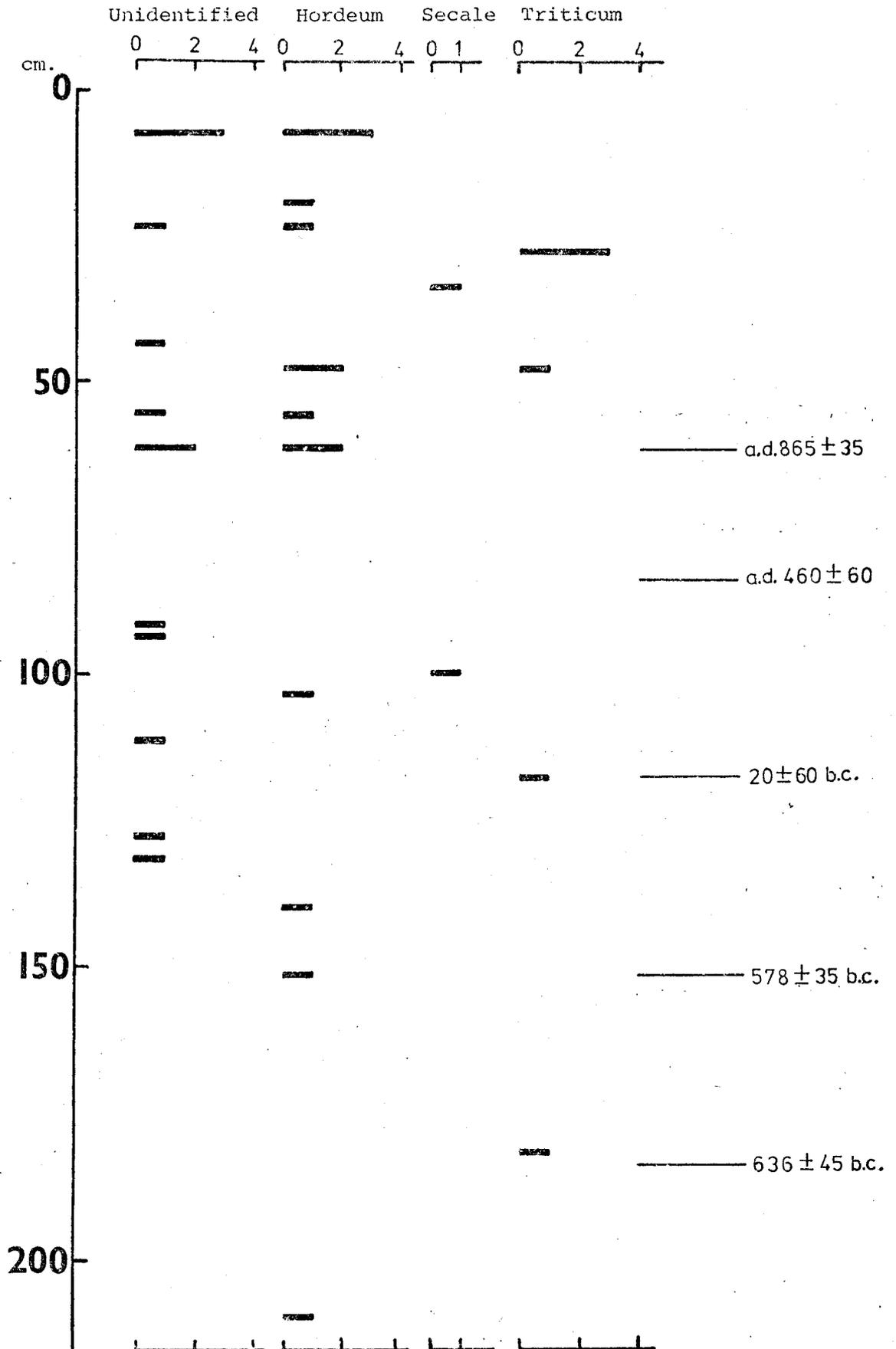


Fig. 7d Cereal pollen recorded at Steng Moss
(shown as no. of pollen grains in the count).

CHAPTER 6

FELLEND MOSS

6.1 Introduction

Fellend Moss (N.G.R. NY 679658) is situated 3.2 km. to the north-west of Haltwhistle and 2 km. east of Greenhead in the south-western part of Northumberland (see Fig. 8). It lies at an altitude of c. 200 m. O.D. in a shallow depression formed by parallel ridges running east-west. To the north, the outcrop of the Whin Sill forms the ridge along which Hadrian's Wall stands, and the Vallum behind the Wall runs along the northern edge of the moss. On the south side of the moss, a large Roman camp covers the top of the ridge formed by rocks of the Upper Limestone Group.

Roman remains are abundant in the surrounding area, but Pre-Romano-British sites or archaeological findings are scarce.

At its largest extent, the moss is c. 750 m. x c. 375 m., but it is divided in its central section by a low sandstone ridge. The surface of the northern part of the moss is 1.2 m. lower than the southern part at transect C, but has a greater depth of peat (Fig. 10c).

The surface vegetation is dominated by Calluna vulgaris, Eriophorum vaginatum and Sphagnum spp. Other species present include Polytrichum commune, Erica tetralix, Andromeda polifolia, Betula pubescens and Pinus sylvestris.

6.2 Stratigraphy

Three line transects were laid out across the bog as shown in Fig. 9. The surface profile was obtained using a Dumpy level and the stratigraphy investigated using a Russian-type borer. Results of the

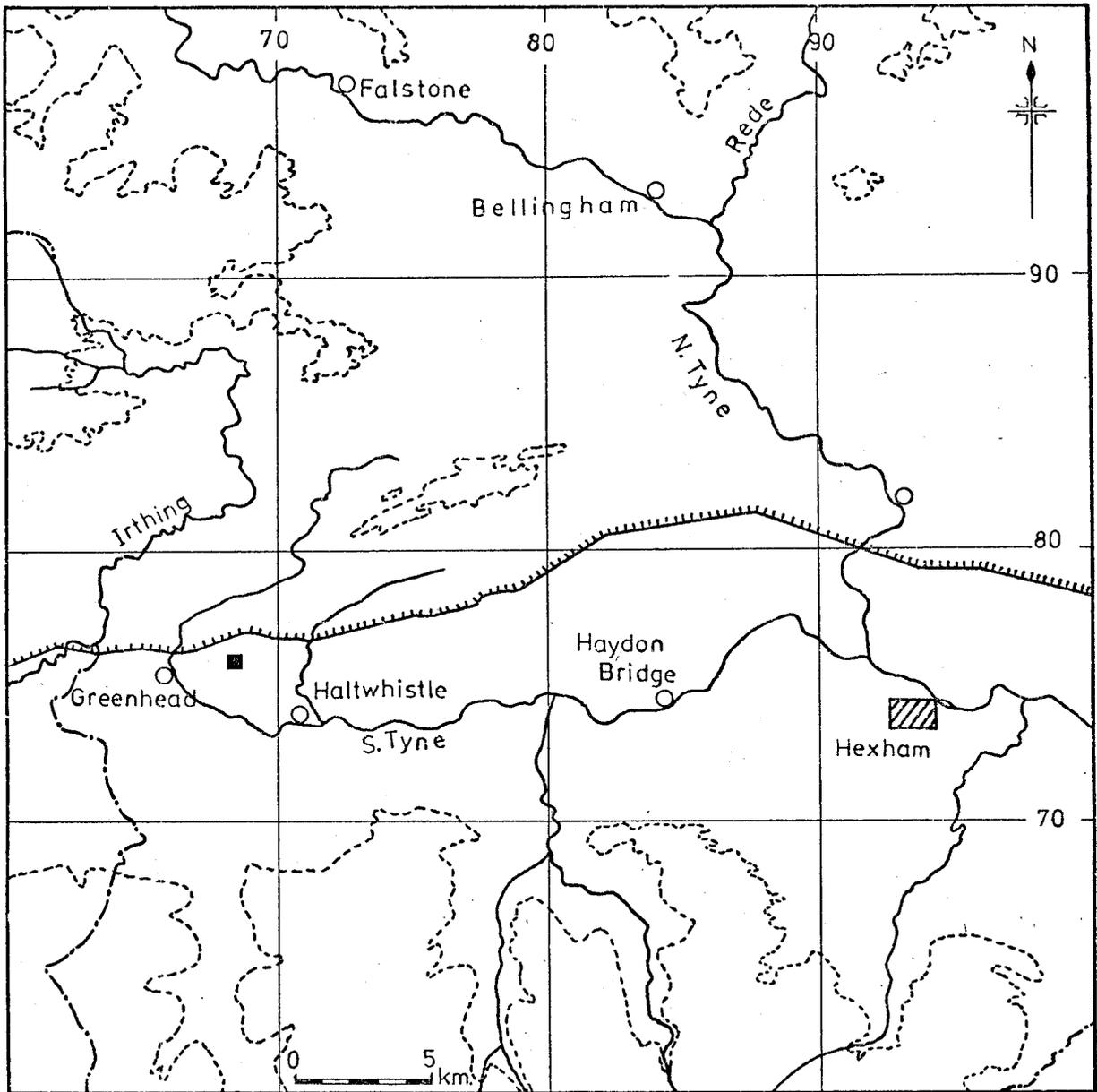


Fig. 8 Map of Fellend Moss locality

Key.

- ~~~~ Major rivers
- Northumberland County boundary
- - - Contour - 305m. O.D.
- ==== Hadrian's Wall
- Fellend Moss

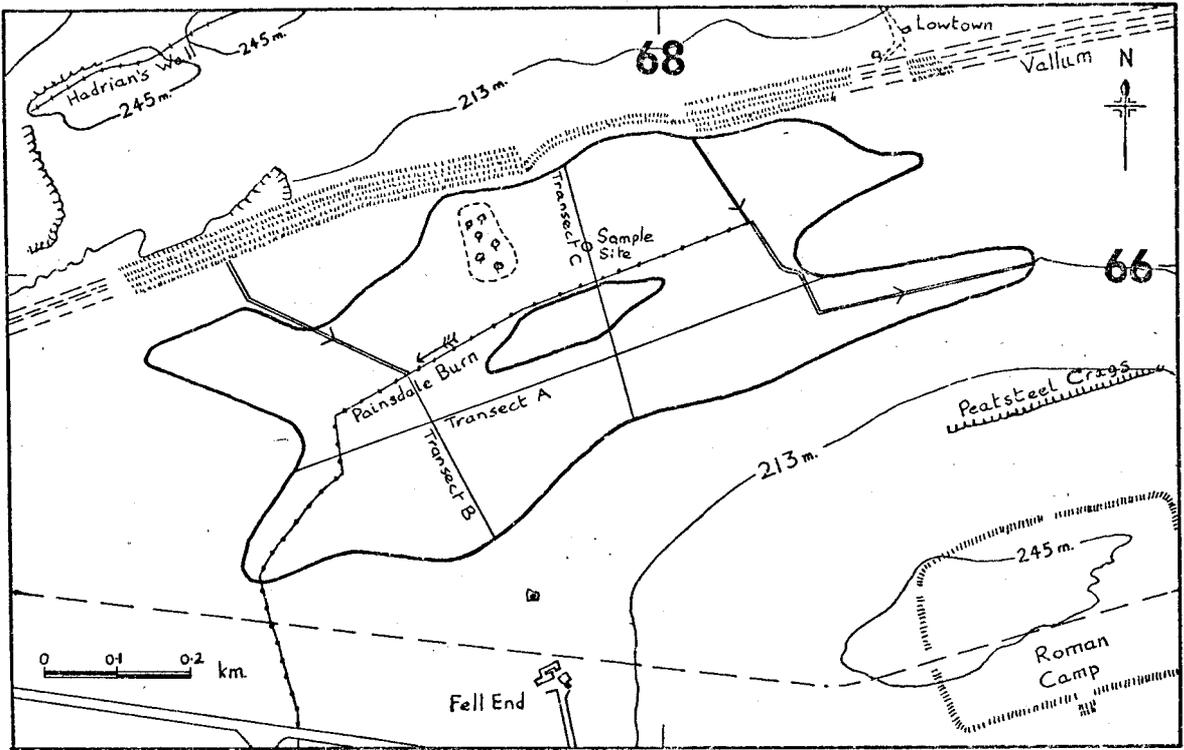


Fig. 9 Map of Fellend Moss

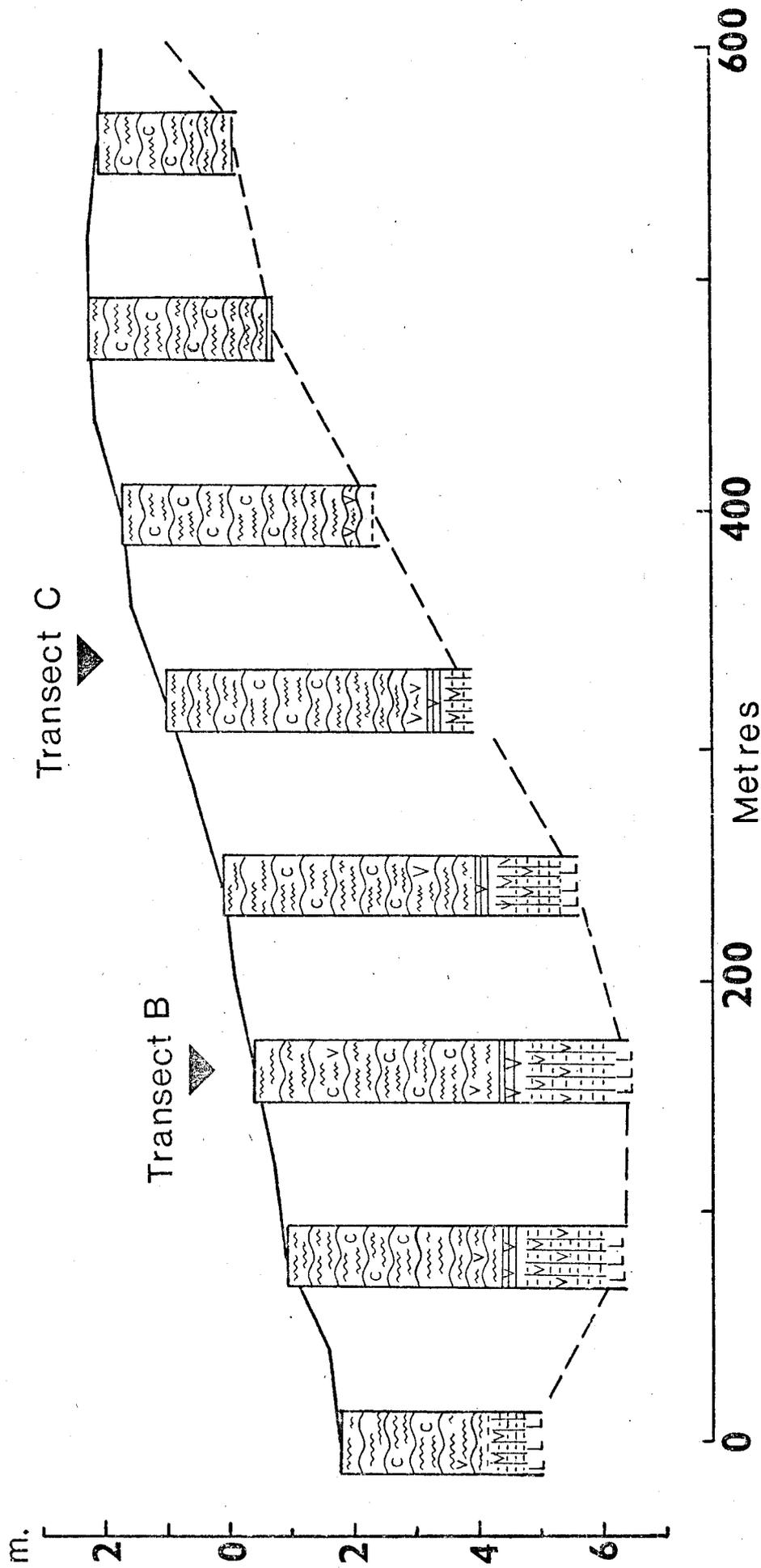


Fig. 10a Stratigraphy of Fellend Moss : transect A

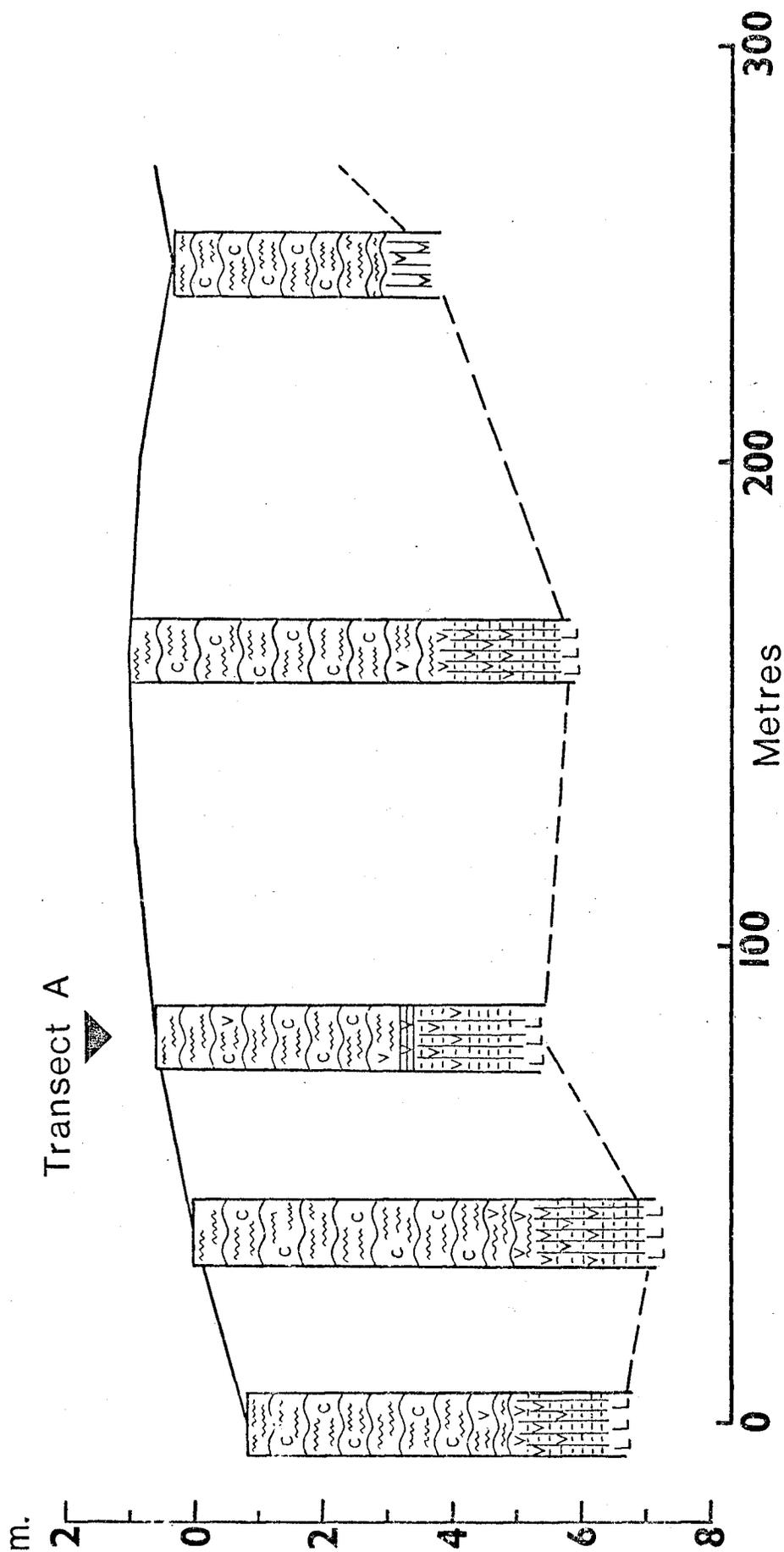


Fig. 10b : Stratigraphy of Fellend Moss : transect B.

investigation are shown in Figs. 10a, 10b and 10c. Stratigraphy at the core site used for pollen analysis was as follows:-

0 - 8	<u>Sphagnum</u> peat. H ₅
9 - 63	<u>Sphagnum/Eriophorum</u> peat with small fragments of <u>Calluna</u> . H ₄
64 - 68	<u>Eriophorum</u> peat. H ₃
69 - 130	<u>Sphagnum/Eriophorum</u> peat with some <u>Calluna</u> . H ₅
131 - 161	<u>Eriophorum</u> peat with small amount of <u>Sphagnum</u> and <u>Calluna</u> . H ₆
162 - 206	<u>Sphagnum/Eriophorum</u> peat. H ₇
207 - 310	<u>Sphagnum/Eriophorum/Calluna</u> peat. H ₆
311 - 423	<u>Eriophorum/Sphagnum/Bryophyte</u> peat with some <u>Phragmites</u> . H ₆
424 - 450	<u>Sedge/Phragmites</u> peat with some <u>Equisetum</u> remains
451 - 795	<u>Sedge/Phragmites/wood</u> peat
796 - 822	Khaki-coloured <u>sedge/Phragmites</u> peat.
823 - 830	<u>Sedge/Phragmites</u> peat with increasing amount of mineral matter.

The base of the northern part of the bog was underlain by fine grey-blue clay, whilst most of the southern part lay over solid rock. The northern part may have been a very shallow lake at one time; certainly the presence of Nymphaea and Potamogeton pollen at the base of the pollen diagram indicates that there were once stretches of open water.

6.3 Collection of Pollen and Radiocarbon samples

At the time of the initial sampling of this site, the water table of the bog was high and prevented the excavation of a pit from which monolith samples could be taken. Consequently, the peat was sampled

with a Russian-type borer, taking multiple shot cores down to 4.5 m. Four cores were taken from each 50 cm. boring. Of the multiple shot cores, one of each four from the same level was used for the pollen analysis, whilst the other three were stored in half cylindrical plastic containers. These containers were sealed in polythene bags and kept at 4°C until they were required.

Samples selected for pollen analysis were prepared and counted using standard methods described in Chapter 2. A more detailed analysis of the stratigraphy was made by examining the macro remains retained after sodium hydroxide treatment. Results of this examination were as follows:-

- 0 - 8 Sphagnum peat.
- 9 - 63 Sphagnum/Eriophorum peat with occasional
 Calluna fragments.
- 64 - 70 Eriophorum peat
- 71 - 78 Eriophorum/Sphagnum/Calluna peat.
- 79 - 104 Sphagnum/Eriophorum peat.
