

# Palynological evidence for early cereal cultivation in Strathearn

C. Caseldine\*

Excavation of a stone circle at Moncreiffe House in Strathearn by Dr Margaret Stewart (Stewart 1974) revealed a complex sequence of monuments which incorporated various deposits suitable for pollen analysis. The site at Moncreiffe House, now in the path of the M90, is situated on a fluvio-glacial terrace above the present flood plain of the River Earn at an altitude of 30 m (no 132194, fig 1). This terrace provides a pocket of sandy and coarse sandy soils of the Boyndie Association (Laing 1976) between the steep slopes of Moncreiffe Hill to the N and the gleys developed on the Carse clays to the S. On the terrace three distinct soil series have been identified and the site itself is located within freely-drained podsols of the Boyndie Series derived from fine fluvio-glacial sands (fig 1, table 1). This pocket of land would probably have provided one of the few sites suitable for settlement during the earlier prehistoric period at the eastern end of Strathearn in the area influenced by Carse clay deposition.

The interpretation of the archaeological record of the site will not be discussed here, except in providing a context for the deposits that have been analysed. Although originally considered to be a stone circle, excavation led to the discovery of more complex features and four phases of utilisation have been identified by Dr Stewart:

Phase I—construction of a henge surrounded by a ditch, of which only the ditch and a series of pits remain. The coarse ditch infill included a fragment of Beaker pottery and around the outer margin of the ditch a series of small stakeholes were discovered thought to be contemporary with the henge. The assumed date for this phase is between c 2500–1800 bc.

Phase II—a small central burial cairn was constructed within the former henge area surrounded by four or five stone monoliths, probably between 1600 and 1400 bc.

Phase III—some of the stone used in Phase II was then used for the recumbent stone circle which was the main extant monument, itself probably built around 1200 bc. This later feature had a central cairn with a spread of quartz pebbles.

Phase IV—the burials and central cairn of Phase III were disturbed as part of the site was apparently used for smelting. A partial shelter was constructed around a clay-lined pit using stones from the peristalith of the cairn and small stakeholes were uncovered associated with this phase, estimated as occurring between 500 bc and ad 500.

No complete buried soils were discovered so the palaeoenvironmental analyses relied heavily on 'derived' deposits such as the infills of the ditch, pits, sockets and stakeholes, perhaps the commonest types of deposits found on archaeological sites. Of crucial importance in interpreting the results from such deposits is often the rate of inwashing, whether, for instance,

\* Department of Geography, University of Exeter.