- 105 - 130 Sphagnum peat with Eriophorum and Calluna remains.
- 131 - 150 Eriophorum/Sphagnum peat.
- 151 - 158 Eriophorum peat.
- 159 - 207 Sphagnum/Eriophorum peat.
- 208 - 310 Sphagnum/Eriophorum peat with Calluna.
- 311 - 416 Eriophorum/Sphagnum/Paludella squarrosus peat.
- 417 - 480 Sedge/Phragmites peat with Equisetum fragments.
- 481 - 704 Sedge/Phragmites/wood peat.

After pollen analysis, five levels were selected for radio-carbon dating. A further visit to the core site was made. The water

table having dropped considerably, a pit was excavated from the side of which monolith samples were taken between the surface and 1.7 m depth in the form of 25 cm³ blocks. These were then cut to one cm. thick slices of peat in the laboratory and stored in boxes at 4°C. Samples from 64, 104, 132 and 176 cm. were selected for radiocarbon dating along with level 320 cm. for which peat between 317 and 322 cm. from the three multiple shot samples was used. Pollen analysis was carried out on samples chosen for radiocarbon dating and on levels above and below in each case to check for correct selection with respect to the pollen diagram. All five samples were oven dried at 100°C for 24 hours prior to despatch for radiocarbon dating at the Scottish Research and Reactor Centre.

Results of the radiocarbon assay are shown in Table 4. The conventional 5568 assay dates have been corrected to tree-ring calendar years using conversion tables (McKerrell, 1975). For the purpose of comparison with other pollen diagrams and with archaeological data, the dates shown on the pollen diagram are in conventional 5568 radiocarbon years. The range given for all dates is that of one standard deviation.

Dates used in the discussion are identified in the normal manner i.e. small letters for radiocarbon assay dates, and capitals for corrected and historical dates. For the calculation of rates of peat formation, the corrected dates have been used (Table 5).

6.4 Interpretation of the Pollen Diagram

A considerable depth of peat was collected from the core site at Fellend Moss. The lowermost sample counted was from 768 cm. beneath the surface. Below 400 cm. only occasional levels were counted, with the intention of placing the profile within the general context of the

Godwin zonation scheme (Godwin, 1940). In like manner to that for Steng Moss, the part of the pollen diagram concerned with forest clearance episodes has not been divided into local pollen assemblage zones. Radio-carbon dates for five levels allow vegetation changes due to human interference to be related to historical and prehistoric periods.

Alnus pollen first appears in the diagram at 640 cm., but does not rise to high values until 512 cm. The zone boundary VIc/VIIa may therefore be placed at around 540 cm. The whole of the profile below this level is likely to be contained within zone VI because moderately high values of Quercus and Ulmus pollen are present throughout.

The curve for Ulmus pollen falls from 13% of tree pollen at 576 cm. to 5% at 512 cm. and is absent at 448 cm. It is suggested, therefore, that the elm decline occurs between 512 cm. and 448 cm., and is marked 'E.D.' on the diagram.

Pollen of herbaceous plants remains at low values throughout, until at 328 cm. the pollen of Gramineae, Plantago lanceolata and Rumex acetosa/acetosella and the spores of Pteridium begin to rise, reaching a maximum at 320 cm. and declining thereafter. If the calculated average rate of peat formation is accepted (Table 5), this phase would have lasted about 200 years. It is suggested that this rise of herbaceous pollen is indicative of a period of shifting agriculture during which small temporary clearances, such as those described by Iversen (1941, 1949) and later by Turner (1964, 1965), interrupted the forest canopy.

Whilst cereal pollen was not recorded at these levels, the pollen of some plants often associated with disturbance by cultivation, such as Urtica and members of the Cruciferae family, is present. For the most part, however, it would appear that pastoralism was predominant, as evidenced by the high proportion of Gramineae, Plantago lanceolata and

Rumex compared to other herbaceous pollen. Peat from 320 cm. was radiocarbon dated to 1738 ± 60 b.c. (2140 B.C.), placing this episode in the Early Bronze Age of Northumberland.

Between 315 cm. and 176 cm. herbaceous pollen is again at low values, although small amounts of Plantago lanceolata pollen and pollen of other herbaceous species occur intermittently. Peat from 176 cm. was radiocarbon dated to a.d. 2 ± 45 (A.D. 40). It seems, therefore, that from the Early Bronze Age to the years just prior to the arrival of the Romans, very little use was made of the land in the pollen catchment area of Fellend Moss. The occasional presence of small amounts of herbaceous pollen suggests that some clearings were maintained within the forest, probably by grazing pressure from livestock, although actual clearances must have been infrequent. The paucity of known Bronze Age or Iron Age settlement sites in the area lends support to the interpretation.

At 176 cm. the curves for Gramineae, Plantago lanceolata and Rumex pollen and Pteridium spores begin to rise once again and at 168 cm. they rise sharply to very high values. At the same time, Plantago major/media and Ranunculaceae pollen reappear and form continuous curves. The pollen of Compositae (Tubuliflorae) appears for the first time at 168 cm. and that of Chenopodiaceae is present in small amounts.

The much higher and sustained herbaceous pollen percentages occurring between 168 and 132 cm., with maxima at 164 cm. and 152 cm., infer that forest clearance was on a comparatively extensive scale. The period concerned which may have begun in the very late pre-Roman Iron Age, covers the whole of the Romano-British period and continues into Anglo-Saxon times. This being more or less synchronous with the first extensive clearances recorded at Steng Moss, it will be referred to as Britanno-Roman. If the date of A.D. 40 is accepted for the first rise

of herbaceous pollen, it is tempting to associate the very sharp rise of Gramineae, Plantago lanceolata and Rumex curves at 168 cm. with the construction of Hadrian's Wall, immediately to the north of Fellend Moss in A.D. 122-130. A great deal of wood would have been required for this project.

Cereal pollen was only recorded at 168 cm., although small amounts of Cruciferae, Chenopodiaceae and Urtica pollen are present at intermittent levels and suggest that some cultivation may have been practised. For most of the period, however, pollen of Gramineae, Plantago lanceolata, Rumex and Ranunculaceae is present in substantial quantities and indicates that the agricultural economy was predominantly pastoral.

It may be noted that at Fellend Moss there is no significant increase in Betula pollen until the beginning of the Britanno-Roman clearance phase. It is therefore suggested that at Fellend Moss the rise of Betula pollen, which typically occurs in zone VIII can be attributed to anthropogenic rather than climatic factors. This is different to the situation at Steng Moss, where the Betula rise occurred somewhat earlier, and may be due, in part, to factors associated with climatic change.

Up to about A.D. 635 (132 cm.) the rise of the tree pollen curve indicates that forest regeneration took place. Herbaceous pollen curves fall to low values once more, with Gramineae pollen having declined to 46% of tree pollen at 112 cm., at which level Plantago lanceolata was 3% and Rumex 1%. The situation in the pollen catchment area after the departure of the Romans was very similar to that recorded at Steng Moss. Cleared land was apparently maintained for some time, perhaps for as much as a century longer at Fellend Moss than at Steng Moss, but

during the Anglo-Saxon period much land was abandoned, allowing forest regeneration to take place. Again, this may reflect a movement of agricultural activity from the uplands to the fertile lowland valleys, which the technical innovations brought by the Anglo-Saxons would have allowed.

At 106 cm. herb pollen curves begin to rise very rapidly, reaching a maximum at 194 cm. Pollen of cereals, Cannabis, members of the Cruciferae family and Urtica indicate that arable farming was of some importance. Peat from 104 cm. was radiocarbon dated to a.d. 1005 ± 40 (A.D. 1030). This is the first recorded occurrence of Cannabis pollen at Fellend Moss, but it has been recorded from as early as the Bronze Age at Hutton Henry in Co. Durham (Bartley et al, 1976) and from the late Iron Age onwards in other parts of northern England (Oldfield, 1963; Oldfield and Statham, 1963; Walker, 1955; Hicks, 1971; Bartley et al, 1976).

At the same level that cereal pollen is high and Cannabis pollen is present, Gramineae pollen reaches 300% and that of Plantago lanceolata is 60%, its highest recorded value at this site. These, together with high percentages of Rumex and Compositae (Tubuliflorae) pollen indicate that land under pasture was also widespread.

Associated with this clearance phase is a sharp rise of the Corylus curve. Presumably Corylus was coppiced and harvested.

The radiocarbon date suggests that responsibility for this period of greatly increased agricultural activity may lie with immigrant Scandanavian settlers; either directly or by the expansion of settlement into the uplands which their presence in coastal areas must have encouraged. In consideration of this idea, it is interesting to note that a very similar change of vegetation, shown by the pollen diagram

from Steng Moss, apparently took place a century and a half earlier.

The phase of clearance activity centred around A.D. 1030 was, however, only shortlived. Above 104 cm. herbaceous pollen percentages decline rapidly and remain at comparatively low values until at 64 cm. the Gramineae and Plantago lanceolata curves rise sharply once more. Peat from 64 cm. was radiocarbon dated to a.d. 1516 \pm 45 (A.D. 1420). This period of decreased land use, during which some degree of forest regeneration took place, covers Norman and Early Medieval times. Norman settlements within the area around Fellend Moss are few in comparison to central Northumberland. Presumably the high fells to the south-west and the wet peatlands or 'flows' to the north and north-west of Fellend Moss were unattractive areas as far as Norman landowners were concerned.

Later, the climatic deterioration of the early 14th century (Lamb, 1966) must have been particularly discouraging in an area which in any case is on the wetter side of the Pennine hills, and the continued low level of agricultural activity during the 14th century follows the general trend for the north of England. Nevertheless, the curves for Plantago lanceolata, Rumex and Pteridium remain continuous and small amounts of other herbaceous pollen such as Artemisia, Ranunculaceae and Compositae (Tubuliflorae) testify to the maintenance of some pastoral farming in the area.

The final phase of forest clearance beginning c. A.D. 1420 and lasting until the present day opens with arable farming again assuming some importance. Cereal pollen has reappeared at 72 cm. and is 6% of tree pollen at 64 cm. However, between 48 cm. and 8 cm. there is only one level at which cereals are recorded, although Cannabis pollen is frequent. Godwin (1967a) pointed out that in East Anglia at least, cultivation of hemp was enforceable by law during Tudor times.

Presumably it was much in demand at that time, which might explain the comparatively large amounts of Cannabis pollen appearing in the pollen diagram for Fellend Moss.

Above 24 cm. the curves for Gramineae, Plantago lanceolata and Rumex pollen all rise to very high values, which is suggestive of an increase in the amount of pasture land. Cereal pollen reappears at 8 cm. and is 11% of tree pollen in the surface sample, which perhaps reflects a tendency towards increased arable farming during the twentieth century.

Corylus pollen again shows a decline towards the top of the profile just as it did at Steng Moss, and at the surface, Pinus pollen is 37% of tree pollen, a result of the modern policy of afforestation.

6.5 Summary of Events

It has been suggested (Jobey, private communication) that the uplands of south-west Northumberland have, throughout much of antiquity been an unattractive area for human settlement, and as a result settlement sites of any age are relatively thin on the ground. The pollen diagram for Fellend Moss reinforces this viewpoint to a certain extent. Only one short period of shifting agriculture (in the Early Bronze Age) was recorded prior to the arrival of the Romans in the area. That the Romans had a considerable impact upon the landscape is shown both by the abundance of Roman remains and by the large increase of open land indicated by the pollen diagram.

After the Roman withdrawal, prosperity appears to have continued for some time, but during Anglo-Saxon times, forest regeneration was allowed to take place. Early in the eleventh century there was a second period of extensive but evidently short-lived clearance, which

must be attributed in one way or another to an influx of Scandanavian settlers.

There was only limited agricultural land use during Norman and Early Medieval times. From the beginning of the fifteenth century the forest was progressively cleared, with cereal cultivation of some importance initially, but with pasture land becoming more widespread from the early eighteenth century onwards.

Table 4: RESULTS OF RADIOCARBON ASSAY ON PEAT SAMPLES FROM FELLEND MOSS

Laboratory Reference Number	Depth (cms.)	Significance	Assay Date (5568 Radiocarbon Yrs.)	Corrected Date (Tree-ring Range)	Average of tree-ring Range (Tree-Ring Calendar Years)
SRR-873	63-64	Dates the beginning of the final phase of forest clearance	a.d. 1516 ± 45	A.D. 1400 - 1440	A.D. 1420
SRR-874	103-104	Dates an extensive but short-lived clearance	a.d. 1005 ± 40	A.D. 1015 - 1045	A.D. 1030
SRR-875	131-132	Dates the maximum of forest regeneration between two clearance phases	a.d. 620 ± 40	A.D. 620 - 650	A.D. 635
SRR-876	175-176	Dates the beginning of a period of extensive forest clearance	a.d. 2 ± 45	A.D. 20 - 60	A.D. 40
SRR-877	317-322	Dates the maximum of a period of small temporary clearances	1738 b.c. ± 60	2110 - 2170 B.C.	2140 B.C.

Table 5: ESTIMATED RATES OF PEAT FORMATION

Depth (cms.)	Average corrected date	Rate of peat formation (Yrs. per 1 cm. of peat)
0	A.D. 1950	8.28
64	A.D. 1420	9.75
104	A.D. 1030	14.10
132	A.D. 635	13.52
176	A.D. 40	15.14
320	2140 B.C.	

FELLEND MOSS

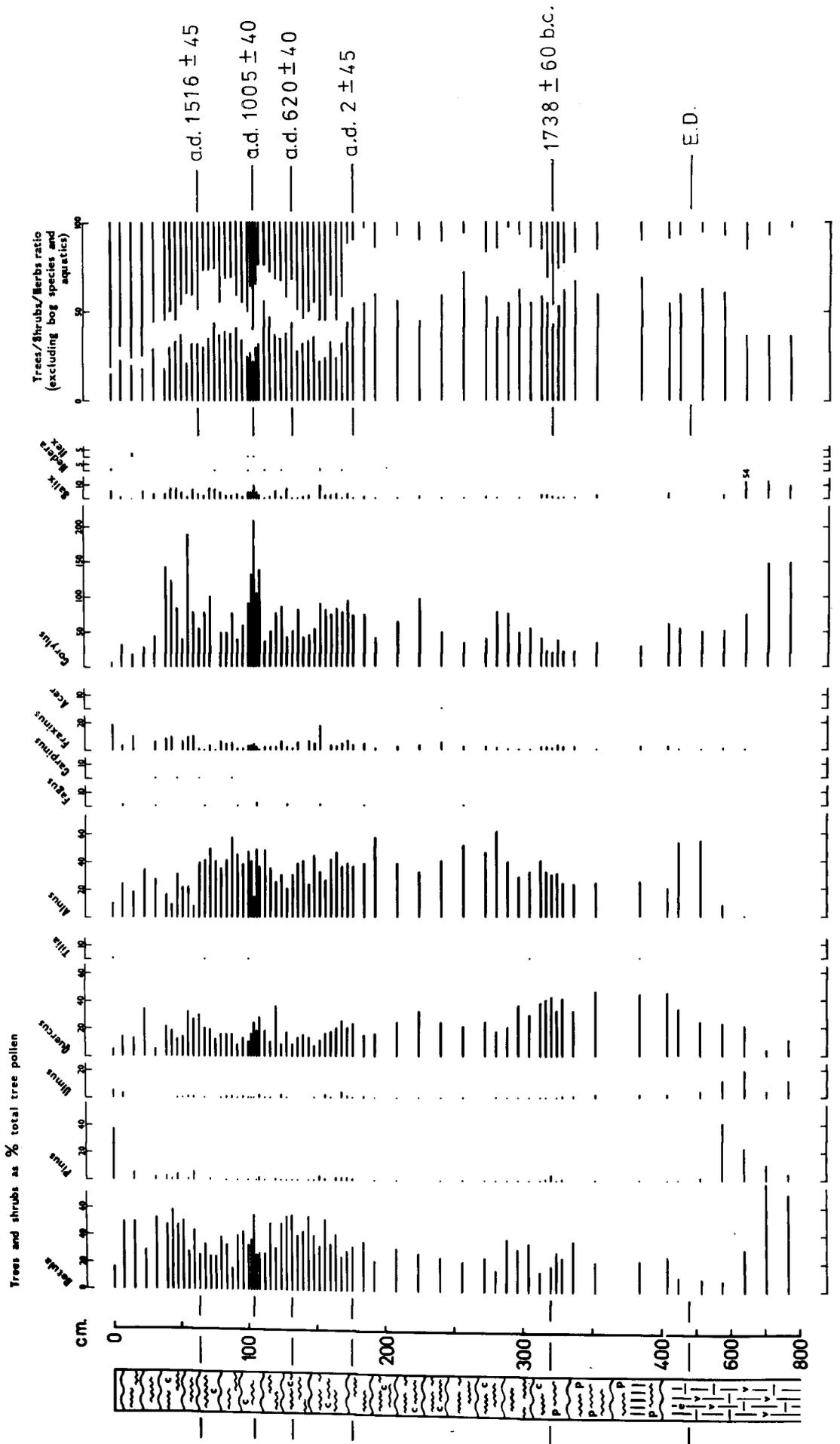


FIG. 11a

Note: Change of scale for lower part of diagram

FELLEND MOSS

Herbaceous species as % total tree pollen

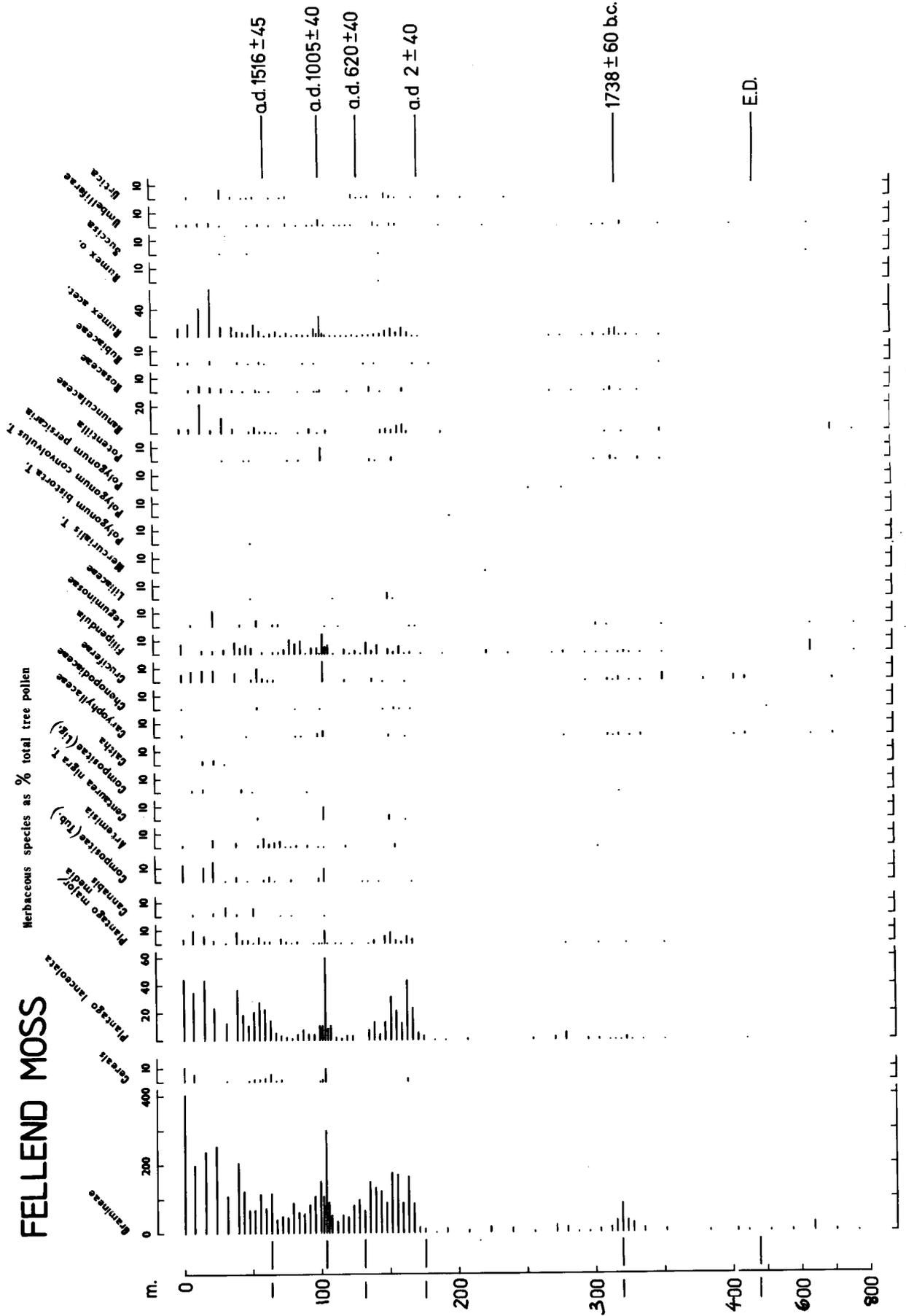


FIG. 11b

Note: Change of scale for lower part of diagram

FELLEND MOSS

Bog and aquatic species and spores as % total tree pollen

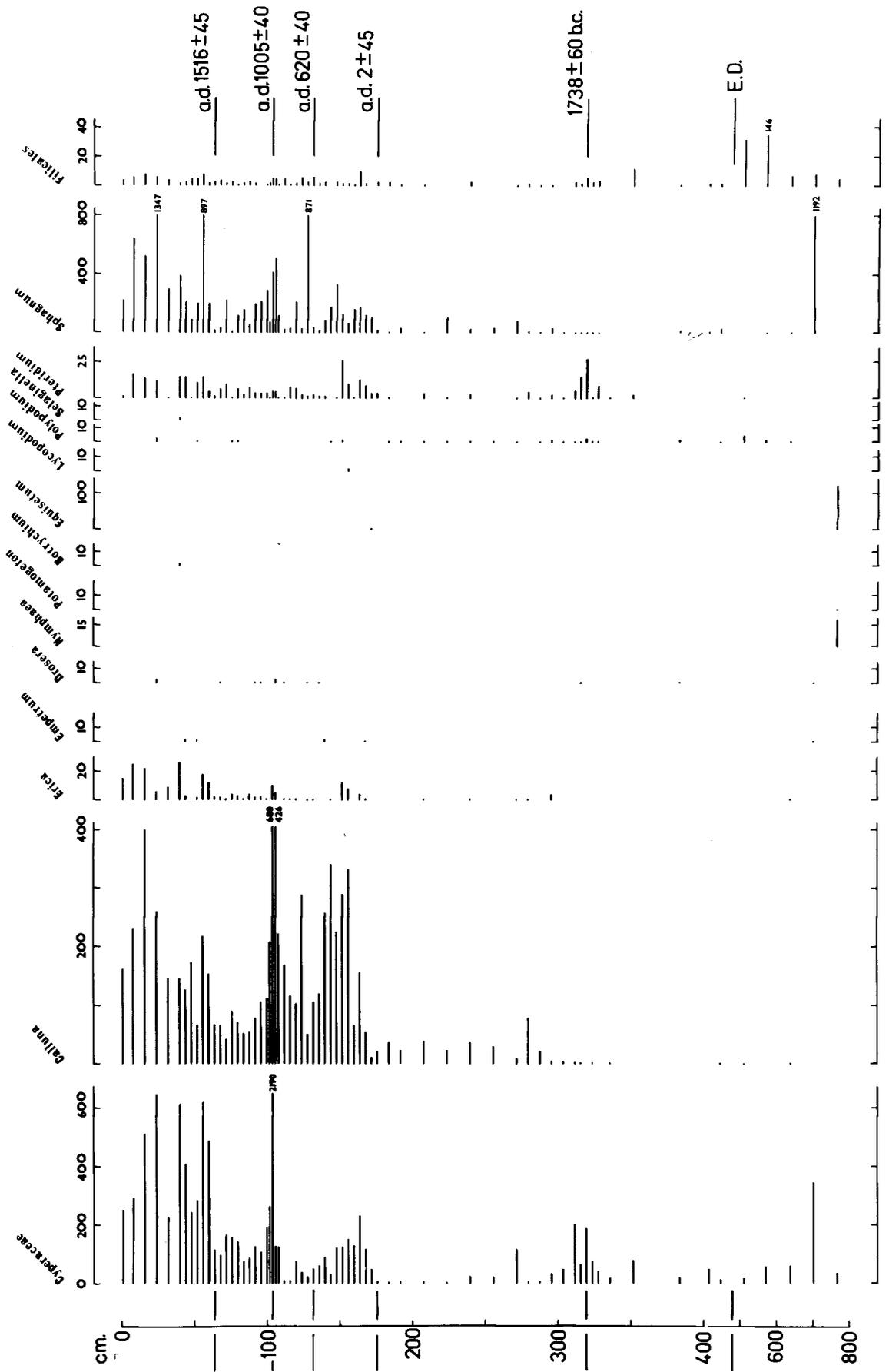


FIG. 11c Note: Change of scale for lower part of diagram

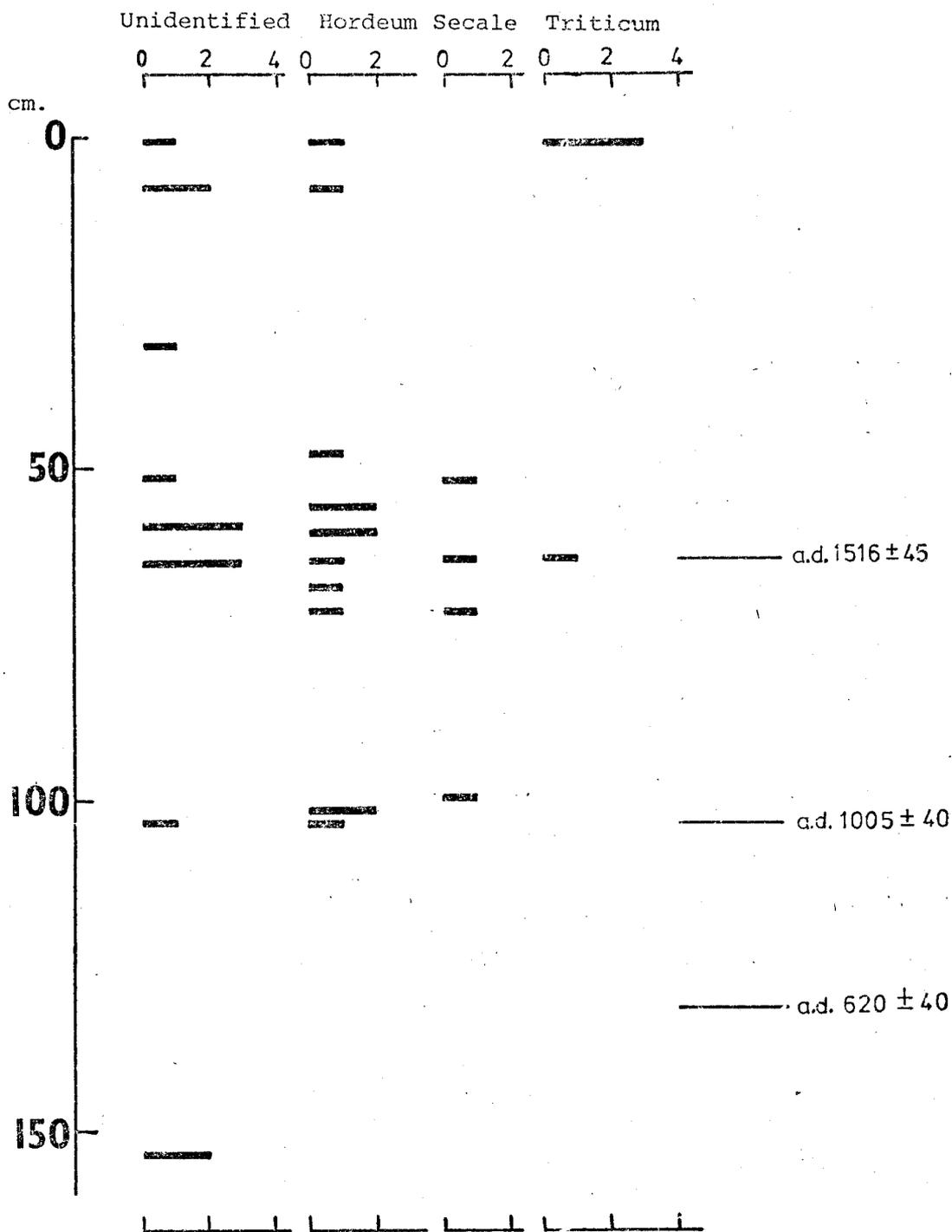


Fig. 11d Cereal pollen recorded at Fellend Moss
(shown as no. of pollen grains in the count).