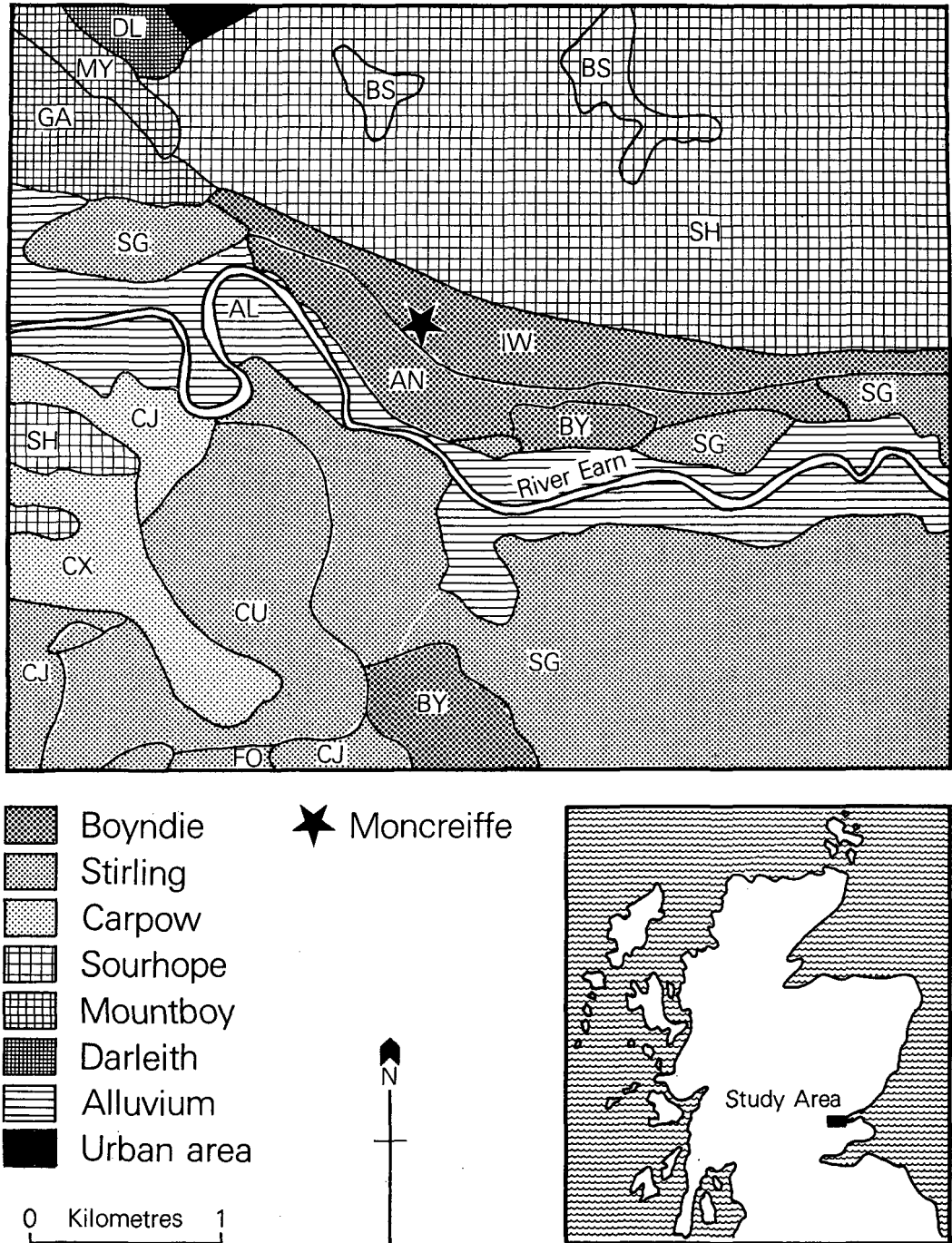


FIG 1 Location of the excavation and surrounding soil associations

TABLE 1  
Soil associations around the Moncreiffe House site

Association	Profile characteristics	Parent material
Boyndie	Freely drained or imperfectly drained podsoils	Fine, medium and coarse fluvio-glacial sand derived from Highland rocks
Stirling	Poorly drained podsoils and non-calcareous gleys	Estuarine fine sands, silts and clays. 'Carse' deposits
Carpow	Freely drained and imperfectly drained brown forest soils	Terrace silts, sands and gravels
Sourhope	Freely drained brown forest soils	Drifts from lavas of Old Red Sandstone age.
Mountboy	Freely drained and imperfectly drained brown forest soils	Till from Old Red Sandstone lavas and sediments
Darleith	Freely drained brown forest soils	Basic lavas and basic intrusive rocks

timbers decayed *in situ* or were physically removed, or whether in ditches there was gradual siltation and slumping or more rapid, possibly conscious, infilling. Thus the interpretation of the pollen evidence from 'derived' deposits relies on a clear understanding of the origin and mode of deposition as well as on the relationship of each deposit to the sequence on the site as a whole. Clearly the value of 'derived' deposits is less than that of buried soils or surfaces of known provenance but they are often the only deposits available and have to be used, albeit with care.

### SAMPLING AND DERIVATION OF THE DEPOSITS

Because of the absence of any convincing evidence for buried soil profiles and the considerable disturbance experienced on the site during the prehistoric period a spot sample approach was adopted taking samples from recognized stratigraphical positions. This allowed each sample to be related to the overall archaeological sequence and hence to be placed within an assumed chronological framework. Discussion of the samples below follows their assumed chronological order and this sequence is followed for the presentation of the pollen diagram (fig 2).

Preparation of the material for pollen analysis followed standard procedures (Faegri 1975), the siliceous nature of the deposits requiring additional processing in Hydrofluoric acid. Pollen preservation was poor in all the samples with quite high counts for indeterminable pollen and these high percentages must be borne in mind when considering possible differences between pollen assemblages. However where there are fundamental differences in the presence and absence of different pollen taxa between samples the high indeterminate counts are not considered to have been a major contributory factor. The count of Total Land Pollen (TLP) varied from 163 in F and 183 in I to 479 in A, but for all samples except F and I at least 350 TLP were counted. It must be emphasized that individually the samples may not be in chronological order in fig 2 but they are grouped according to their location on the site and as such are related to different stratigraphical positions which presumably reflect different age.

The possibility of contamination in such deposits is obviously high when the local soils are extremely sandy. This problem was examined by analysing material from above and around the sediment samples. A profile was also taken from the outer margin of the ditch to test for pollen being transported through the later overburden thrown up during construction of the nearby driveway. In all cases the results from the surrounding matrices proved negative, pollen was either absent or present only as poorly preserved traces. A surface sample of soil and leaf litter was also taken from the edge of the site (table 2) and the absence in the fossil deposits of *Tilia* (lime) and *Fagus* (beech) pollen which dominate the surface assemblage, deriving from trees on the driveway and around the house, is taken as further evidence of the lack of recent contamination. The

MONCREIFFE HOUSE

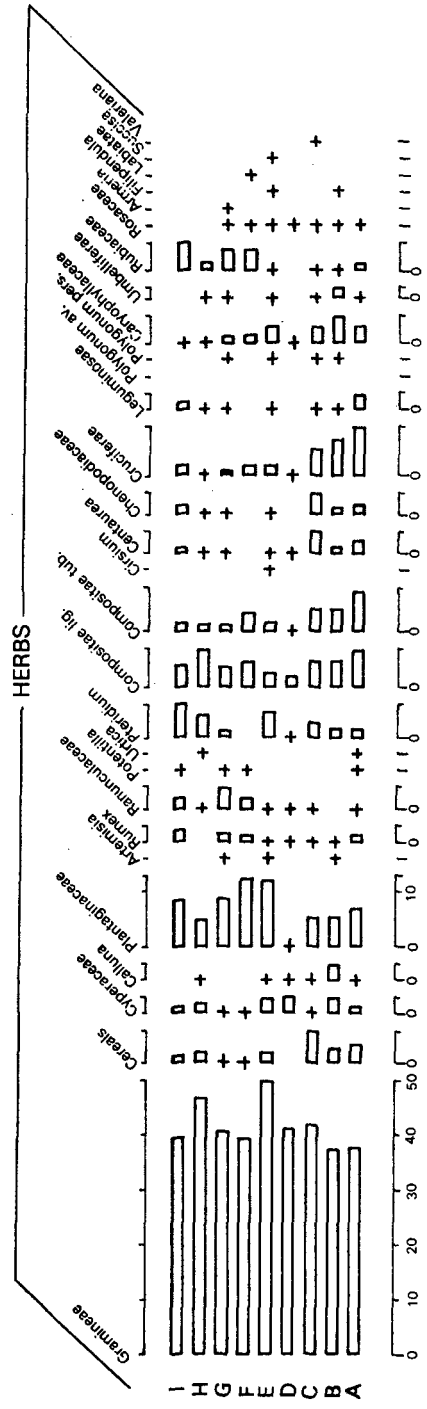
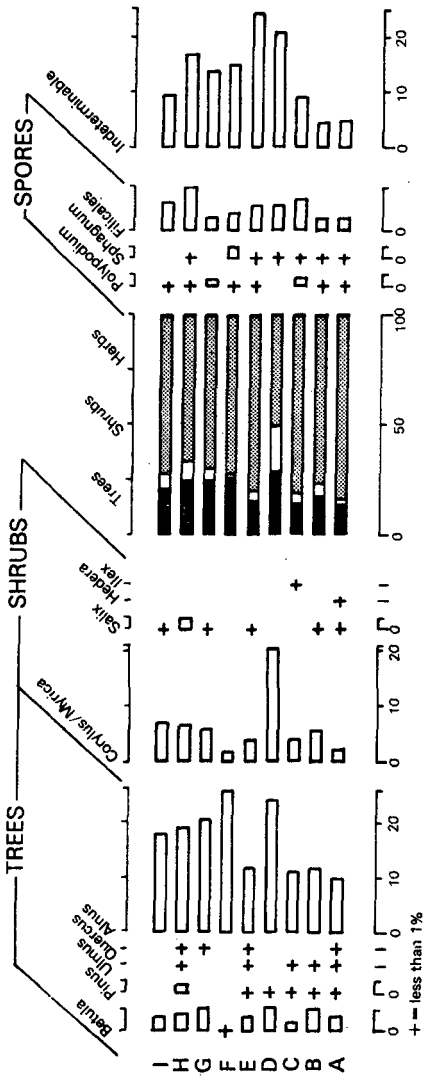