CHAPTER 7

BROAD MOSS

7.1 Introduction

Broad Moss (N.G.R. NT 963215) is a raised peat bog resting on a wide col between the valley of the Harthope Burn and the headwaters of the Threestone Burn, in the north-western part of Northumberland. It is 7.3 km. south-west of the town of Wooler, 5.3 km. west of the village of Ilderton and 2.6 km. north-east of Hedgehope Hill, the second highest peak of the Cheviot Hills (Fig. 12). At 390 m. O.D. it is the highest of the sites examined during this study, and it lies at the junction of the Cheviot granite and the andesitic lavas which together form the bulk of the Cheviot Hills. Its largest dimensions are 0.6 km. x 0.85 km., but the western part has been disturbed by peat cutting (see Fig. 13). The surface vegetation is dominated by Eriophorum vaginatum, Calluna vulgaris and Sphagnum spp., with Polytrichum commune and Erica tetralix widespread.

7.2 Stratigraphy

Two line transects were laid out across the moss as shown in Fig. 13 and the stratigraphy was investigated at 80 m. intervals along each of the transects. A Dumpy level was used to determine the surface profile of the moss along the transects. Results of the investigation are shown in Figs. 14a and 14b.

The base of the moss is largely underlain by a thin layer of coarse clayey material which lies on bedrock. The lower part consists of wood peat with some well-humified Sphagnum and Eriophorum remains but the upper part consists almost entirely of Sphagnum and Eriophorum peat. There is no evidence to suggest that open water ever existed at the site.

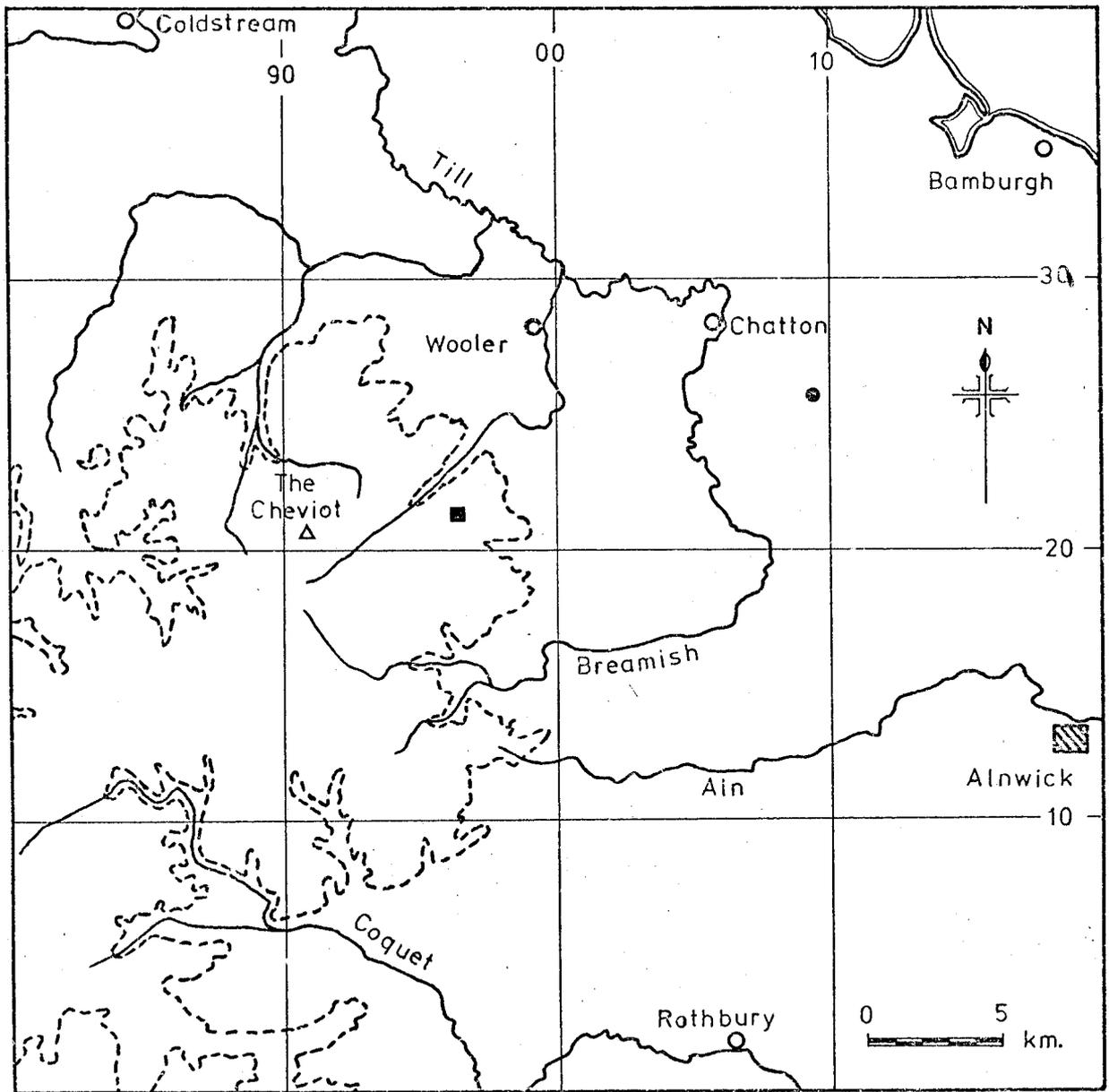


Fig.12 Map of locality of Broad Moss and Camp Hill Moss

Key

- ~ Major rivers
- - - Contour - 305 m. O.D.
- Broad Moss
- Camp Hill Moss

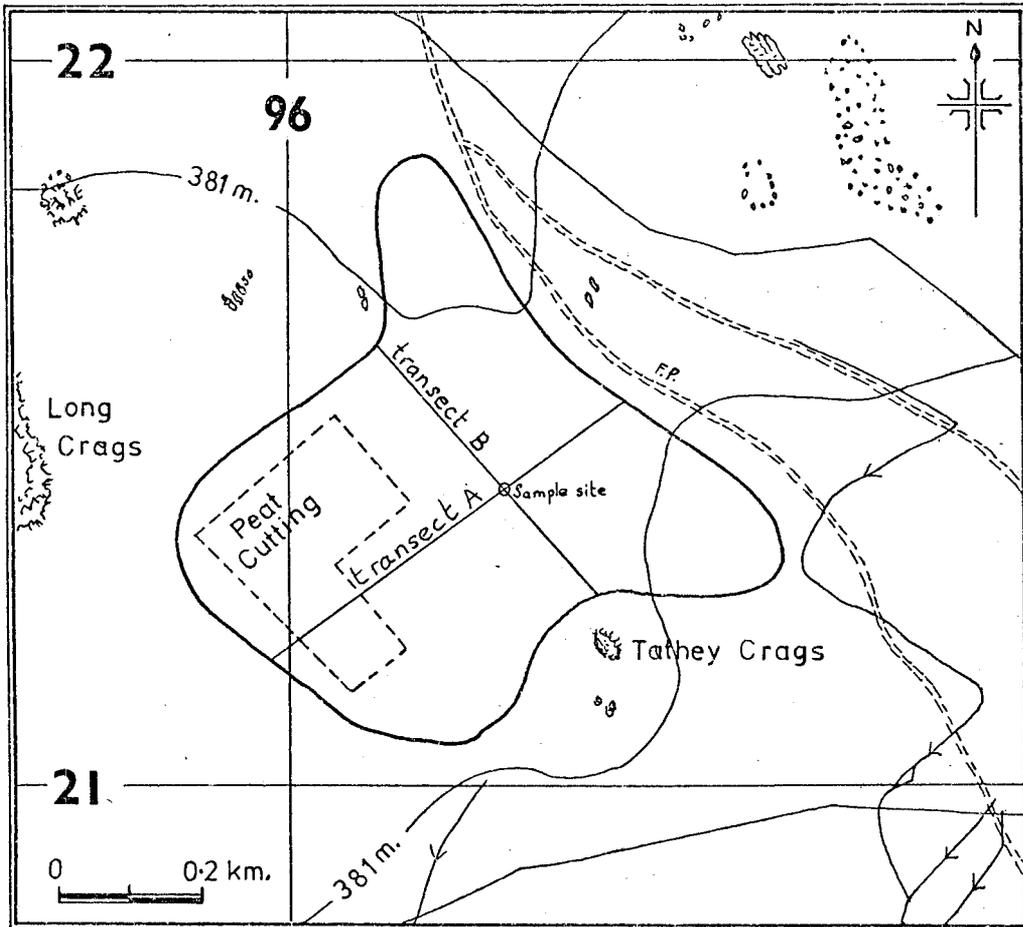


Fig. 13 Map of Broad Moss

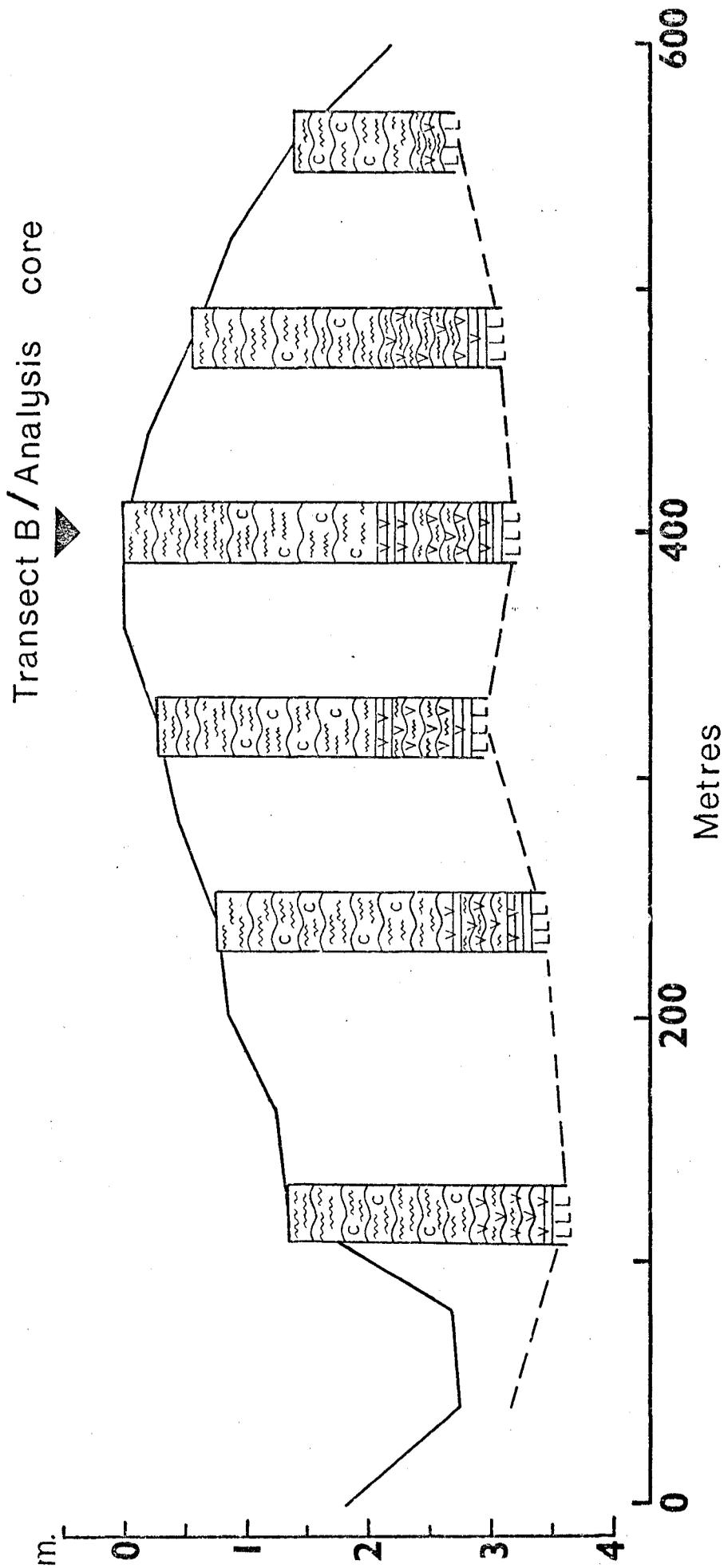


Fig. 14a Stratigraphy of Broad Moss : transect A.

Transect A/Analysis Core

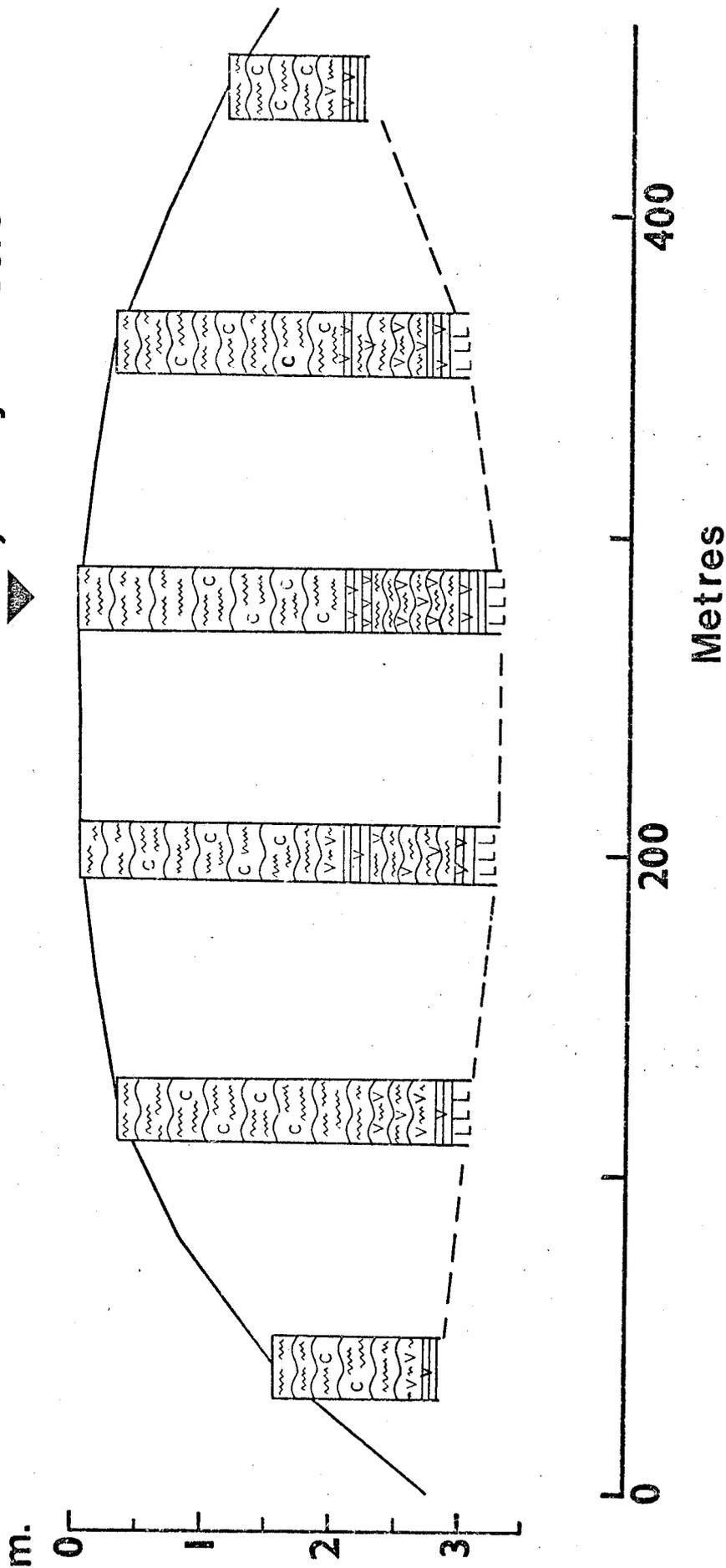


Fig. 14b. Stratigraphy of Broad Moss : transect B.

Stratigraphy at the core site was as follows:-

cm.