FIG 2 Pollen diagram of the analysed samples from Moncreiffe House

TABLE 2  
Surface pollen sample from Moncreiffe House

<i>Arboreal Pollen</i>		<i>Non-Arboreal Pollen</i>	
<i>Betula</i>	1.5	Gramineae	24.8
<i>Pinus</i>	4.6	Cereal type	2.0
<i>Ulmus</i>	1.5	Cyperaceae	1.0
<i>Quercus</i>	+	<i>Calluna</i>	1.0
<i>Tilia</i>	22.8	<i>Centaurea cyanus</i>	+
<i>Alnus</i>	+	Caryophyllaceae	+
<i>Fagus</i>	30.9	Chenopodiaceae	+
<i>Acer</i>	+	Cruciferae	+
<i>Picea</i>	+	<i>Plantago lanceolata</i>	+
AP	63.8	Ranunculaceae	+
<i>Shrub Pollen</i>		Rosaceae	+
<i>Corylus/Myrica</i>	1.0	Rubiaceae	+
<i>Salix</i>	+	<i>Rumex</i>	1.5
Shrubs	1.5	<i>Urtica</i>	+
<i>Spores</i>		<i>Valeriana</i>	+
<i>Polypodium</i>	+	NAP	34.7
<i>Pteridium</i>	1.0		
Filicales	+		
Spores	1.5		

(All are expressed as a percentage of the TLP sum)

variety of pollen found in the archaeological deposits and the variation between deposits is also thought to make contamination less likely, unless it occurred during the prehistoric period.

The samples taken for analysis are described below:

(i) *Henge stakeholes* (A and B). The original henge structure was at one stage surrounded by several stakes of uncertain purpose and the lowermost parts of several stakeholes were found on excavation. Samples A and B were taken from two adjacent stakeholes and in determining the origin of the fill it is still uncertain as to whether the stakes decayed *in situ* or were removed. There is no evidence for enlargement of the holes as might be expected on removal (Limbreys 1975) but with only the lower part remaining this cannot be conclusively ruled out. The infill may therefore either represent the inwashing of soil immediately upon removal of the stakes, or the more gradual infill associated with decay. The samples must therefore date at the earliest to the abandonment of the outer fence which may or may not pre-date the abandonment of the henge. Because of the small size of the holes infill would have been rapid whenever a void became available.

Both A and B have very similar pollen assemblages with high values for Non-Arboreal Pollen (NAP). Although this comprises mainly Gramineae (grass) pollen many weed taxa are well represented in both, especially *Plantaginaceae* (mainly ribwort plantains), Cruciferae (crucifers), Compositae (including *Taraxacum* type, dandelion), *Chenopodiaceae* (fat hen family) and *Centaurea cyanus* (cornflower). Cereal type pollen is also represented at values of up to 3% TLP but the grains were too poorly preserved to allow any species identification. The Arboreal Pollen (AP) component is low consisting mainly of *Alnus* (alder).

(ii) *Ditch infill* (C). Most of the ditch infill was very coarse but a thin patch of silty infill was discovered by the eastern ditch terminal. It formed a discrete band and although not on the immediate floor of the ditch it probably represents a short period of siltation which took place after initial slumping of the sides. Thus the silt was deposited as the ditch became disused but before it was physically infilled with the coarse material. The pollen assemblage found in the silt compares favourably with that in the stakeholes except for higher values for Cereal type pollen. The same suite of herb taxa are present and the low AP count is largely dominated by alder.

(iii) *Pit infill* (D). Only one of the pit infills provided a countable pollen assemblage. The material in the pit showed little variation in composition and the sample which provided the pollen

count was obtained from the base of the infill. The derivation of D is somewhat analogous to that of the stakeholes although on a large scale, the date of infilling again depending on the opening of the pit. Despite being dominated by Gramineae most of the herb taxa found in the earlier samples are either absent or only present at very low percentages. There are high values for *Alnus* (24.3%) and *Corylus/Myrica* (hazel/sweet gale, 20.3%).

(iv) *Stone socket infill and sealed surface* (E, F and G). These samples relate to the later use of the monument, first as a burial cairn and then as a stone circle. E and F were taken from the sockets of fallen free-standing stones and in this case there is good evidence that at least one of the sockets, E, was opened as a result of the physical removal of a stone which formed part of the burial cairn construction. G was taken from the land surface beneath the fallen stone from whose socket sample F was taken. It is difficult to know whether E and F are contemporary but F and G should be similar as the socket should have filled immediately after the stone fell sealing the surface. The pollen assemblages of the three are similar except that E has lower values for *Alnus*. Overall Gramineae is the dominant pollen type but the rest of the NAP record varies from that previously recorded. Plantaginaceae values are higher, between 8.6% and 12%, Rubiaceae (bedstraw family) appears at up to 3.7% and in the other herbs Compositae values occur at more than 1%. Cereal type pollen grains are recorded but at very low levels.

(v) *Stakehole of clay-lined pit* (H). Only one sample was taken from deposits related to the final use of the site. H was obtained from the truncated remnants of one of the small stakeholes surrounding the clay-lined pit. As with the earlier stakeholes it has been assumed that infill was rapid and would have taken place as soon as a void was produced. Here the pollen assemblage is similar to that of E, F and G except for higher Compositae values and lower Plantaginaceae values, *Salix* (willow) appears at more than 1% and a further noticeable difference is the appearance of *Pteridium* (bracken) at 4%, a species only occasionally found in the earlier deposits.

(vi) *Cremation* (I). The cremation deposit was associated with one of the stone sockets and on analysis it was found to contain pollen, probably from the surface on which the cremation took place. The date of the cremation and the relationship of the pollen evidence to the general sequence at the site is not clear. The pollen assemblage shows similarities to E, F, G and H but Plantaginaceae reaches 9% and percentages for Chenopodiaceae, Cruciferae and *Centaurea cyanus* are higher.

## ENVIRONMENTAL HISTORY OF THE SITE

On the evidence of their incorporated pollen assemblages it would appear that the oldest sediments on the site, the material in the stakeholes around the ditch and the silt in the ditch, probably derived from the same source and at the same time. These sediments originated from the surface soil around the ditch during the later period of henge use and were washed in when the stakes were no longer used and the ditch was still open. The total abandonment of the henge may have occurred at the same time for, although this cannot be conclusively proved, it is clear that there was no continuous slow infill of the ditch. Hence infilling of the ditch, thus covering the silt, should have occurred very soon after initial siltation, and as, palynologically, the sediments from the ditch and the stakeholes cannot be separated, contemporaneity of the two types of deposits seems very likely. The presence of a Beaker sherd within the coarse infill provides an approximate date for deposition and suggests that the landscape interpreted from the pollen in the deposits is probably of late third or early second millennium date.

The pollen assemblages in A, B and C, the stakeholes and the ditch infill, are indicative of

the presence of cereal cultivation with Cereal type pollen at very high levels for largely self-pollinating plants and a suite of herbs characteristic of arable or disturbed ground. In view of the variety of taxa and the high local type pollen frequencies, cultivation must have taken place very close to the henge itself, and from the low AP count it seems likely that much of the terrace must have been treeless. This small area must have provided one of the few patches of cultivable land in this part of northern Strathearn and had obviously been cleared, if not by the builders of the henge then by earlier communities.