0 - 20	<u>Eriophorum</u> peat. H ₄
21 - 30	<u>Sphagnum/Eriophorum</u> peat. H ₃
31 - 77	<u>Eriophorum</u> peat with small amounts of <u>Sphagnum</u> . H ₄
78 - 100	<u>Sphagnum/Eriophorum</u> peat with <u>Calluna</u> . H ₅
101 - 124	<u>Eriophorum</u> peat. H ₆
125 - 135	<u>Sphagnum/Eriophorum</u> peat. H ₇
136 - 150	<u>Eriophorum</u> peat. H ₇
151 - 189	<u>Sphagnum/Eriophorum</u> peat with some <u>Calluna</u> remains. H ₇
190 - 204	Well-humified <u>Sphagnum/Eriophorum</u> peat with wood. H ₇
205 - 238	Amorphous peat with many wood fragments. H ₈
239 - 296	Well-humified <u>Sphagnum/Eriophorum</u> peat with wood fragments. H ₈
297 - 320	Amorphous peat with wood fragments. H ₈
320	Clay

7.3 Collection of Samples for Pollen Analysis

Initially, a pit was excavated with the intention of taking monolith samples from an exposed section, but this proved to be possible for only the upper 50 cm. of the profile. For this upper part the peat was taken in overlapping blocks of approximately 25 x 25 x 25 cm. These were transported back to the laboratory and cut into 1 cm. thick slices from which a 1 cm³ sample was taken for pollen analysis. The slices were then sealed in polythene bags and stored in boxes at 4°C.

The remainder of the profile down to 320 cm. was sampled with the Russian borer, taking four cores at each 50 cm. interval. Back in the laboratory, one core from each 50 cm. interval was cut into 1 cm. slices

and a 1 cu. cm. sample taken for pollen analysis from the centre of each slice. The rest of the cores were stored at 4°C in half-cylindrical plastic containers sealed in polythene bags.

Radiocarbon dating of samples from Broad Moss was not considered to be absolutely necessary because the pollen diagram displayed a similar pattern of forest clearance episodes to those recorded at Steng Moss and Fellend Moss, for which radiocarbon dates had already been obtained.

The laboratory techniques used to prepare and count the samples are described in Chapter 2. The macro remains, retained after sodium hydroxide treatment, were examined using a low power binocular microscope (x 10 - x 70 magnification). This examination allowed a more detailed description of the stratigraphy, as follows:-

<u>Depth (cm.)</u>	
0 - 20	<u>Eriophorum</u> peat.
21 - 56	<u>Eriophorum/Sphagnum</u> peat.
57 - 79	<u>Eriophorum</u> peat.
80	<u>Sphagnum/Eriophorum</u> peat with <u>Calluna</u> .
81 - 102	<u>Sphagnum/Eriophorum</u> peat.
103 - 122	<u>Eriophorum</u> peat.
123 - 186	<u>Sphagnum/Eriophorum</u> peat.
187 - 191	<u>Sphagnum/Eriophorum/wood</u> peat.
192 - 222	Highly humified peat with few remains
223 - 236	Highly humified wood peat.
237 - 282	<u>Sphagnum/Eriophorum/wood</u> peat.
283 - 320	Well humified wood peat.

The completed pollen diagram for Broad Moss is shown in Figs. 15a, 15b and 15c.

7.4 Interpretation of the pollen diagram

The absence of radiocarbon dates for the Broad Moss pollen diagram means that correlation of forest clearance episodes with historic and pre-historic events cannot be made directly. However, the general pattern of forest clearance activity shows many similarities with that at Steng Moss and Fellend Moss, and so, using the dates obtained from these two sites, an approximate dating of the Broad Moss diagram has been deduced.

In the lower part of the profile, Ulmus pollen values are very low, but at the same time Alnus, Fraxinus and Tilia are present. This suggests that the whole of the profile is composed of peat which formed after the onset of the elm decline, i.e. in zones VIIb and VIII.

It is noticeable that the amount of Betula pollen present is slightly higher throughout the profile, than might normally be expected. It may be that the woodlands represented in the diagram were predominantly those of higher land of the Cheviot Hills, where the altitude and nature of the terrain might have favoured an open woodland in which Betula species were well represented.

Tilia pollen is present in very small amounts in the lower part of the profile, but does not form a continuous curve. Its disappearance above 240 cm. cannot necessarily be interpreted as a 'Tilia decline' such as described by Turner (1962).

The first significant rise of Gramineae pollen occurs at 240 cm. although small amounts of Plantago lanceolata pollen are present below this level. Between 240 cm. and 216 cm., Gramineae pollen is slightly more abundant than previously and Plantago lanceolata and Rumex pollen form more or less continuous curves. Pteridium spores are also continuously present in small amounts. It is suggested that this represents an opening out of

the canopy as a result of grazing pressure, created by domestic stock, which affected the regeneration of trees. Comparison with the diagrams from Steng Moss and Fellend Moss favours an Early Bronze Age date for this activity.

Both Gramineae and Plantago lanceolata pollen rise to form small peaks in their curves at 212 cm. and 188 cm. The pollen of other Plantago species is present at the same time and Pteridium spores, present during the first Gramineae peak, rise to high values during the second Gramineae maximum. Cereal pollen grains are present at 212 cm. and 192 cm. and small amounts of pollen of other herbaceous plants such as members of the Compositae (Tubuliflorae) family and Urtica are present. This pollen assemblage is indicative of two periods of shifting agriculture of the kind seen at Steng Moss and Fellend Moss during the Bronze Age and Early Iron Age.

Although the presence of Gramineae, Plantago lanceolata, Rumex and Compositae (Tub.) pollen suggests that pastoralism was predominant, the appearance of small amounts of cereal pollen shows that some cultivation was practised.

Between 180 cm. and 160 cm. herbaceous plants are poorly represented on the pollen diagram. Small temporary clearances, characteristic of the phases of shifting agriculture, must have been scarce within the pollen catchment area, during the time represented by this section of the profile. Consequently the proportion of tree pollen is comparatively high.

However, at 160 cm. the first period of extensive forest clearance began with a rise of Gramineae, Plantago lanceolata, Plantago major/media, Artemisia, Ranunculaceae and Rumex pollen and of the spores of Pteridium. The proportion of herb pollen rises to very high values and remains so

until a rapid decrease takes place between 132 cm. and 128 cm. Cereal pollen was recorded at only one level during this phase, and the pollen of plants such as Urtica and members of the Compositae (Lig.), Chenopodiaceae and Cruciferae families, which are often associated with disturbance by cultivation, was present only in small amounts.

If this first phase of extensive forest clearance is correlated with similar events at Steng Moss and Fellend Moss, then it may be placed between the end of the Iron Age and the beginning of the Anglo-Saxon period of Northumberland. The pollen assemblage demonstrates the continued importance of a pastoral economy, with cultivation of apparently limited significance.

Towards the end of this phase, at 132 cm., Gramineae pollen is 290% of tree pollen, for this one level only. There is no proportional rise in the pollen curves of other associated herbaceous species. A good deal of the Gramineae pollen present at this level is of the large group described by Faegri and Iversen (1975) as 'Festuca type', which includes the genus Molinia. It is possible that Molinia was growing on or near the bog and that anthers were deposited on the bog surface by birds or wind, giving rise to an over-representation of Gramineae pollen at this level. It is unlikely that an increase of Gramineae pollen due to the extension of pastureland could have occurred without a concomitant increase of other herbaceous species.

Above 128 cm. Gramineae pollen falls rapidly from 118% to 49% of tree pollen at 124 cm. and then more gradually to 30% at 108 cm. A similar decline occurs for Plantago lanceolata and Rumex pollen. Pteridium spores are absent between 132 cm. and 112 cm. The proportion of tree pollen rises correspondingly and indicates that much land was abandoned and forest regeneration allowed to take place. If the period

of extensive clearance corresponds to the Britanno-Roman periods of Steng Moss and Fellend Moss, the decline would have occurred early in Anglo-Saxon times.

From 108 cm. to 100 cm. there is once more a rise of herbaceous pollen; in particular of Gramineae, Plantago lanceolata and Rumex pollen and during which, small amounts of cereal pollen are present. However, all these curves fall slightly before rising again at the beginning of a second period of clearance.

Between 92-96 cm. and 60 cm., the proportion of pollen derived from herbaceous plants is comparatively high. Gramineae, Plantago lanceolata, Rumex and Ranunculaceae pollen and Pteridium spores are high throughout this period, suggesting that pastoral farming was an important activity. The amount of land used seems to have been gradually extended between 84 cm. and 72 cm. as evidenced by relatively large amounts of Artemisia pollen, some Compositae (Tubuliflorae) pollen and increased amounts of Gramineae and Rumex pollen. Gramineae, Plantago lanceolata and Rumex pollen percentages are very high at the 72 cm. level, being 167%, 53% and 17% of tree pollen respectively.

Nevertheless, cereal pollen is continuously present between 96 cm. and 64 cm. Cruciferae pollen is high between 80 cm. and 72 cm. and Chenopodiaceae pollen is present as 4% of tree pollen at 76 cm. Thus for at least some part of this clearance period, mixed farming was apparently the common practice.

It is worth noting the single occurrence of Juglans pollen at 96 cm. Juglans is thought to have been brought to this country by the Romans, its English name being derived from the Celtic word 'wealdh', meaning foreign.

Above 72 cm., the pollen of herbaceous plants declines, very

rapidly at first, levels off between 68 cm. and 60 cm., then declines again, such that at 56 cm. Gramineae pollen is only 28% of tree pollen, Plantago lanceolata pollen is 6%, that of Rumex is 1% and cereal pollen is absent. This decline may be correlated with similar phenomena noted at Steng Moss and Fellend Moss, where the very high peak of herbaceous pollen (72 cm. at Broad Moss) occurs around A.D. 900 and A.D. 1030 respectively, and has been attributed to the arrival of Scandanavian settlers in Northumberland. At Broad Moss, the pattern of decline is rather more like that at Steng Moss in so much as herb pollen values level off for a short while after the initial drop and then fall again.

If the assumptions that have been made concerning the dating of this episode of forest clearance can be relied upon, then it becomes evident that in the pollen catchment area of Broad Moss there was much more forest clearance and agricultural activity in Mid to Late Anglo-Saxon times than at either Fellend Moss or Steng Moss. This is perhaps not unexpected. The royal palace of the seventh century Northumbrian kings has been excavated at Yeavering near Wooler (Hope-Taylor, 1961). The area was thus a centre of Anglo-Saxon activity, and must have continued to be so.

The regeneration of forest recorded by the pollen diagram and reaching a maximum at 56 cm. seems likely to have been a result of the environmental and political changes which took place during the fourteenth century and which brought about a general decline of agriculture over much of northern Europe.

At 48 cm. a rise in the proportion of herbaceous pollen marks the beginning of a period of massive forest clearance lasting until the present day. Gramineae and Rumex pollen curves rise progressively to reach very high maxima of 494% and 67% of tree pollen respectively, whilst the maximum

of the Plantago lanceolata pollen curve is 125% at 20 cm. Excepting for the top 8 cm. of the profile, Plantago major/media, Compositae (Tub.) Artemisia, Cruciferae, Ranunculaceae and cereals present more or less continuous pollen curves during this final clearance episode, with comparatively high values recorded.

There was apparently greater emphasis placed on arable farming than had previously been the case, for large amounts of cereal pollen were recorded, along with pollen of plants commonly associated with disturbance by cultivation, such as members of the Cruciferae, Chenopodiaceae and Compositae (Lig.) families and of Centaurea cyanus. In addition, Cannabis pollen occurs in relatively large amounts between 40 cm. and 16 cm., with a maximum of 19% at 36 cm. It would seem, therefore, that once the political strife in the Border region had ceased, the area around Broad Moss became agriculturally important, with large amounts of land made over to both arable and pastoral farming.

This may have lasted until the twentieth century, but in the top 8 - 12 cm. of the profile, herbaceous pollen percentages decline slightly in favour of tree pollen. This seems likely to be largely a result of modern afforestation schemes, evidenced by increased amounts of Pinus pollen, but may also be partly due to some abandonment of marginal land allowing a spread of moorland communities.

Corylus pollen shows a steady decline during the final period of extensive clearance. This is probably due in part to the declining importance of coppicing, and in part to the demand for arable and pastoral land.

7.5 Summary of Events

An approximate dating of the pollen diagram for Broad Moss has been attempted because the pattern of forest clearance episodes appears

to be very similar to those for Fellend Moss and Steng Moss. Periods of small temporary clearances, indicative of the practice of shifting agriculture, occur during times that are suggested to be Bronze Age to Pre-Roman Iron Age. Subsequently, there are three periods of extensive forest clearance which are equated with the three major clearance episodes of Fellend Moss and Steng Moss, namely Britanno-Roman, Mid Anglo-Saxon to Early Medieval and c. 15/16th Century to present. During the so-called Britanno-Roman clearance period, cultivation was of minor importance, but during the two later periods, mixed farming was practised, with arable farming of some considerable importance during the final period.

BROAD MOSS

Trees and shrubs as % total tree pollen

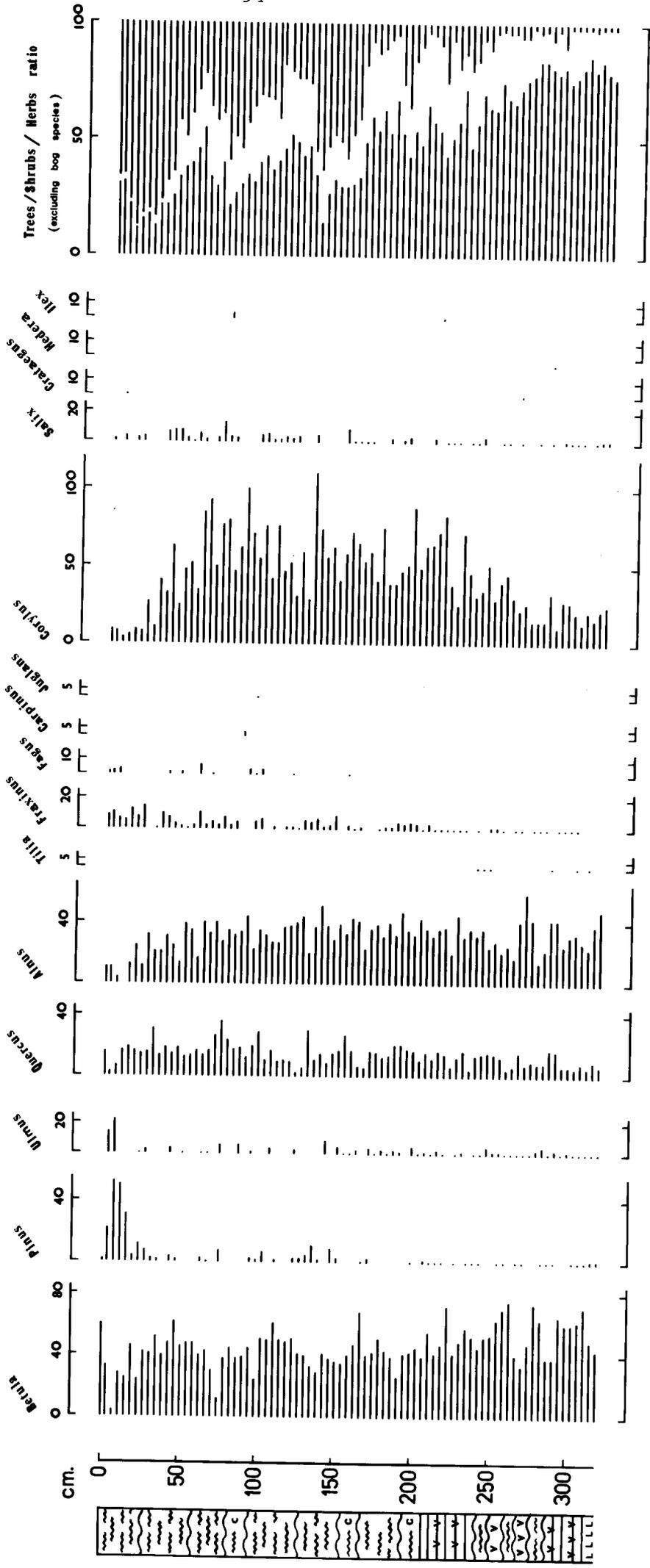


FIG. 15a

BROAD MOSS

Pollen of bog species and spores as % tree pollen

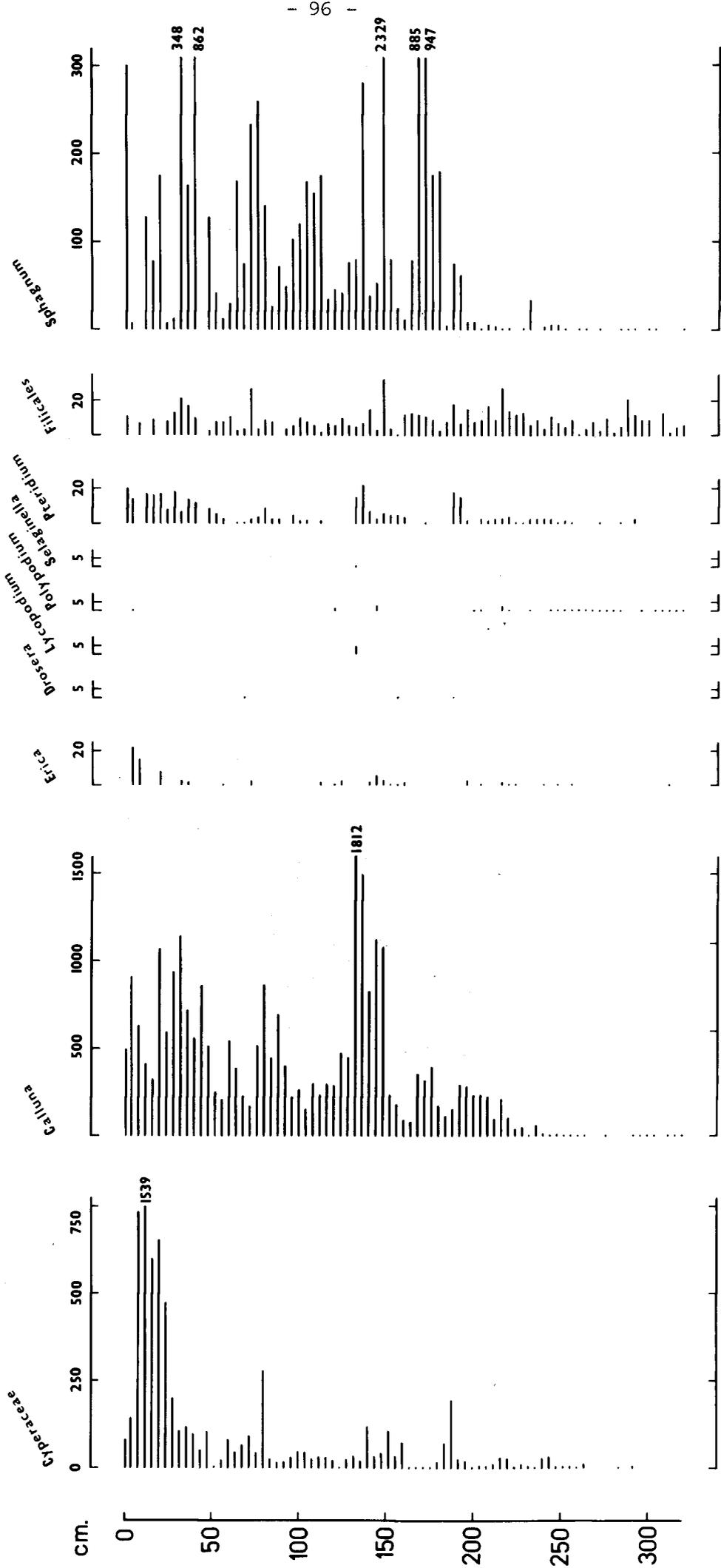


FIG. 15c

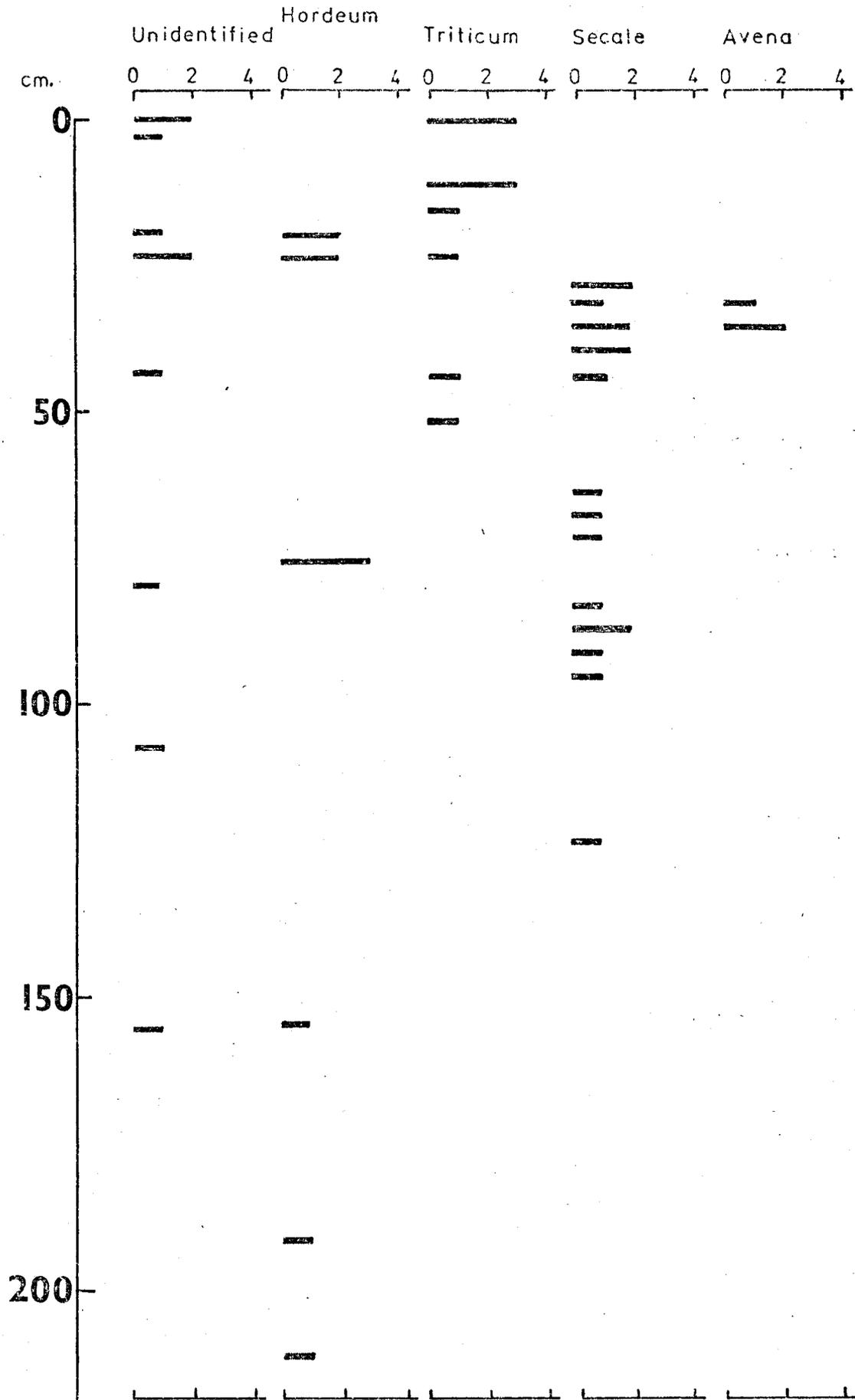


Fig. 15d Cereal pollen recorded at Broad Moss
(shown as no. of pollen grains in the count).

CHAPTER 8

CAMP HILL MOSS

8.1 Introduction

Camp Hill Moss (N.G.R. NU 100263) is 4.0 km. east of the village of Chillingham, 11.2 km. east-south-east of Wooler and 7.7 km. south of Belford in the north-eastern part of Northumberland (Fig. 12). It is situated at c. 205 m. O.D. in a shallow basin between the low ridges of Willie Law and Camp Hill, and, at 150 m. x 100 m., it is the smallest of the mosses investigated.

The moss is c. 1.5 km. to the east of Millstone Hill, where non-sepulchral cairns were excavated (see Chapters 4 and 9). In addition, cairnfields occur at either side of the moss on both Willie Law and Camp Hill. There is a long cairn on the southern side of Millstone Hill which is presumed to be of Neolithic age. Bronze Age remains have been found around the site, (Jobey, 1968) and Iron Age settlements are to be seen in the area, notably the hillforts of Ross Castle, 2.1 km. to the south-west and Old Bewick, 5.3 km. south-south-west. Roman remains are not so abundant as further south, although the Roman road known as the Devil's Causeway ran along the valley of the Till, 6.5 km. to the west of Camp Hill Moss.

Surface vegetation is dominated by Eriophorum vaginatum, Calluna vulgaris and Sphagnum spp. with Polytrichum commune also evident.

8.2 Stratigraphy

Two transects were laid out across the bog as shown in Fig. 17 and the stratigraphy was investigated using a Russian-type peat borer. A Dumpy level was used to determine the surface profile of the moss along

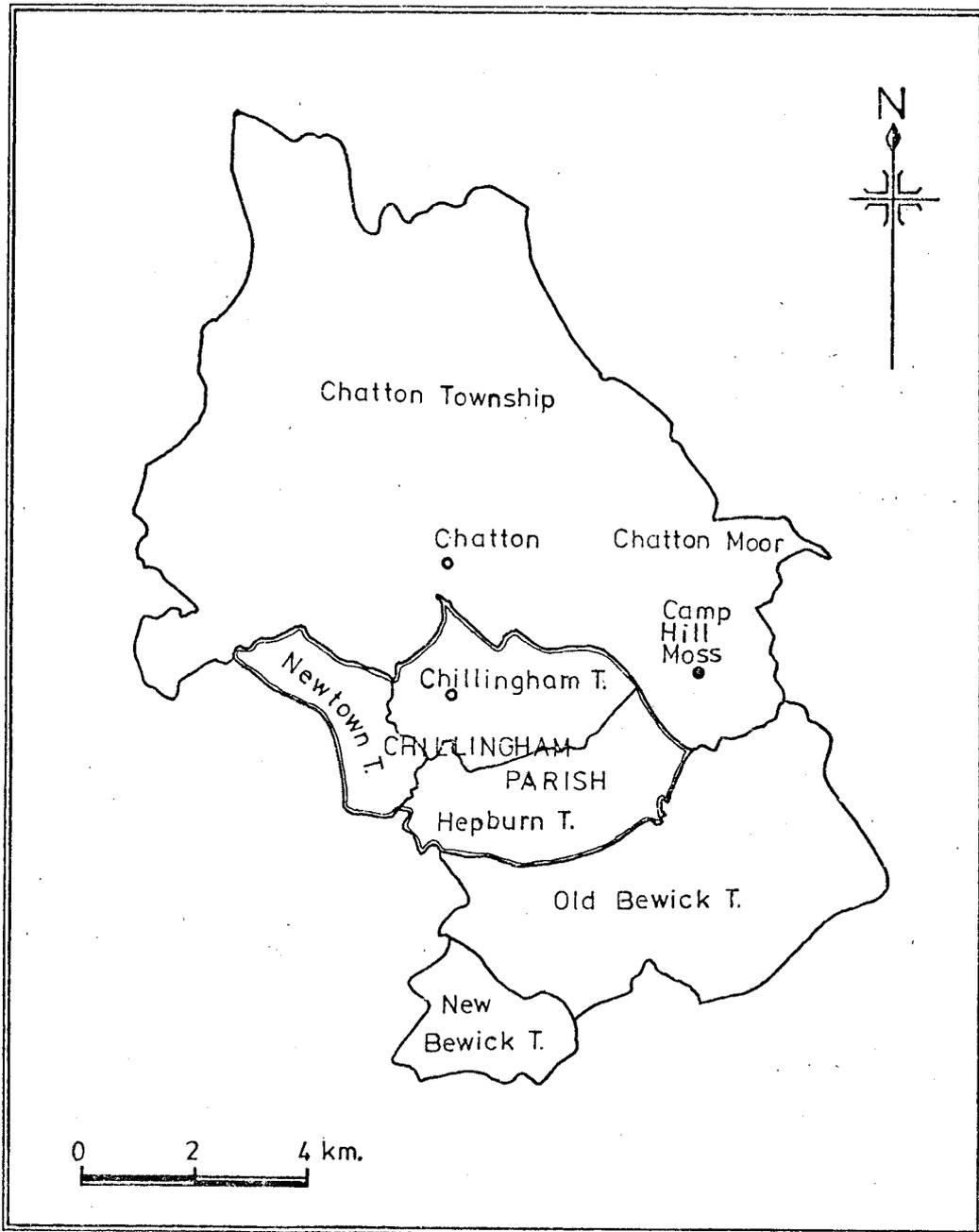


Fig. 16 Sketch map showing Parishes and Townships around Camp Hill Moss

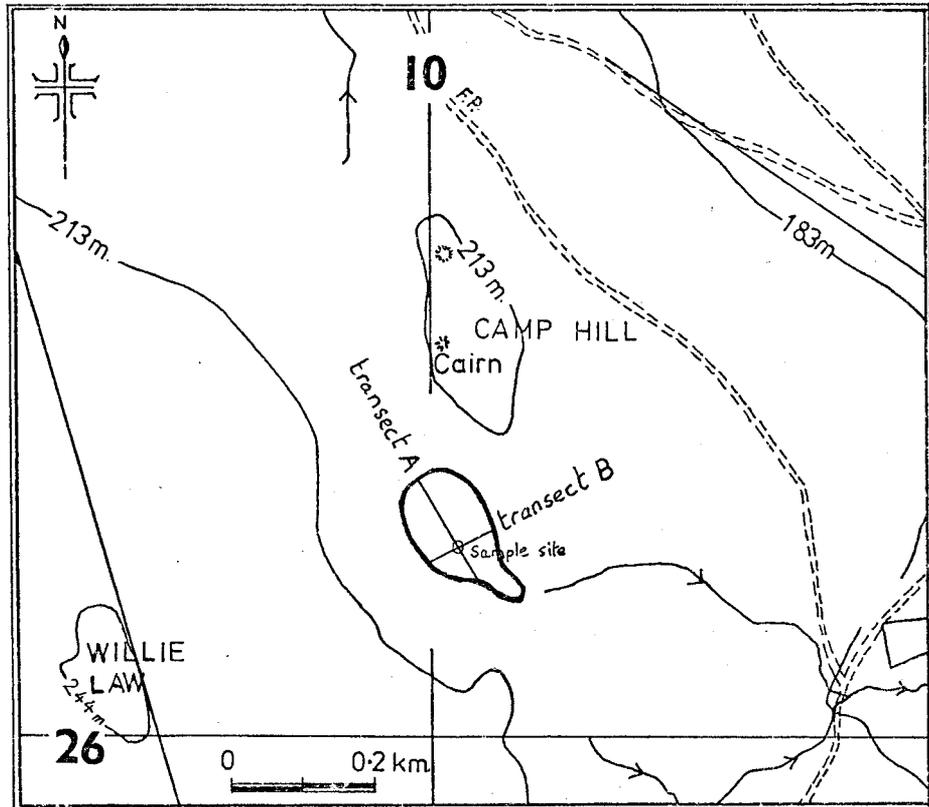


Fig. 17 Map of Camp Hill Moss

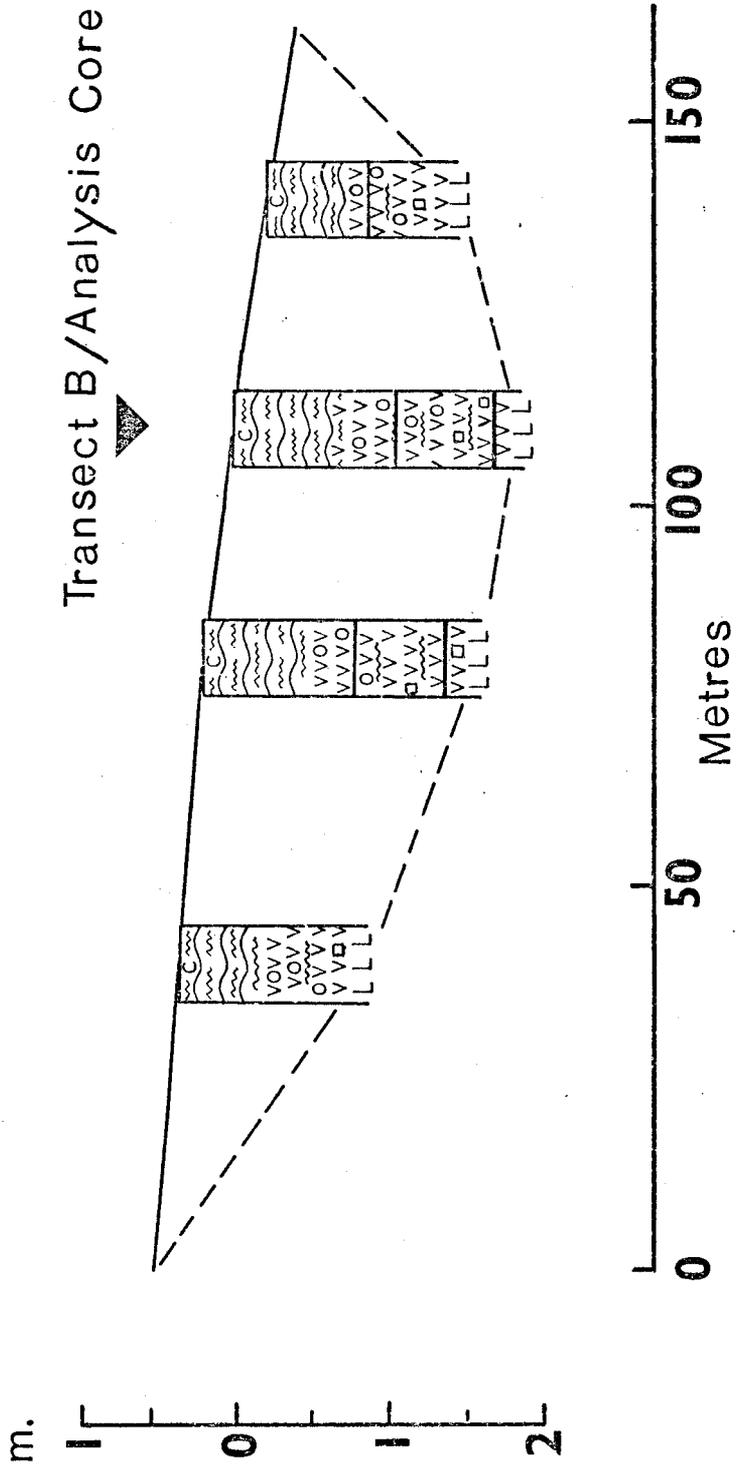


Fig. 18a. Stratigraphy of Camp Hill Moss : transect A

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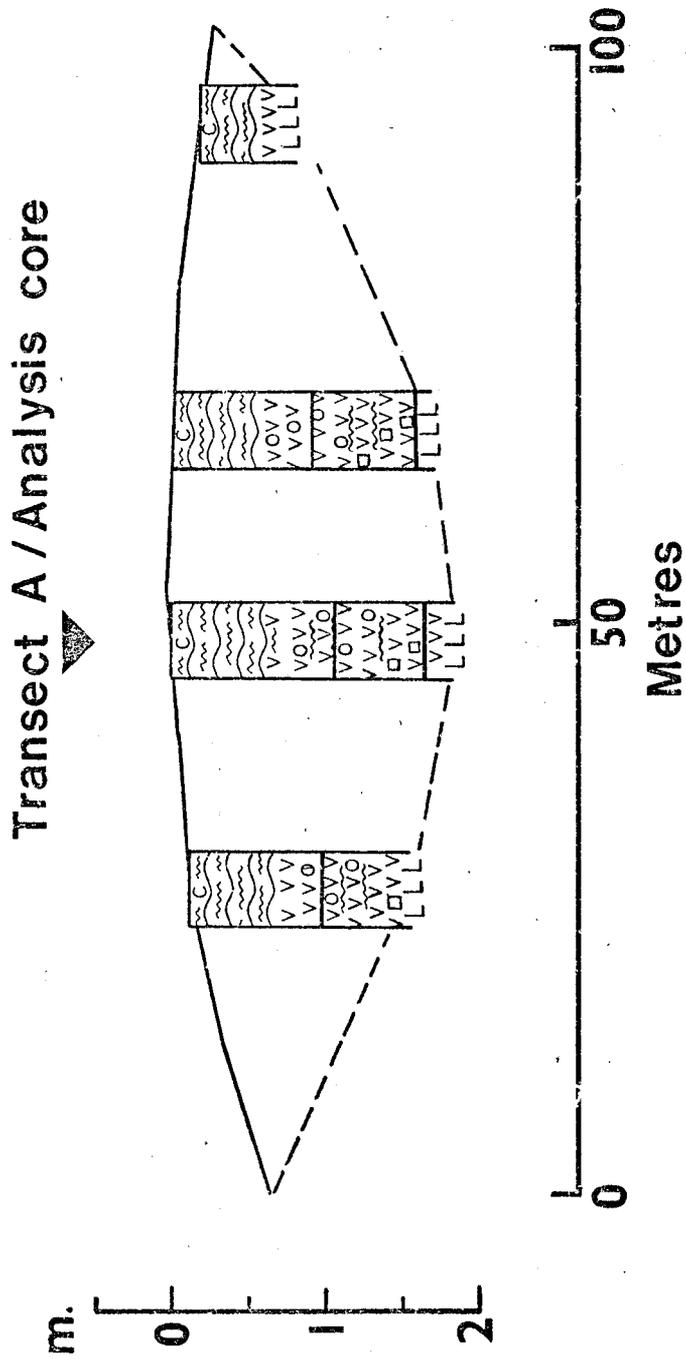


Fig. 18b. Stratigraphy of Camp Hill Moss : transect B.

Fig. 18b

the transects. Results of these investigations are shown in Figs. 18a and 18b. The base of the moss is underlain by coarse clayey material above which the peat is largely wood peat, sometimes with large pieces of wood preserved. Wood remains are particularly dense between about 100 cm. and 60 cm. at the core site. The uppermost peat layers consist of Eriophorum and Sphagnum peat with some Calluna remains.

Stratigraphy at the core site was as follows:-

<u>cm.</u>	
0-18	<u>Eriophorum/Calluna</u> peat. H ₅
19-60	<u>Eriophorum/Sphagnum</u> peat. H ₅
61-105	<u>Eriophorum/Sphagnum</u> peat with dense concentration of large pieces of <u>Betula</u> wood. H ₅
106-187	Highly humified peat with many pieces of wood. H ₇
188	Clay

8.3 Collection of pollen analysis and radiocarbon samples

The peat at the deepest part of the moss was sampled by excavating a pit and cutting the samples from the sides in the form of 25 cm³ overlapping blocks. This was possible for the whole depth of peat, the clay base being encountered at 1.87 m. below the surface. The blocks were returned to the laboratory and cut to 25 cm² x 1.5 cm. slices, and a 1 cm³ sample was taken from the centre of each slice for pollen analysis. The slices were then sealed in polythene bags and stored in boxes at 4°C. Samples selected for pollen analysis were prepared and counted according to standard methods described in Chapter 2. A more detailed analysis of the stratigraphy was made by examining the macro remains retained after sodium hydroxide treatment. Results of this examination were as follows:-

<u>cm.</u>	
0-2	<u>Eriophorum/Calluna</u> peat with <u>Paludella squarrosa</u> .
3-17	<u>Eriophorum/Calluna</u> peat with small amounts of <u>Sphagnum</u> .
18-30	<u>Eriophorum/Sphagnum</u> peat.
31-35	<u>Eriophorum</u> peat.
36-62	<u>Eriophorum/Sphagnum</u> peat with <u>Paludella squarrosa</u> at 54 - 56 cm.
63-71	<u>Eriophorum/Sphagnum/Wood</u> peat.
72-145	Wood peat with <u>Eriophorum</u> .
146-187	Highly humified wood peat.

After completion of the pollen diagram, five levels were selected for radiocarbon dating. All were sent to the Harwell radiocarbon dating laboratory. Results of the radiocarbon assays are shown in Table 6. The assay dates have been corrected using tables given by McKerrell (1975), in which standard 5568 C_{14} dates are converted to tree-ring calendar years. To enable easy comparison with other pollen diagrams and archaeological data, the dates shown on the pollen diagrams are conventional 5568 C_{14} dates. The range given for all dates is that of one standard deviation. The dates used in the discussion are identified in the conventional manner by the use of capital letters to identify corrected dates and small letters to indicate uncorrected dates. Corrected dates have been used to calculate rates of peat formation.

8.4 Interpretation of the pollen diagram

Besides having the smallest surface area of any of the peat moss sites investigated, Camp Hill Moss is also comprised of the shallowest depth of peat, being only 1.87 m. at its deepest part. In addition the

pollen diagram presented problems of interpretation not encountered with those from previous sites.

The major problem was that of local over-representation of Betula and Alnus pollen in certain parts of the profile. Large pieces of Betula and Alnus wood, preserved in the peat, testify to the presence of those trees on the bog itself, which explains why their pollen is present in such quantities. A consequence of this over-representation was the depression of the calculated percentages of other species, tree, shrub and herbaceous, and thus a distortion of the pattern of events depicted by the pollen diagram. A correction factor was thus incorporated in all calculations for levels at which over-representation was thought to have been significant and where macro remains of the over-represented species could be demonstrated. The method used was that initially suggested by Faegri (1944) and later by Faegri and Iversen (1975), in which the over-representation is compensated for by assuming that the pollen percentage of the species in question has changed continuously between two adjacent 'normal' spectra. Percentages in between may then be calculated from the formula

$$p_1 = a_p \frac{100 - r_1}{s - a_r}$$

where p_1 is the 'corrected' percentage to be calculated, a_p the number of pollen grains of the species in the count, r , the fixed percentage of the over-represented species, a_r the number of pollen grains of the species, and s the total of all pollen grains in the sum.

Between 132 cm. and 49 cm. the 'normal' value for Betula pollen was considered to be 45% of total tree pollen, and between 187 cm. and 144 cm. the 'normal' value for Alnus pollen was estimated to be 40% of total tree pollen. All other values in these parts of the profile were re-calculated accordingly. The counted values are shown on the pollen

diagram as solid sections, whilst corrected values are represented by the solid section plus an outline section. In the case of Alnus and Betula pollen curves, the 'fixed' percentages are represented by a break in the solid section. The tree/shrub/herb ratio shown on the diagram is based on uncorrected counts. All percentages quoted in the text are corrected.

The second major problem of interpretation concerns the radiocarbon dating of peat from 29 - 30½ cm. The assay date of 1950 ± 70 radiocarbon years is clearly too young, and thus one must assume that some contamination of the sample occurred. Possibly modern roots were present in the peat at this level, although they were not revealed by visual examination of the sample. This assay result has not been recorded on the pollen diagram nor used to calculate rates of peat formation. The surface sample is assumed to be 0 radiocarbon years.

In like manner to the procedure adopted in previous chapters, the pollen diagram for Camp Hill Moss has not been arranged into local pollen assemblage zones. Radiocarbon dating of five levels has allowed correlation with historical and archaeological periods.

The whole of the profile is apparently later than the elm decline, Ulmus pollen percentages being very low throughout most of the section.

Although human interference is likely to have been primarily responsible for the elm decline, there is no evidence for forest clearance as such, below 121 cm. (1560 ± 70 b.c.). There is a distinct band of charcoal at 170 - 174 cm., but the pollen diagram shows no evidence of clearance at this level. Burning must therefore be ascribed either to natural agencies or to a passing group of Neolithic herders or hunters.

Alnus pollen decreases rapidly between 152 cm. and 140 cm. such that at 140 cm. it is no longer considered to be over-represented. Betula

pollen, however, rises to high values just as Alnus is declining, and large amounts of Betula wood are preserved in the peat. Very large pieces of Betula wood are present between 100 cm. and 60 cm.

It is suggested that a gradual change from Alnus to Betula took place when peat growth had progressed so far above the inorganic base of the moss that growth of a less demanding species, in terms of mineral requirements, was enhanced. A change to a drier climate and resultant drying out of the bog would have produced the same effect, but there is no evidence to indicate a climatic change in Northumberland at this time, nor is there any stratigraphical evidence from the peat profile.

The first distinct evidence for forest clearance comes at 121 cm. when Plantago lanceolata and Rumex acetosa/acetosella pollen appear as continuous curves and Gramineae pollen rises slightly. Peat from 119½-121 cm. was radiocarbon dated to 1560 ± 70 b.c. which corresponds well with the date of 1690 ± 90 b.c. for carbonized material obtained from beneath the cairn on Millstone Hill.