The low number of tree species recorded in the sediments may be taken as an indication of the degree of clearance for alder would probably have been important on the margin of the flood plain and on the waterlogged carse areas, and, with birch, hazel and possibly oak, it would have formed the woodland on the slopes behind Moncreiffe. The absence of any significant record for oak may be due to the problem of the preservation of *Quercus* pollen in soils (Havinga 1964) but in view of the wide variety of other pollen types represented this is not considered likely. The absence of elm is not surprising considering the low percentage of elm pollen recorded at peat and lake sites in southern Perthshire after c 3000 bc (Caseldine 1980). Thus the lack of the main mixed oakwood species not only confirms the apparent age of the deposits, but also shows that most of the primary oak woodland, which would have developed on the terrace during the earlier Postglacial, had already been removed.

The infill of the pit (D) also post-dates the utilization of the henge and from the pollen evidence probably represents gradual infilling for there is a considerable difference between its pollen assemblage and those of the ditch and stakeholes. The difference also suggests that the infilling of the ditch took place as the henge was abandoned leading to a period of disuse before the construction of the first stone monument.

The pollen record from the pit shows a much more wooded landscape with a secondary woodland dominated by alder and hazel and areas of grassland lacking the variety of herb species present earlier. The terrace was by no means completely reforested but any human pressure on the land was considerably reduced and not concerned with arable agriculture.

The assemblage found in D is not only useful in establishing the likelihood of a hiatus between the henge and the later stone monuments but also in indicating the status of the soil at this time. Although previously cultivated there is no evidence that this form of agriculture had seriously depleted the soil in any way. Woodland regeneration was able to take place with hazel expanding and there is no record of heather spreading over the site. Podsolization may have started this early preventing the regeneration of oak woodland but probably not continued to any significant extent as seen in the rest of the plant record.

The interpretation of E, F and G as contemporaneous deposits is thought valid despite differences in the detail of their pollen assemblages because of the general similarity of the main NAP taxa represented, the difference from the earlier assemblages and the origin of the material. There is much less evidence for cereal cultivation, although *Cereal* type pollen is present as are some arable weeds, and there was more woodland than before, mainly of alder. The dominance of pastoral weeds such as ribwort plantain implies that grazing was of prime importance but probably within a system of mixed land use. This interpretation could be an example of the misleading impression given by local pollen from the immediate vicinity of the site, where the open ground would probably have been dominated by grasses and plantains especially if it was lightly grazed. Such a problem of interpretation is difficult to overcome but the presence of *Cereal* type pollen does show that cultivation was again taking place and the area was being used for agriculture of some form. By this time, the middle of the second millennium bc either there was less demand for arable land in Strathearn or agricultural practices had changed, for there was certainly

less cereal cultivation close to the site and it is highly unlikely that the area of carse clays to the S would have been available for cultivation. The slight difference between E and the other two samples, F and G, may reflect a temporal difference with E showing higher grasses, Cereal type pollen and *Pteridium* and less Ranunculaceae (buttercup family), *Rumex* (dock) and Rubiaceae, but could also reflect a difference in the soil horizon from which the material originally derived. There is a greater ratio of Crumpled:Degraded pollen in E and comparison with patterns of preservation in present day soils in Perthshire shows that this may be a sign of derivation from a horizon with a higher humic and lower mineral component (Caseldine 1980). In the parent soil this would make E representative of a higher soil horizon and hence dominantly showing a later pollen assemblage which, on the evidence of the changes in pollen content, would indicate some clearance of alder and the initial spread of bracken. Assuming that all these samples relate to the period between phases II and III then they show the surrounding environment between c 1400 and c 1200 bc with clearance of the secondary woodland of alder and hazel having taken place before c 1400 bc.

From the pollen assemblage found in I there is little reason to suspect that it is a later intrusion into the site. The only noticeable difference between it and E, F and G is the higher count for *Pteridium*. This may have derived from the surface on which the cremation took place which, on the rest of the evidence must have been very close to the site, or just emphasizes the trend observed earlier in E and shows the material to have derived from the very surface of the soil.