Between 121 cm. and 100 cm. Plantago lanceolata, Rumex acetosa/acetosella and Gramineae pollen are maintained at significantly high values to indicate continued land-use in the area. Peat from 98½-100 cm. gave a radiocarbon date of 1160 ± 80 b.c. The pollen assemblage suggests that small temporary clearances, typical of a shifting agricultural economy, and noted at other sites in Northumberland (Chapters 5, 6 and 7) were continuously present in the pollen catchment area of Camp Hill Moss during the Early to Mid Bronze Age. The correlation afforded by radiocarbon dates points to the association of this phase of clearance activity with the cairnfields of Millstone Hill and adjacent areas. It should be noted though, that as with similar episodes in other parts of Northumberland, there is no pollen analytical evidence to indicate that cultivation was of any importance.

After this early period of activity, Plantago lanceolata, Rumex acetosa/acetosella and Gramineae pollen values fall again, indicating that the density of small temporary clearances decreased until a further rise of these pollen types at 80 cm. shows a renewal of agricultural activity in the pollen catchment area. Peat from 79 - 80½ cm. was radiocarbon dated to 720 ± 70 b.c. (890 B.C.) placing the beginning of this phase of renewed clearance activity in the Late Bronze Age. It continues with cultivation apparently of slightly more importance. Cereal pollen appears during this period, together with small amounts of pollen from plants associated with arable activity such as Centaurea cyanus and members of the Compositae (Liguliflorae) and Cruciferae families.

The end of this period of comparatively small scale forest clearance is marked by a very dramatic rise of herbaceous pollen types at 54 cm. Peat from 52½ - 54 cm. was radiocarbon dated to a.d. 1310 ± 80 (A.D. 1325). It would seem, therefore, that there was little or no intensification of forest clearance around Camp Hill Moss during the Late Iron Age/Romano-British period, such as was found at sites situated on the main Pennine massif.

From 54 cm. the pollen catchment area of Camp Hill Moss was progressively cleared of forest, with pollen of many herbaceous plants rising to very high values. Gramineae pollen rises to 500% of tree pollen, that of Plantago lanceolata to 100%, Rumex acetosa/acetosella to 28%, and Compositae (Tubuliflorae) to 21%, all of which points to the establishment of large areas of pasture land. The increased significance of arable farming is shown by a rise of cereal pollen to 22% of tree pollen, with large amounts of Cruciferae and Urtica pollen present and lesser amounts of Cannabis, Compositae (Liguliflorae), Chenopodiaceae and Leguminosae pollen.

It is worth noting that the pollen of Juglans, an introduced tree species, is present in levels at either side of the radiocarbon dated level, i.e. A.D. 1325. Pollen of this species was found at Broad Moss, although probably from a slightly earlier date.

After the maximum of herbaceous pollen at 31 cm., the herbaceous pollen curves fall rapidly before rising to very high values once more. There must have been a short period when the intensity of land use was relaxed and some forest regeneration allowed to take place. After reaching a second maximum at 22 cm., pollen of herbaceous species declines, largely because of a rise of Pinus and Ulmus pollen. The rise of Pinus pollen is probably associated with afforestation schemes in modern times. The rise of Ulmus pollen is also a typical feature of modern times. Corylus pollen declines at the same time as that of herbaceous species, probably a result of the decreasing importance of hazel coppicing.

The pollen diagram for Camp Hill Moss differs greatly from those for the other three Northumberland sites in that here, the beginning of the first extensive clearance of forest has been radiocarbon dated to A.D. 1300 - 1350, much later than at the other sites. It must be remembered though, that Camp Hill Moss has a much smaller surface area than the other mosses investigated, and that pollen falling on to the bog surface is likely to have originated from a more localized area.

Camp Hill Moss lies in the south-eastern part of Chatton township in Chatton parish and just to the east and north-east of Chillingham and Old Bewick townships respectively (Fig. 16). Part of these three townships, including that part of Chatton which contains Camp Hill Moss, lies on the Fell Sandstone plateau to the east of the Till valley and part lies within the confines of the valley itself. The historical record (N.C.H. XIV, 1935) shows that many farmsteads were in existence in the

townships during the thirteenth century, but that there were also forest areas maintained for hunting which included some areas of 'moor'.

In 1279 John de Vesci obtained licence to enclose his moor of Chatton (probably to the north of Camp Hill Moss) which was within the bounds of the royal forest. The moor contained 300 acres and there was a covert of 16 acres within it. In the quo warranto proceedings of 1291/92 William de Vesci claimed free warren in the forest of Chatton except for about 200 acres which had been disforested by the king (Hodgson 1820). This was evidently the enclosure which had been licensed in 1279, forming Chatton Park. In 1368 it was stated that Henry, Lord Percy held in Chatton a park called 'le Kelsowe' with wild animals in it, which was of no value except for the maintenace of wild animals.

The first known lord of Bewick was Arkle Moreal of Bamburgh whose lands were forfeited to Henry I in 1095. These were eventually given to St. Albans Abbey and its cell Tynemouth Priory, c. 1105-6. In 1295 the lands of the Priory were measured field by field and there were 253 acres of arable land and 33 acres of pasture. The prior of Tynemouth also had extensive forest rights in Bewick. In a list of payments made by the priory between 1235 and 1260 there is 'for the fine of the forest of Bewick to the Lord king, £20' (NCH VIII, p.76 n, 1907).

There is no record of the enclosure of the common lands of Chatton. The lord's waste was gradually brought under cultivation: in each of the rentals there are fresh intakes, called improvements in the later rentals. In the survey of 1616 it was stated that 'The lords of the said manor have had there in ancient time a park which now is and of long time hath been disparked ... there are not great timber wood of oak or other kind of wood within the said manor, saving some small wood of oak, ash and such like which grow in certain places of the park and at Chatton Sheles.' (NCH XIV, 1935).

The impact of the plague and the Scots raiding were certainly felt in these townships during the fourteenth century. The second Lord Percy died in the early spring of 1351/2 and the inquistio post mortem after his death shows the ravages of the Black Death in Chatton. Out of 27 bondage holdings, 11 were lying waste for lack of tenants and out of 13 cottages, 8 were waste and uncultivated. Chatton and Chillingham were two of the parishes which in 1344 petitioned the king for relief from taxation because they were laid waste by the ravages of the Scots. In Chillingham in 1353, out of 22 farmsteads only 4 had tenants and the rest were laid waste, but this may have been due in part to the Black Death.

The historical record suggests that the lowland parts of the townships were cleared at an early date and used for arable and pastoral farming, but that the upland parts, apart from some small tracts, were not disforested until sometime between c. 1300 - c. 1550.

The pollen diagram indicates that this began c. 1300 - 1350, and it is from this time that cereal pollen begins to appear in quite large amounts in the pollen assemblage. However, it is difficult to accept that large tracts of land were being cleared at a time when the climate had deteriorated and the Scots raids and Black Death had led to the abandonment of many farms. A slightly later date would seem to be much more likely. The final phase of extensive clearance at Fellend Moss for example, which also felt the decline of the fourteenth century, begins at about A.D. 1400 - 1440.

8.5 Summary of Events

Peat growth began at Camp Hill Moss at some time after the elm decline, and for most of its history trees were apparently growing on the bog, much of the peat being wood peat. Forest clearance began in

the pollen catchment area in the Early Bronze Age and it is to this period that the small non-sepulchral cairns, comprising the 'cairnfields' in the vicinity of the bog, are assigned. Human activity at this time was probably of the small temporary clearance type associated with shifting agriculture.

This pattern remained much the same, although with cereal cultivation perhaps becoming of more importance until around A.D. 1325 when rapid and extensive clearance of the forest took place. The pollen assemblage thereafter suggests that both pastoral and arable farming were widely practised until, at the 20 cm. level, much land was apparently abandoned to moorland or forest.

TABLE 6

RESULTS OF RADIOCARBON ASSAY ON PEAT SAMPLES FROM CAMP HILL MOSS

Laboratory Reference Number	Depth (cm.)	Significance	Assay Date (5568 C ₁₄ yrs.)	Corrected Date	Average of Tree-ring range (Tree-ring calendar yrs.)
HAR - 1949	29 - 30½	Dates maximum of first very high rise of herbaceous pollen	a.d. 1950 ± 70	-	-
HAR - 1948	52½-54	Dates beginning of extensive and permanent clearance	a.d. 1310 ± 80	A.D. 1300-1350	A.D. 1325
HAR - 1947	79 - 80½	Dates beginning of a period of small temporary clearances	720 ± 70 b.c.	910-870 B.C.	890 B.C.
HAR - 1946	98½-100	Dates the end of first period of small temporary clearances	1160 ± 80 b.c.	1510-1420 B.C.	1465 B.C.
HAR - 1945	119½-121	Dates the beginning of first period of small temporary clearances	1560 ± 70 b.c.	2070-1990 B.C.	2030 B.C.

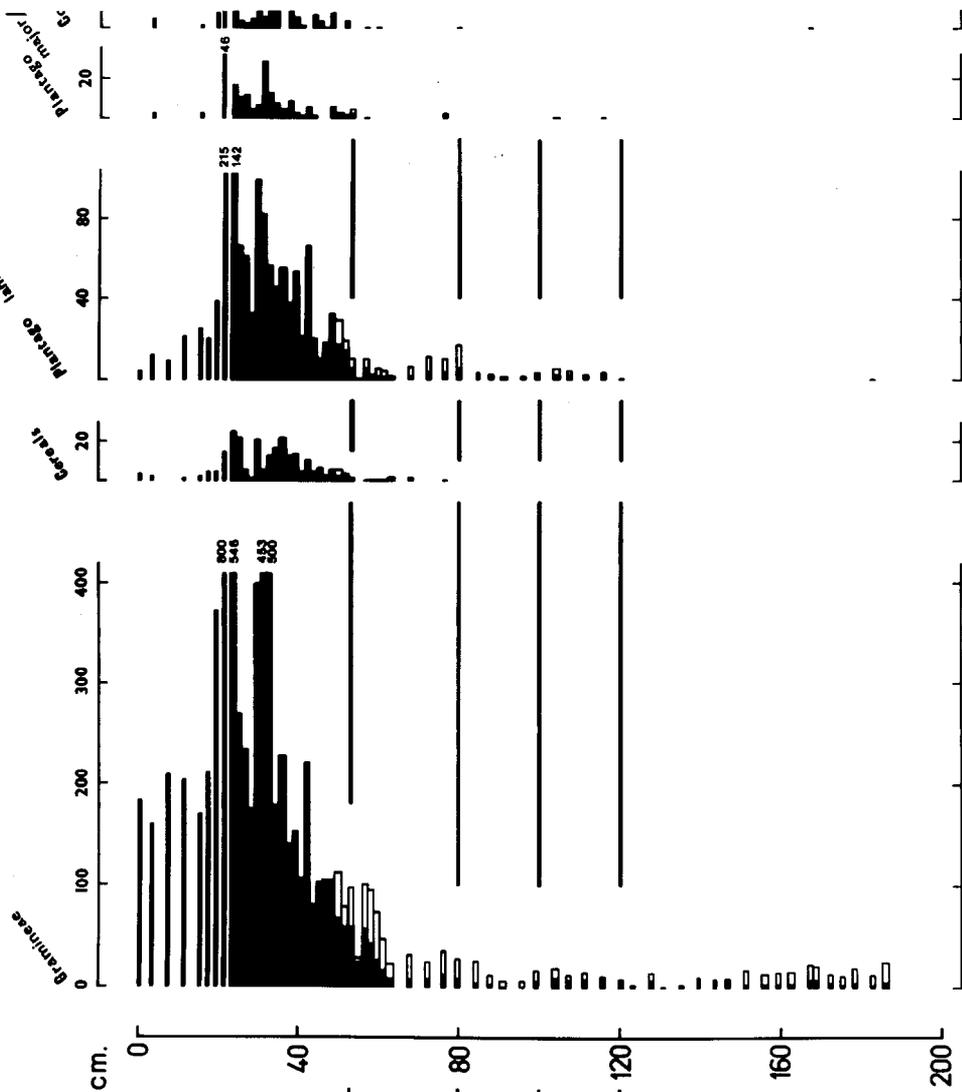
TABLE 7

RATES OF PEAT ACCUMULATION AT CAMP HILL MOSS ESTIMATED
FROM CORRECTED RADIOCARBON DATES

Depth (cm.)	Date (Tree-ring calendar years)	Average rate of accumulation (No. of years to accumulate 1 cm. of peat)
0	A.D. 1950	11.6
52½ - 54	A.D. 1325	85.2
79 - 80½	890 B.C.	28.8
98½ - 100	1465 B.C.	26.9
119½ - 121	2030 B.C.	

CAMP HILL MOSS

Herbaceous pollen (excluding bog species) as % total tree pollen



CAMP HILL MOSS

Bog species and spores as % total tree pollen

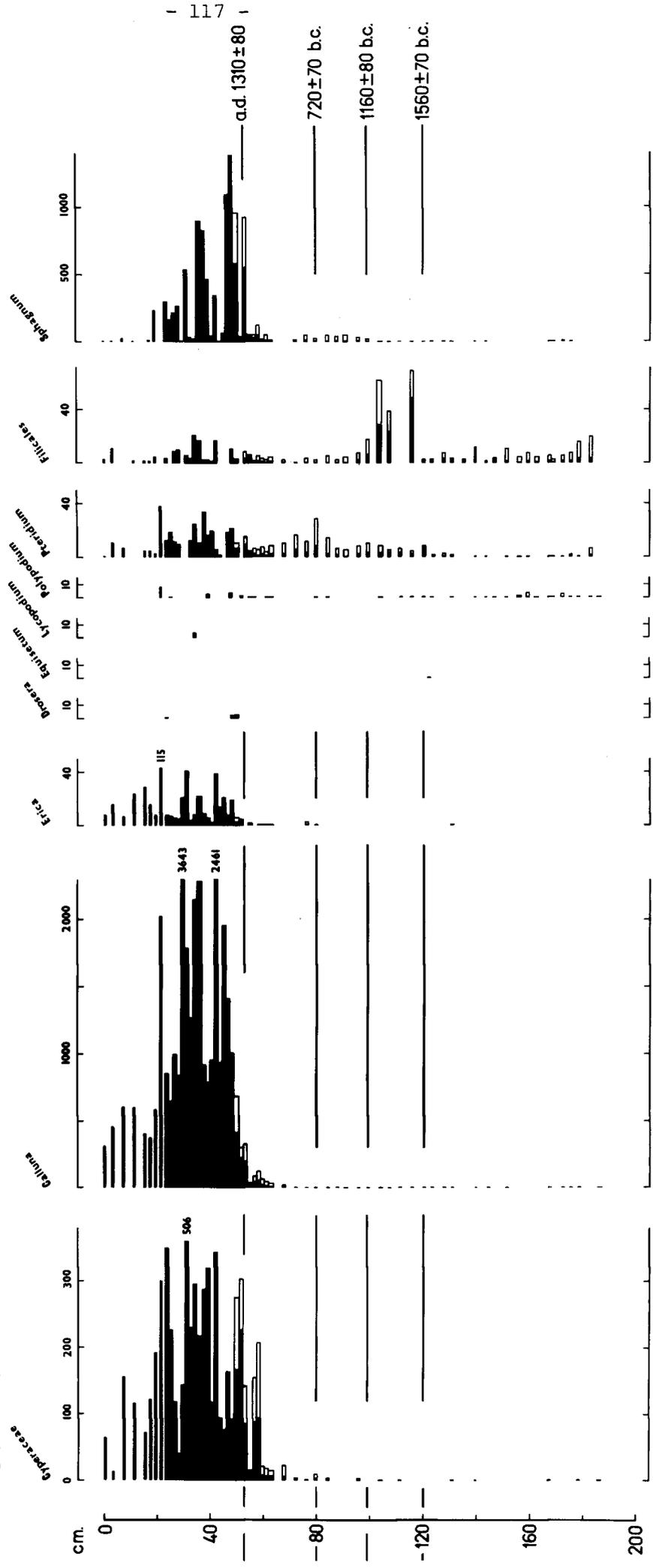


FIG. 19c

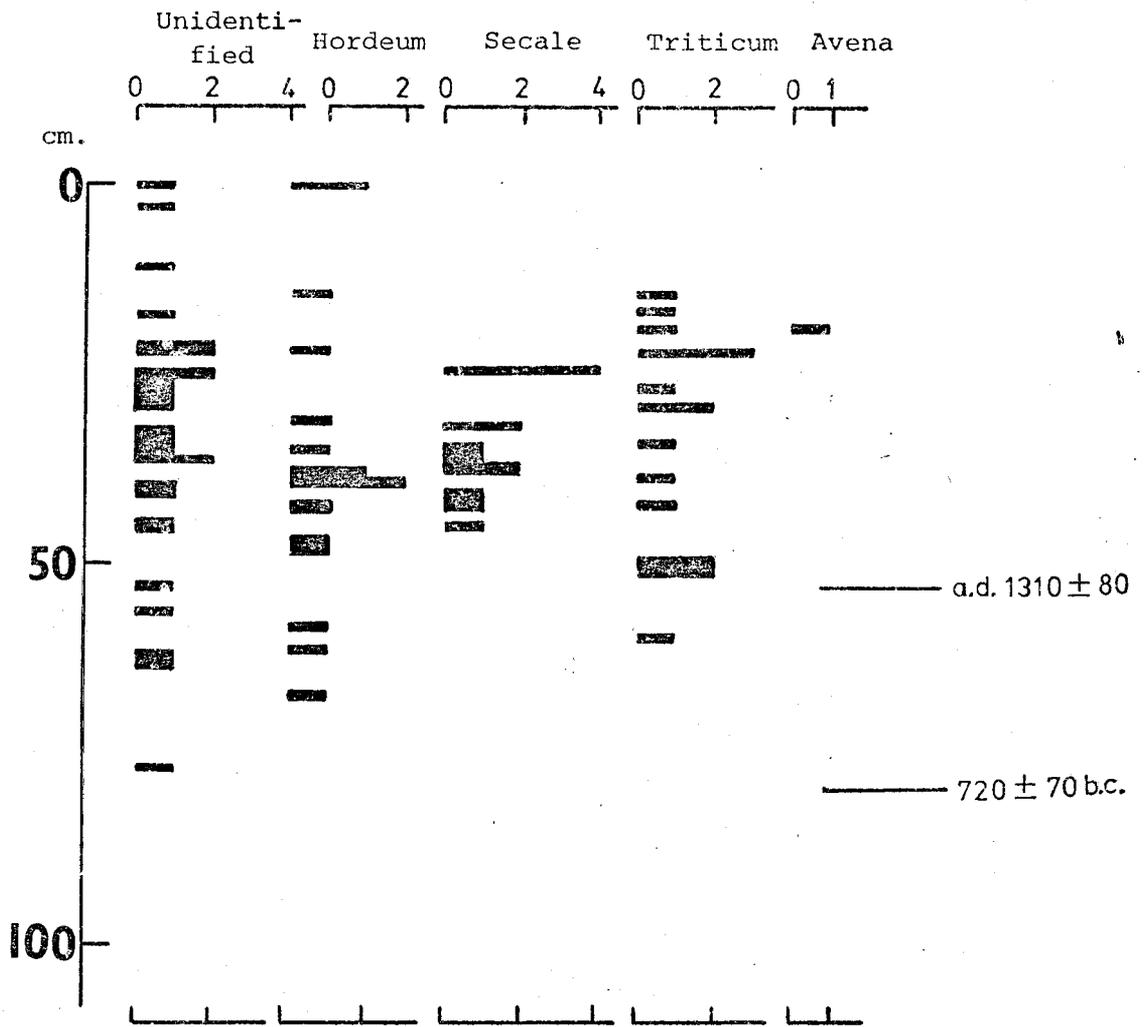


Fig. 19d Cereal pollen recorded at Camp Hill Moss
(shown as no. of pollen grains in the count).

CHAPTER 9

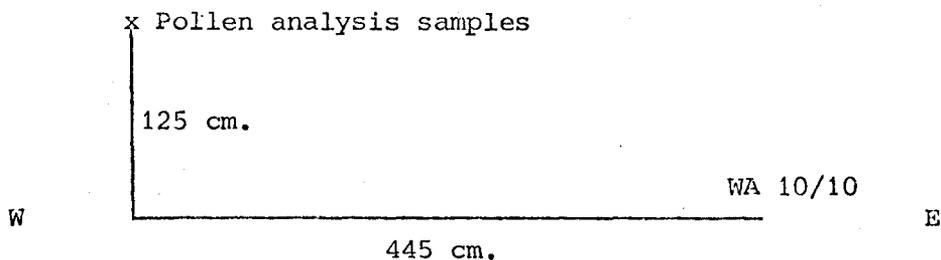
PALYNOLOGICAL INVESTIGATIONS AT ARCHAEOLOGICAL SITES

During the course of this study, archaeologists working in Northumberland have excavated a number of sites from which it was possible to obtain samples for pollen analysis. These samples were generally buried beneath the archaeological remains, which in some cases allowed a dating of the deposit. The pollen analysis of such samples, whilst not constituting a major part of the study, provides useful information about the immediate environment of the respective sites.

9.1 Vindolanda

The remains of the Roman fort of Vindolanda (N.G.R. NY 770664) and its associated civilian settlement occupy nearly 20 acres of land at a site 2.1 km. to the north-west of Bardon Mill in the South Tyne valley. Fellend Moss is 9.3 km. away to the west, and the equally large site of Housesteads Roman fort, on Hadrian's Wall, is 3.2 km. to the north-east. A brief history of Vindolanda is given in Chapter 4 of this thesis.

During the excavation of 1975, a profile nearly 1.5 m. deep was exposed which, by reference to other parts of the site with similar stratigraphy, was dated to A.D. 100-125. The position of the profile was related to site reference WA 10/10 as shown below.