Archaeologically the assemblage found in the stakeholes from around the clay-lined pit (H) could post-date the youngest of the other samples by as long as 1600 years but there is very little difference in the pollen spectrum found in H to those found in E, F and G. The assemblage shows a dominantly open vegetation cover of grasses with plantain, bracken and Compositae and again some Cereal type pollen. The AP and shrub pollen content is almost identical to that of G except for the presence of *Pinus* (pine) and *Salix* (willow) at over 1% TLP. In such a low count these differences may not be significant but in view of the poor dispersal of *Salix* pollen the appearance of such frequencies may reflect the increasing local presence of willow, perhaps as scrub colonizing open ground marginal to the wetter areas to the S. The overall species similarity between H and other samples makes the disparity in timing between the abandonment of the circle and the use of the pit seem unlikely. As several of the stones were apparently used to assist in the construction of the shelter with which the stakeholes were associated it may be that the deposits sampled from the stone sockets date to the later phase and could be as late as c ad 400 rather than before c 1200 bc. Without clearer dating evidence either explanation could be correct. The absence of heather and the present use of the area for cultivation shows that the soils derived from the finer sands of this part of Strathearn, although eventually podsolised, were always of a better structure than those derived from the coarser sands and gravels which were more freely draining. On the finer sands podsolization never seems to have advanced to the point whereby acid heath took over.

The pollen evidence from the samples taken from Moncreiffe House, despite the difficulties encountered in analysis and interpretation, do show differences in the local environment associated with the different constructional phases found on the site. The indication of cereal cultivation at an early stage, possibly in the third millennium bc, is of interest and has implications for the interpretation of pollen diagrams elsewhere in southern Perthshire and for the interpretation of the role of early prehistoric communities in the area. The development of secondary woodland with alder and hazel following cultivation indicates a period of reduced human pressure on the landscape after the initial development of agriculture, but the rather uncertain nature of the later record, especially the dating of the deposits, does not allow any detailed interpretation of subsequent land use changes.



The results from Moncreiffe House appear to confirm the findings of Romans and Robertson further to the N at Dalladies near Fettercairn. On the basis of pollen and pedological analyses of a soil profile buried beneath the Neolithic long barrow they concluded that,

‘. . . in north-east Scotland about 5000 years ago brown forest soils under a mixed deciduous forest (within which oak was an important constituent) had developed on free-draining moraines, fluvio-glacial outwash sands and gravels around the margins of the main mass of the Grampian Highlands. These soils proved attractive to an immigrant population with agricultural experience.’ (1975, 38).

It was this type of environment that was exploited by agriculturalists in the latter part of the 3rd millennium bc at Moncreiffe and they may well have been taking advantage of clearings already made by earlier communities.

### ACKNOWLEDGMENTS

The work described here was carried out while the author was in receipt of a research scholarship from the University of St Andrews. Dr Stewart made many valuable comments on the text and on the interpretation of the results.

### REFERENCES

- Caseldine, C J 1980 *Aspects of the vegetation history of south-east Perthshire*, PhD thesis, Univ of St Andrews.
- Faegri, K 1975 *Textbook of pollen analysis*. Oxford.
- Havinga, A J 1964 ‘Investigation into the differential corrosion susceptibility of pollen and spores’, *Pollen Spores*, 4 (1964), 621–35.
- Laing, D 1976 ‘The soils of the country round Perth, Arbroath and Dundee’, *Mem Soil Survey of Great Britain (Sheets 48 and 49)*, Edinburgh.
- Limbrey, S 1975 *Soil science and archaeology*. London.
- Romans, J C C & Robertson, L 1975 ‘Soils and archaeology in Scotland’ in Evans, J G, Limbrey, S & Cleere, H (eds), *The effect of man on the landscape: the Highland Zone*, London, 37–9. (= *Counc Brit Archaeol Res Rep*, 11).
- Stewart, M E C 1974 ‘Moncreiffe Stone Circle’, *Discovery & Excavation in Scotland 1974*, 86–7.