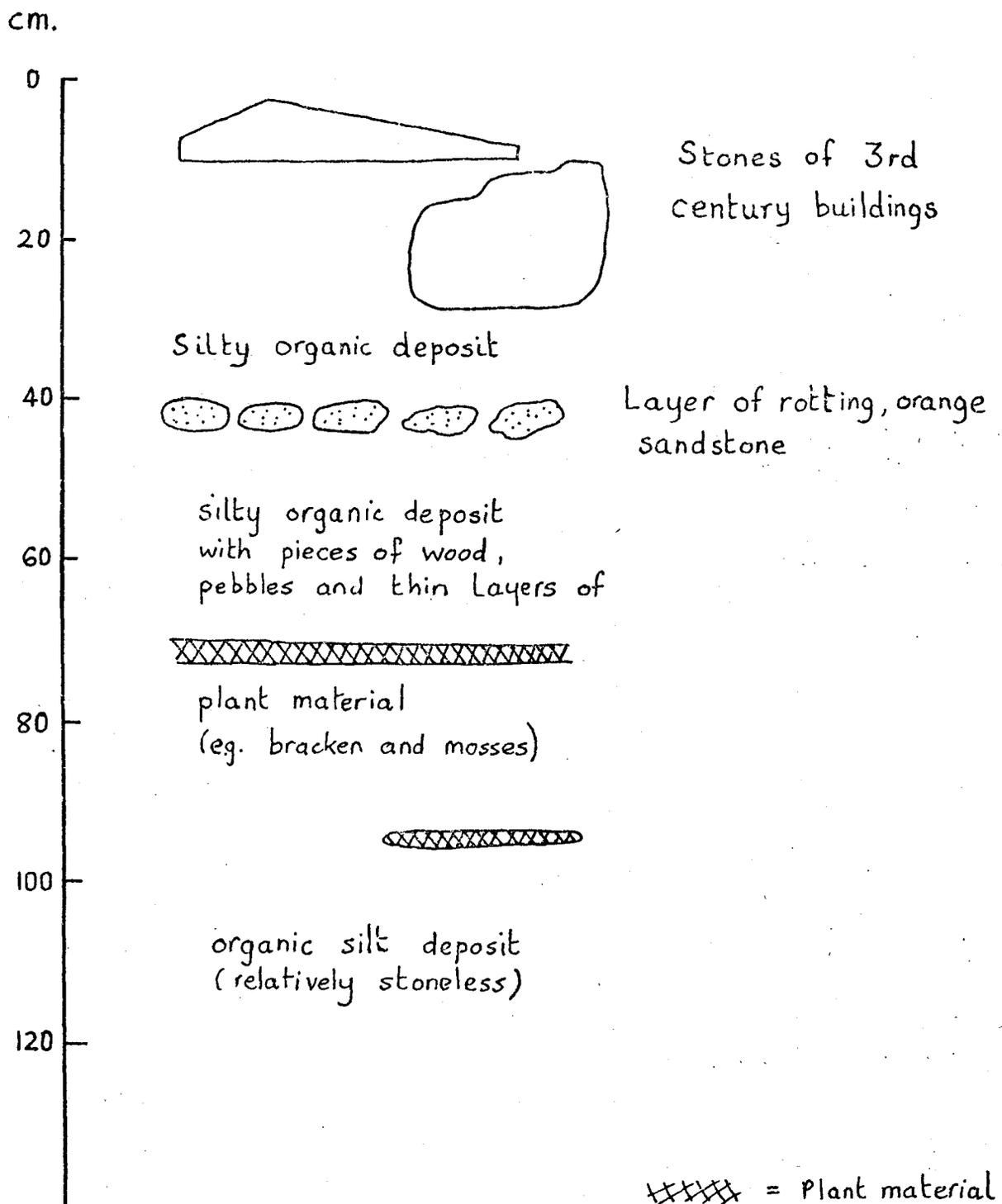


Fig. 20 Stratigraphy of Vindolanda section

The section exposed was at the western end of the excavated area and faced eastwards. It lies outside a centurion's house and the lower part, just above the clay, represents the accumulation of silt and organic matter in a marshy hollow between the house and the higher ground to the west.

9.1(i) Stratigraphy

An illustration of the section is shown in Fig. 20, details of which were as follows:-

<u>cm.</u>	
32	} Silty organic deposit
35	
37.5	
40	Top of sandstone layer
42.5	Bottom of sandstone layer
52.5	Piece of wood present
55	Layer of wood
57.5	} Silty
60	
62.5	
67.5	Just above thin organic layer
70	Just below thin organic layer
85	Changing to an organic silt, with less wood and stones
87.5	Very little silt - like a layered peat
90	A little more silt
92.5	More clay and silt, plus bone (possibly Curlew)
95	Piece of wood
102.5	A little more silty; piece of wood present
110	Piece of wood
115	Large stone. Sample taken to one side
135	Just above piece of leather.

Samples for pollen analysis were collected at 2.5 cm. intervals by pushing glass tubes (neck dia. 1.6 cm.) into the deposit. These were then taken back to the laboratory where eleven samples at 7.5 to 10 cm. intervals were prepared as described in Chapter 2. Treatment with hydrofluoric

acid was necessary in all cases.

9.1(ii) Interpretation of the pollen diagram

The deposit from which samples were taken was of comparatively very small surface area (c. 15 sq. m.). It is likely therefore, that the pollen rain falling on to the surface of the deposit is almost entirely of very local origin (Tauber, 1965). Thus it is the immediate environment of the site that is referred to in the interpretation of the pollen diagram.

Results of the pollen analysis are shown in Figs. 21a, 21b and 21c. All values are expressed as percentage of total dry land pollen. It is felt that, in this instance, this is a better method than calculating values as percentage of total tree pollen. In some of the samples from the lower part of the profile, pollen concentrations were low and the proportion of tree pollen was very small. Calculations based on such low tree pollen counts would have been statistically unsound.

It was found that the pollen diagram could be best described by dividing it into three local pollen assemblage zones, which have been numbered VA1 - VA3.

Local pollen assemblage zone VA1 (130 cm. - 90 cm.)

In this, the lower part of the profile, tree pollen percentages are very low. Gramineae pollen is present in large amounts, never being less than 59% of total pollen, with Plantago lanceolata and Plantago major/media also at high values. Cereal pollen is contained in all levels except 130 cm. There are small amounts of pollen of plants such as members of the Compositae (Liguliflorae), Chenopodiaceae and Cruciferae families, which are often associated with disturbance by cultivation. It is possible however, that disturbance associated with the settlement site itself may have given rise to habitats suitable for these plants.

The proportion of tree pollen, although small, shows a progressive increase throughout the zone, rising from 0.4% at 130 cm. to 11% at 90 cm. Of the trees that are present, Alnus is dominant. Possibly the sides of Bradley Burn, Brackies Burn and Bean Burn, which enclose the site on three sides, presented suitable habitats for the survival of alder trees at a time when the land around was largely cleared.

The overall impression given by this pollen assemblage zone is one of open grassland with a small amount of cultivation being practised.

Local pollen assemblage zone VA2 (82.5 cm. - 72.5 cm.)

The dominant feature of this zone is the very high proportion of Alnus pollen, and it is this tree which is largely responsible for the sudden increase of tree pollen from 11% to 64% of total pollen at the beginning of zone VA2, and the equally sudden decrease from 62% to 16% at the close of the zone. Both Betula and Quercus pollen also show a slight increase during zone VA2, whilst Corylus pollen exhibits a more noticeable increase.

With the whole profile covering perhaps only 25 years, it must be assumed that local pollen assemblage zone VA2 represents a very short space of time, probably of the order of 2 - 5 years. Clearly this is not long enough to allow substantial forest regeneration of the magnitude that would account for the greatly increased tree pollen values. If the sides of the burns surrounding the site were indeed suitable habitats in which Alnus flourished, then two reasons for high Alnus pollen percentages may be suggested.

Firstly it may be that for climatic or other reasons, Alnus pollen production was unusually prolific for the short span of time being considered. McVean (1955) has noted that catkin formation in Alnus glutinosa (L.) Gaertn. is favoured by abundant sunshine during the period

April-June of the flowering year, and is also influenced by the size of crop and amount of sunshine during the previous year. If these favourable conditions occurred during zone VA2, the alderwoods presumed to be growing along the courses of the burns may have been sufficiently close to the site to have given rise to the increase in Alnus pollen recorded in the pollen diagram. It may be that conditions which encouraged high pollen productivity in Alnus might have been similarly advantageous for other deciduous tree species. Jones (1959) has noted that for Fagus and Quercus, very warm temperatures during the late summer and autumn of the previous year favour the laying down of flower buds for the following year and that the size of crop in the preceding year is also important. Possibly there were a few favourable seasons in which pollen productivity of several tree species was enhanced.

Secondly, there is a possibility that the break up of Alnus catkins in high winds might result in whole masses of pollen being deposited together, or that birds might have acted as agents for catkin dispersal. This was suggested by Tinsley and Smith (1974) who, working on surface pollen studies across a woodland/heath transition, noted that the magnitude of deposition of Alnus pollen in relation to its distance from origin is most unpredictable and can be quite high at some distance from its source.

Although tree pollen percentages are very high during zone VA2, a good deal of open ground must nevertheless have remained. Cereal pollen continues to be present throughout the zone, although only small amounts of pollen from other herbaceous plants are recorded.

Local pollen assemblage zone VA3 (65 cm. - 35 cm.)

At the beginning of this zone tree pollen percentages have dropped from 62% of total pollen at the end of zone VA2 to 16% of total pollen, but they rise steadily throughout the zone, reaching 27% at 35 cm. Such a

VINDOLANDA

Tree and Shrub pollen as % total pollen

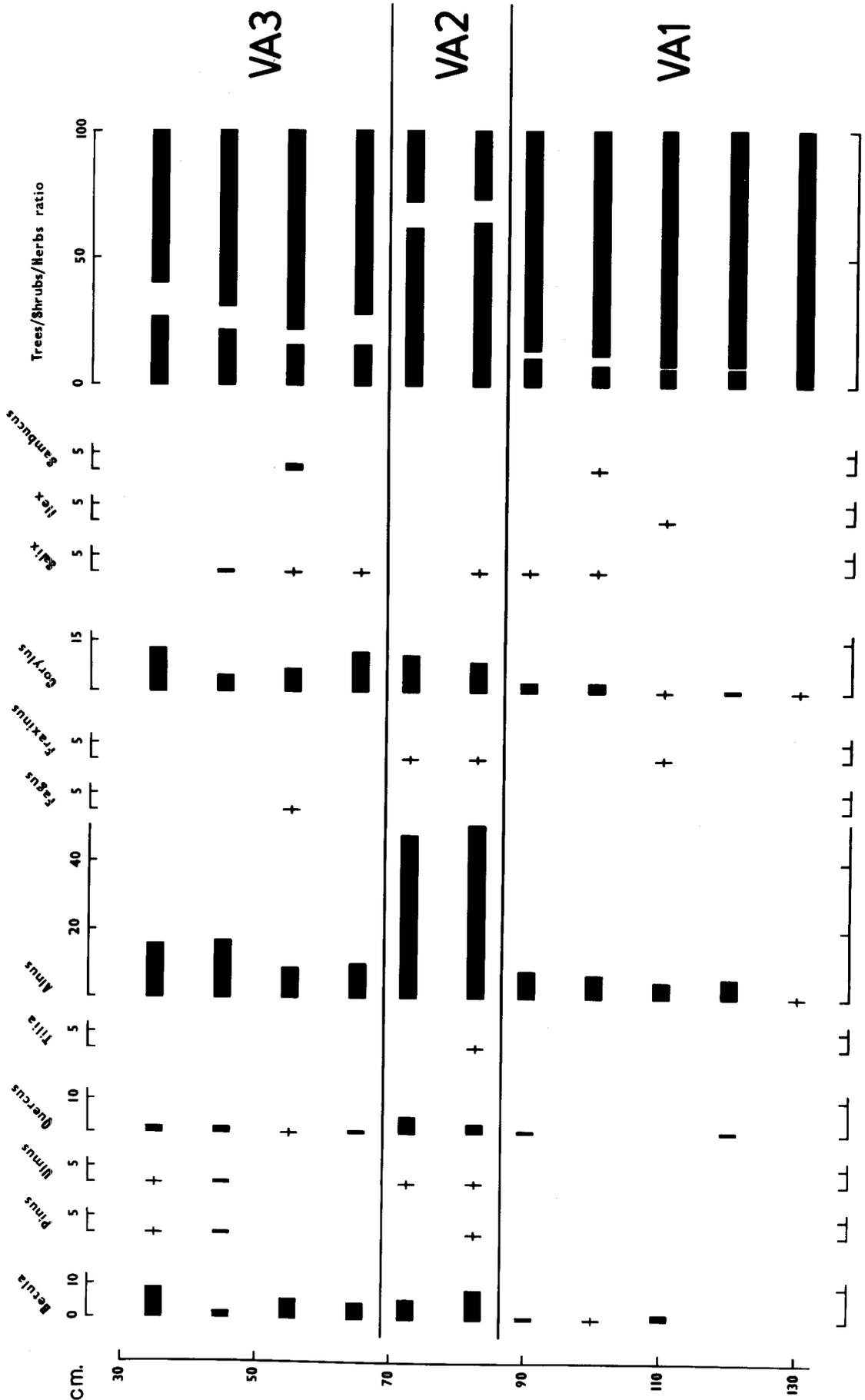


FIG. 21a

VINDOLANDA

Pollen of herbaceous species as % total pollen

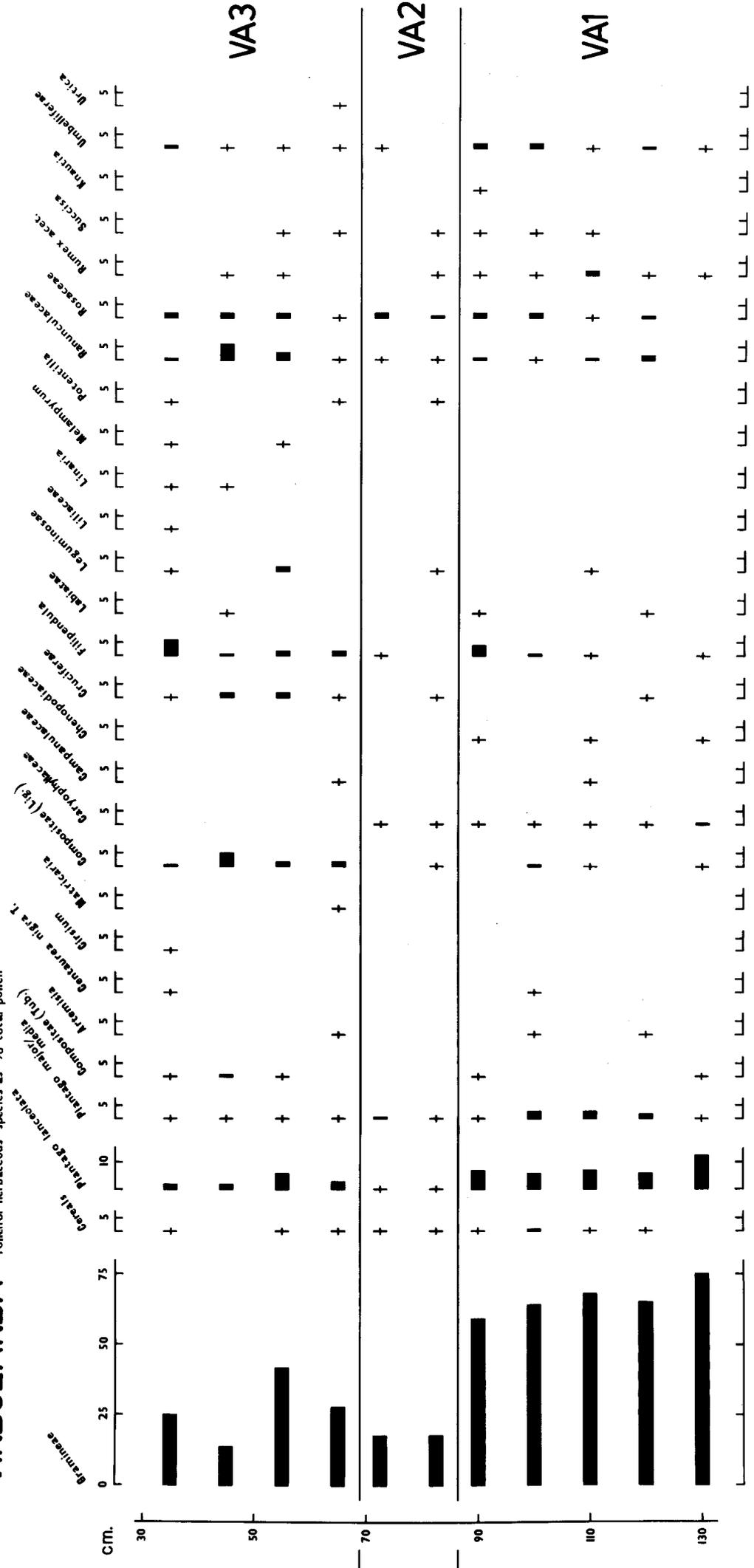


FIG. 21b

VINDOLANDA

Pollen of some herbaceous species and Pteridophyte spores

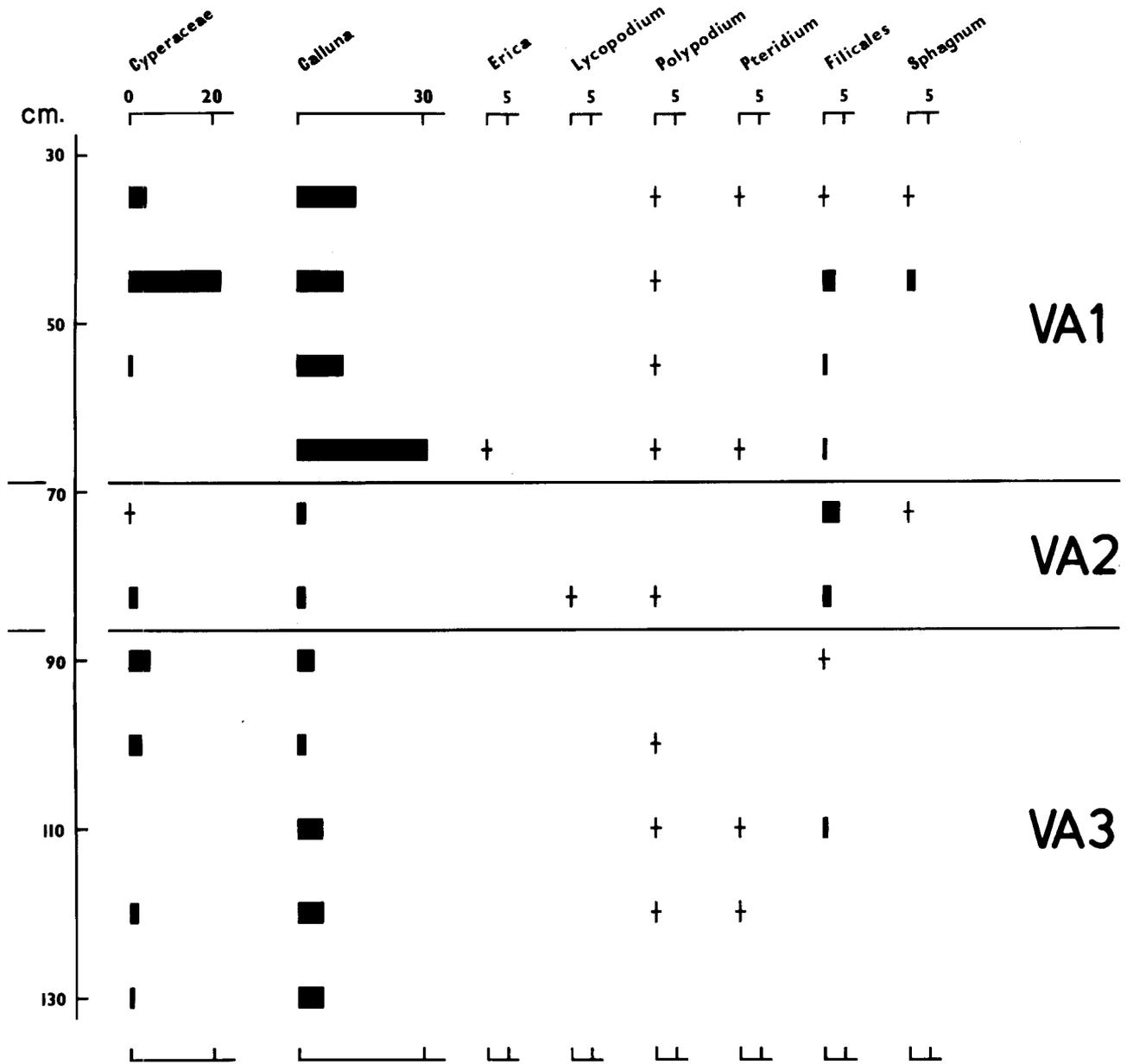


FIG. 21c

gradual increase could be attributed to some degree of woodland regeneration within the pollen catchment area, more particularly because it is caused by a slight increase in pollen of all tree species.

Nevertheless, Gramineae and Plantago lanceolata pollen percentages are moderately high, although generally less than in zone VA1. Small amounts of cereal pollen are present in all but the 45 cm. sample and pollen of members of the Compositae (Liguliflorae) and Cruciferae families, sometimes indicative of arable activity, is present in moderate quantity during the zone. Pollen of members of the Compositae (Tubuliflorae) and Ranunculaceae families, which are normally associated with pastureland, together with the Gramineae and Plantago lanceolata pollen recorded, infers that some pastureland was maintained in the vicinity of the site.

Zone VA3 differs from zone VA1 in that increased tree pollen percentages and smaller amounts of herbaceous pollen types, particularly Gramineae suggests that less land in the pollen catchment area was in agricultural use, and that a certain amount of woodland regeneration was being allowed to take place. There does not, however, seem to have been any significant change in the nature of farming practices; cereal pollen being recorded at most levels but always as a low percentage of total pollen.

9.2 Kennel Hall Knowe

During excavations in 1976, a sample of buried turf was taken from beneath a stone rampart enclosing an Iron Age/Romano-British settlement site in the North Tyne valley, by Mr. G Jobey of Newcastle University. The site at Kennel Hall Knowe (N.G.R. NY 667898) was enclosed initially by wooden palisades and at a later date by stone ramparts. It was thought that pollen analysis of the turf sample, preserved beneath the innermost stone rampart, might reveal the existing vegetation just before the rampart

was built and possibly through this, shed some light on the continuity or otherwise of settlement.

A one cm.² sample of the turf was prepared using standard methods described in Chapter 2 and including treatment with hydrofluoric acid. Results of pollen analysis are presented in Table 8.

The pollen assemblage suggests that, at the time of burial of the turf, an open scrub woodland existed in the immediate vicinity of the settlement site. The high amounts of Betula, Alnus and Corylus pollen present would be expected from an impoverished woodland. Further, Calluna vulgaris, a heath and moorland plant indicative of relatively acidic soil conditions, had apparently become well established, whilst the presence of small amounts of pollen of herbaceous species such as Plantago lanceolata provides evidence of some pasture land as well.

The question of continuity of settlement is difficult to resolve using evidence from the turf sample alone. Samples, e.g. from a nearby peat deposit covering the whole of the period concerned would have to be analysed in order to be able to assess the situation properly. Nevertheless, two major possibilities are suggested by the pollen assemblage.

Firstly, that small amounts of land were still being used (i.e. settlement was continuous) but scrub woodland grew right up to the walls of the settlement site. Secondly, that after the period of wooden palisades, the site was abandoned for a sufficient length of time for secondary woodland to establish itself around the site before re-occupation by the stone-rampart builders.

9.3 Cairnfields, Millstone Hill

In Chapter 4, the problem concerning the origin of the archaeological features known as 'cairnfields' was discussed. Samples of the old soil surface beneath two cairns on Millstone Hill were taken in the hope

that any pollen preserved might provide further clues to the age and purpose of the cairns. Two of those sampled are part of a large number of cairns, generally considered to be field clearance cairns (Jobey, 1968), which are scattered across Millstone Hill at c. 225 m. - 245 m. O.D. on moorland dominated by Calluna vulgaris. They were c. 6 m. x 4 m. x 50 cm. and c. 6 m. x 4 m. x 70 cm. high and completely lacking in skeletal remains or grave goods. The third cairn was of similar size and structure, but its purpose was sepulchral. The soil beneath the cairns was a well-developed podzol with a distinct iron pan separating the E and B horizons (see Pyatt, 1965).

All samples were returned to the laboratory and prepared using the standard method, but including treatment with hydrofluoric acid. Unfortunately, all samples were poor in pollen and most of that present was of Calluna vulgaris.

Mention has been made (Chapter 4) of charcoal fragments recovered from the topsoil beneath one of the small cairns, by Mr. G. Jobey of Newcastle University, and which yielded a radiocarbon date of 1690 ± 90 b.c. It was noted that this date coincides with the dating of the first forest clearance episodes shown by the pollen diagram for Camp Hill Moss c. 1.5 km. distant, and suggested that the cairnfields are associated with this initial clearance activity.

There is no evidence on the pollen diagram from Camp Hill Moss for the existence, at that time, of a Callunetum heath vegetation in the pollen catchment area. The development of such a vegetation type apparently did not take place before the widespread clearance of forest from the area c.A.D. 1325.

It would appear, therefore, that the old soil surface was not sealed off for some considerable time after the erection of the cairns.

Indeed, since the cairns are covered by only a thin layer of loose peaty turf, and are comprised of large stones, the pollen found in the old surface soil may represent a very modern pollen fallout washed down by rainwater.

TABLE 8

RESULTS OF POLLEN ANALYSIS ON BURIED TURF SAMPLE FROM

KENNEL HALL KNOWE

	<u>% of Total Tree Pollen</u>
<u>Trees</u>	
<u>Betula</u>	37
<u>Quercus</u>	6
<u>Alnus</u>	56
<u>Fraxinus</u>	1
 <u>Shrubs</u>	
<u>Corylus</u>	176
<u>Salix</u>	3
<u>Calluna vulgaris</u>	105
 <u>Herbs</u>	
Gramineae	43
Cereals	-
Cyperaceae	1
 Caryophyllaceae	 4
<u>Filipendula</u>	1
Labiataeae	1
<u>Plantago lanceolata</u>	4
<u>Plantago major</u>	1
Ranunculaceae	5
Rosaceae	2
<u>Rumex acetosa/acetosella</u>	1
Liliaceae	1
 <u>Pteridophytes</u>	
<u>Lycopodium</u>	2
<u>Polypodium</u>	66
<u>Pteridium aquilinum</u>	1
<u>Sphagnum</u>	33
Filicales	269

Percentage of Trees/Shrubs/Herbs

22 / 64 / 14

CHAPTER 10

DISCUSSION

10.1 A note on the interpretation of the pollen diagram

The first problem of interpretation that arises is that of the area represented by the pollen spectrum at different levels in each of the pollen diagrams. Tauber's work on pollen dispersion showed that the earlier concept of a general 'pollen rain', supposed to represent the regional pollen production, is inadequate for a precise understanding of pollen diagrams and led to the conclusion that pollen transfer must have a composite nature (Tauber, 1965, 1967). For closed deciduous forests, at least three components will be of importance: pollen carried through the trunk space, pollen carried above the canopy, and pollen brought down by rain. The significance of this differentiation is that pollen carried through the trunk space will be local in origin, whilst pollen from the other two sources is likely to have originated in a wider area. On the basis of Tauber's work, and that of others (Janssen, 1966; Anderson, 1970) it may be argued that, if a core sample is taken from the centre of a large bog, it will contain a higher proportion of the 'regional' pollen component than will a sample from the centre of a small bog.

Steng Moss, Fellend Moss and Broad Moss have comparatively large surface areas (0.49, 0.37 and 0.36 sq. km. respectively) and were sampled near their centres. It is therefore argued that they present a fairly regional picture of vegetation changes. Furthermore, because the pollen diagrams from these three widely separate regional sites show much the same vegetation changes, it is suggested that the pattern of change must be valid for an even larger area; probably for much of the uplands between them.

Camp Hill Moss, on the other hand, is a much smaller bog (surface area 0.045 sq. km.) and thus according to Tauber, presents a local picture

of vegetation changes. It is therefore not surprising that it gave a different record of vegetational history.

10.2 History of Forest Clearance

Evidence of Mesolithic influence on the uplands of Britain has been found at many sites (Walker, 1956; Simmons, 1964, 1969a; Smith, 1970; Squires, 1970; Chambers, 1974) but Simmons (1969b) concludes that their ecological impact would have been small. Doubtless Mesolithic people were present from time to time in the Northumberland hills, but this study was primarily concerned with the later clearances. Thus at Fellend Moss and Steng Moss, although the profiles include peat formed during Mesolithic times (pre-elm decline), this was not sampled closely enough to detect any vegetational changes which might have been caused, for example, by the use of fire as a hunting tool. Thus absence of evidence does not, in this case, mean that there was no Mesolithic activity.

The fall in Ulmus pollen which occurs in all pollen diagrams from north-western Europe, within a century or two on either side of 3,000 b.c., was used by Godwin (1940) to mark the zone boundary, VIIa/VIIb. Comprehensive reviews have been published both on the nature and interpretation of the elm decline (Smith, 1961) and on deductions as to climatic change which have been drawn from pollen diagrams (Iversen, 1960; Troels-Smith, 1960; Frenzel, 1966). Nevertheless, no single and universally satisfying explanation of the fall in the elm curve and the accompanying vegetation changes, has emerged. Troels-Smith in 1960 postulated the anthropogenic explanation of the elm decline; that a new technique of keeping stalled domestic animals was introduced into Europe on a very wide scale at the opening of the Neolithic period, and that these animals were fed by repeated

gathering of leafy branches of those trees known to be nutritious - the elms - and by ivy where that plant grew. This would have reduced very greatly the pollen production of the elms. Whatever may have been the climatic character of the centuries on either side of 3000 b.c., the very regular association between the decline of Ulmus pollen and the presence of Plantago lanceolata pollen in very many pollen diagrams, is strong evidence that man's activities played some part in the vegetational changes.

Work by Walker (1965) and investigation of absolute pollen frequencies in lake sediments (Pennington, 1973) has shown that in the hills of the central Lake District, Ulmus pollen was declining both proportionally and absolutely during the fourth millenium b.c., and that no traces of human activity accompany the first fall, beginning at c. 4400 b.c. This first fall is attributed to the effects of generally declining soil base-status under the influence of leaching in a period of wet climate. The second fall occurs between 3285 ± 55 b.c. and 3015 ± 60 b.c., and is accompanied by simultaneous increases in the deposition rates of Gramineae and Plantago lanceolata pollen, and falls in the deposition rates of Pinus and Betula pollen. Such changes are taken to be the result of interference with the forest by the same Neolithic people who were responsible for the Great Langdale axe factory.

At Steng Moss and Fellend Moss, the elm decline horizon, which occurs at c. 400 cm. and c. 480 cm. respectively, was not thoroughly investigated, although at both sites Ulmus pollen appears to have been falling slightly with respect to other tree species before falling sharply to minimal values. However, there is no evidence to suggest that the climatic influences which were operative in the Lake District hills were also felt in the northern Pennines.

Ulmus pollen values are low in the whole of the peat profiles at Broad Moss and Camp Hill Moss. It must therefore be assumed that peat

formation did not begin at these sites until after the elm decline. If the anthropogenic explanation for the elm decline proper is accepted, then man had already begun to affect the vegetation of Northumberland during the Neolithic period, although actual forest clearance cannot be demonstrated.

The first recorded forest clearance episodes began at all sites during the Early Bronze Age and are marked by a rise of Gramineae pollen and a rise or the appearance of pollen of Plantago lanceolata and Rumex acetosa and spores of Pteridium aquilinum. In Chapter 5 such changes were interpreted as being indicative of the existence of small temporary clearances within the pollen catchment area. Such clearances are a typical feature of the shifting agricultural economy which seems to have been characteristic of much of Britain during the Bronze Age (Turner, 1970). The rise and fall of herbaceous pollen during this period is taken to be a result of changes in the density of small temporary clearances within the pollen catchment area (Turner, 1965).

At Steng Moss and Broad Moss, there appears to have been three main phases of Bronze Age clearance activity. The maxima of those at Steng Moss were dated to 1644 ± 45 b.c. (2110-2080 B.C.), 1065 ± 45 b.c. (1375-1265 B.C.) and 636 ± 45 b.c. (855-810 B.C.), with periods of little activity separating them. At Fellend Moss, however, the pollen diagram records only one period, early in the Bronze Age (maximum at 1738 ± 60 b.c., 2110-2170 B.C.), when small temporary clearances were abundant. Thereafter, the area around the site seems to have been sparsely populated until the beginning of the Romano-British period. Jobey (private communication) has pointed out the scarcity of Bronze Age and Iron Age archaeological finds in this part of Northumberland, and it therefore seems reasonable to conclude that this was an 'empty corner' of the county for much of these periods. Possibly shifting agriculture in this area was limited by the large tracts of deep

peat bogs (flows) to the north and the high exposed uplands to the south.

At Camp Hill Moss, in the north-east of the county there was a long period lasting from 1560 ± 70 b.c. (2070-1990 B.C.) to 1160 ± 80 b.c. (1510-1420 B.C.) during which time small temporary clearances were maintained at a more or less constant density within the pollen catchment area. The radiocarbon date of 1690 ± 90 b.c. from charcoal beneath a field clearance cairn on Millstone Hill (Chapter 4) links the 'cairnfields' scattered across the hills around Camp Hill Moss, with this first phase of Early Bronze Age clearance. The pollen diagram shows no evidence of cereal cultivation at that time. The logical conclusion, therefore, is that the purpose of clearing areas of stones (at the same time as woodland clearance) was to promote the growth of pastureland within the woodlands. There is evidence from other sites to show that some cultivation took place during the Bronze Age; a few cereal pollen grains are recorded at Broad Moss and Steng Moss. So, although pastoralism apparently dominated the farming economy, cereals were grown in small amounts. This may also have been the case around Camp Hill Moss where, because of the size of the bog, very small amounts of cereals being grown some distance away might conceivably have gone unrecorded.

Thus at all sites studied, forest clearance throughout the Bronze Age was on a small scale and pastoralism was the common practice. It is suggested that this is likely to have been so for the Northumberland uplands as a whole. Only at a few lowland sites in the north of England is cereal cultivation of importance during the Bronze Age (Walker, 1966; Bartley et al, 1976). Turner (1970) reviewing the evidence for Bronze Age clearance in Britain, points out that more and more forest was being cleared everywhere from about 2000 B.C. onwards, but that the evidence points to a fairly gradual change, and further that '... if one regards the occasional cereal and ruderal pollen grain as the first sign of a rudimentary form of

agriculture associated with a nomadic way of life, and later 'landnam' episodes as representing an economy still based on shifting rather than settled agriculture, then one may well infer that this increasing degree of clearance was caused by a slowly increasing population, which only gradually became more skilful in felling trees and clearing scrub, and also more dependent for subsistence on agriculture and perhaps stock breeding than on fishing, hunting and gathering.' With the possible exception of Fellend Moss which has been discussed, the Bronze Age clearances recorded at the study sites are consistent with this viewpoint.

Although a great deal of forest clearance took place in southern Britain during the Iron Age (Godwin, 1960, 1967b; Turner, 1962; Simmons, 1964), in the more northern parts there is little evidence for wholesale clearance until much later. Walker (1966) concluded, for the Cumberland lowlands that 'the archaeological developments of the Bronze Age and Iron Age did not significantly influence the type of agriculture which had been practised since middle Neolithic times.' In Scotland, in neither the Forth Valley nor Ayrshire is there evidence for extensive clearance until well into the first millenium A.D. (Turner, 1965), and Pennington (1964), working in the Lake District, recorded little change in the Neolithic-Bronze Age economy until about the same time.

Similarly, results of pollen analyses from the Northumberland sites suggest that for most of the pre-Roman Iron Age, the landscape and way of life in the uplands was not significantly different from that of the Bronze Age, although the density of clearances may have increased in some areas. At Steng Moss, for example, Gramineae pollen values are maintained at c. 40% of tree pollen between 578 ± 35 b.c. (830-700 B.C.) and 20 ± 60 b.c. (40 B.C. - A.D. 40). A similar situation occurs at Broad Moss, but as previously noted, there is little evidence for Pre-Roman Iron Age activity around Fellend Moss. This tallies with the archaeological evidence for

settlement. There are sufficient Iron Age settlement sites in the vicinity of Steng Moss and Broad Moss, to account for the clearance activity in these areas, but few known in the area around Fellend Moss (Jobey, 1965, 1966a).

The first clearance of woodland on a large scale occurred at Steng Moss and Fellend Moss, and by inference at Broad Moss either just before or at about the time of arrival of the Romans in A.D. 79-80. It is at this point that the diagram from Camp Hill Moss begins to differ markedly from the others. The first extensive clearances there do not occur until at least A.D. 1300-1350. At Fellend Moss the first rise of herbaceous pollen to very high values was radiocarbon dated to A.D. 20-60 and at Steng Moss to 40 B.C. - A.D. 40. There is a very sharp rise of herbaceous pollen at 156 cm. at Broad Moss, and although the Broad Moss diagram has not been radiocarbon dated, this is expected to have occurred at about the same time as the corresponding phenomenon at the other two sites.

Herbaceous pollen percentages remain high throughout the Romano-British period and do not decline until A.D. 480-520 at Steng Moss and reach minimum values at A.D. 620-650 at Fellend Moss. Cereal pollen and pollen of plants normally associated with disturbance of land by cultivation, appear only in small amounts at all three of these sites and so it must be concluded that limited areas of land were devoted to cultivation, but that pastoralism continued to be the predominant way of life. Results of pollen analysis on samples from the Vindolanda site support this view. The impression is that the landscape at that time was possibly as open as that of today, with large areas devoted to pasture.

Jobey, writing in 1966(b), suggests that the native population of Northumberland increased during the Romano-British period, possibly as a result of some degree of political and economic stability which the Roman military presence encouraged. Certainly at a number of native settlement sites whose occupation spans late Iron Age/Romano-British times, the number

of contemporary hut circles increased during the Romano-British period. This being so, and given the demands for agricultural produce from the Roman garrisons themselves, it is not surprising that forest clearance should have taken place on a larger scale than hitherto. The significant point which arises is that the economic repercussions were apparently felt over a wide area of Northumberland, at least as far north as the Cheviot Hills, for the whole of the Roman occupation. Furthermore, the native economy had sufficient momentum to maintain itself for some time after the departure of the Romans in A.D. 410, before the decline sets in. Such was also the case at Hallowell Moss in Co. Durham (Donaldson and Turner, 1977).

The beginning of these episodes seems to have pre-dated similar events recorded in the north-west of England and south-west Scotland, where many pollen diagrams show extensive clearance around a.d. 400. Smith's (1959) diagram from Helsington Moss shows this clearance across the level of an upper retardation layer which was subsequently radiocarbon dated to about a.d. 436 (Godwin and Willis, 1960) and the diagram from Ellerside Moss (Oldfield and Statham, 1963) also shows extensive clearance at the level of an upper retardation layer. Further north, several of Pennington's (1970) diagrams from the Lake District show extensive clearances which have been dated to a.d. 390 ± 130 at Burnmoor and a.d. 200 ± 130 to a.d. 580 ± 190 at Devoke Water. In south-west Scotland the Bloak Moss diagram (Turner, 1965) shows the first extensive clearance, dated by radiocarbon assay at about a.d. 450.

Barber's diagram from Bolton Fell (Barber, unpublished work, private communication) is consistent with those for Fellend Moss and Steng Moss, and at Hallowell Moss the first extensive clearance was radiocarbon dated to 6 ± 70 b.c. (A.D. 40-90) and those in Weardale (Roberts et al, 1973) to 110 ± 120 b.c. and a.d. 220 ± 100 . Thus the landscape of the Northumberland and Durham uplands as a whole seems to have been laid open some two to four

centuries earlier than the hills and parts of the lowland to the west.

It is difficult to locate the Romano-British period with precision on the Camp Hill Moss diagram, because of the lack of radiocarbon dates at appropriate levels and because of the slow rate of peat formation (1 cm/85.2 yrs.) between 80 cm. (720 ± 70 b.c.) and 52 cm. (a.d. 1310 ± 80). There is a rise of Gramineae pollen to a maximum of 101% (corrected) between 62 cm. and 56 cm. and cereal pollen is continuously present in very small amounts between these levels. Plantago lanceolata although present remains at low levels. Calculating approximate dates from the average rate of peat formation places this activity at about Romano-British times, but it only represents a slight intensification of what was happening in the Bronze Age and Iron Age periods. Whatever the economic or political reasons for wholesale clearance of the forest in other parts of Northumberland, they were evidently not felt on the Fell Sandstone hills around Camp Hill Moss.

The pollen diagrams from Steng Moss, Fellend Moss and (by inference) Broad Moss, show increasing amounts of tree pollen in the pollen assemblage, beginning perhaps a century after the departure of the Romans, which is interpreted as forest regeneration consequent upon the abandonment of upland pastures. A fairly open woodland seems to have been maintained: pollen frequencies of Betula and Corylus, both light-demanding species, remain high and thus it seems likely that some grazing was continued. The reasons for this decline of upland land use during the Anglo-Saxon period are not altogether clear. Donaldson and Turner have mentioned the destruction of British power at Catraeth (Catterick) in A.D. 588-590 and suggested that this may have led to some economic recession in parts of Co. Durham. If this was so, the effects may have extended further north. They also note that Anglo-Saxon place names tend to be concentrated in the southern and eastern parts of Co. Durham, and Pearsall (1961) pointed out that the place-name evidence suggests that Anglian settlement in north-west England was

confined to soils suitable for cultivation. Probably there was a shift of agricultural activity away from the uplands during the Anglo-Saxon period resulting in the relaxation of grazing pressure in upland pastures.

The second period of extensive forest clearance at all three of the 'regional' sites begins with a rapid rise of herbaceous pollen, which reaches high values for a very short span of time before declining equally rapidly. This is particularly marked at Fellend Moss where the maximum was radio-carbon dated to A.D. 1015-1045. At Steng Moss the maximum occurs a little earlier at A.D. 875-925 and after falling quickly, herb pollen values level off at about half the maximum value before declining further. No date is available for a similar phenomena at Broad Moss where herbaceous pollen curves start to rise at some time before the very high rise occurs, but comparison of the three pollen diagrams suggests that the event is more or less contemporaneous with those at Fellend Moss and Steng Moss.

The radiocarbon dates place responsibility for this phase of clearance upon Norse settlers, although there are few archaeological remains to substantiate this. Pennington (1970) attributes the main expansion of grasslands, shown in pollen diagrams from the larger lakes and lowland tarns of the Lake District, to clearance by Scandinavian immigrants, although here again archaeological remains are scarce. Oldfield (1963) recognised a corresponding episode in Lonsdale.

The subsequent regeneration of forest recorded at all three sites probably took place during the fourteenth century and is attributable to a number of factors. The general economic decline of the fourteenth century and the onset of colder wetter conditions have been mentioned previously (Chapter 5) and doubtless contributed to the decline of land use in the uplands of Northumberland. Raiding by the Scots was another significant factor. Broad Moss lies in the township of Selby's Forest (formerly Cheviot township) in the parish of Kirknewton, but so far as is known was never

included in the king's forests, and in 1399 and 1412 it was reported as laid waste by the Scots and worth nothing in consequence (N.C.H. XI, 1922).

After the period of forest regeneration, extensive clearance takes place once more, the beginning of which is dated to A.D. 1400-1440 at Fellend Moss and is likely to have occurred at similar dates at the other two sites.

The anomalous first large scale clearance shown on the pollen diagram from Camp Hill Moss and radiocarbon dated to a.d. 1310 \pm 80 has been discussed in Chapter 8 and is regarded as a very localized phenomenon.

The pollen diagrams for the other three sites all show a decline of land use which is taken to be the result of the recession of the fourteenth century. There is then a final clearance phase during which cereal pollen, pollen indicating arable activity (Godwin, 1968) and in some cases, Cannabis pollen appear in significantly larger amounts than previously and imply that arable farming was of some importance. Hordeum is the principal cereal recorded at Steng Moss and Fellend Moss, whilst in the north at Broad Moss and Camp Hill Moss Triticum and Secale are also important.

There is a decline towards the top of the diagrams in the pollen curves for cereals and arable indicators which by estimating dates from peat formation rates, seems to have occurred at about the beginning of the nineteenth century. A changeover to pasture land is indicated by the pollen assemblages. When John Hodgson visited the area around Elsdon in 1825 he reported, 'The unsteadiness of the climate of Redesdale is not, however, the only cause why agriculture cannot be profitably pursued within it. Its contiguity to the fine corn lands of Scotland, and a turnpike road through it have been the means of introducing meal and flour into it at a lower price than can, upon an average of years, be produced on its own lands. Hence fewer ploughs are used here of late years than formerly were; the eleven corn mills that existed within the parishes of Elsdon and

Corsenside in 1663 were all either entirely ruined or disused except that at Elsdon, in the beginning of the year 1825. This change we conceive to be of considerable advantage to the farmers; for the lightness of the upper soils, and the humidness of the climate are favourable to the growth of grass, so that the produce which can be most profitably sent to market, consists chiefly of young horses and cattle, sheep and wool' (Hodgson, 1827). The changeover of land use was apparently a result of external economic forces.

The final change in land use in these upland areas is marked by the rise of Pinus pollen and in some cases Picea pollen appears for the first time. This is attributed to commercial afforestation schemes.

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