Arch Report. 3500

Vegetational History of the Isles of Scilly: II Radiocarbon dating of Higher Moors peat bog.

Pollen analysis of peat deposits in Higher Moors Nature Reserve (NGR. SV 1112) has shown the past existence of deciduous forest which was progressively cleared by anthropogenic activity (Scaife 1980a and Scaife in Dimbleby et al. 1981). Results of ^{14}C dating have since been forthcoming and contribute to the understanding of these changes.

Samples for radiometric dating were taken from an open trench section in conjunctio with material obtained for pollen analysis. Two centimetre thick slices of peat were cut, providing enough material (c. 1kg) for ^{14}C dating by Harwell measurements laboratory. The four samples submitted produced the following assays:

35 cm	2540 ± 80 bp	(590 bc)	HAR:3724
50 cm	2360 ± 70 bp	(410 bc)	HAR:3723
65 cm	3100 ± 70 bp	(1150 bc)	HAR:3694
75 cm	6330 ± 100 bp	(4330 bc)	HAR:3695

It is immediately apparent that an anomaly exists in the dates obtained; that is, dates at 35 and 50 cm are inverted despite a substantial thickness of intervening highly humified peat. Secondly, there is a marked difference between the base date of the peat section at 75 cm and above at 65 cm. Interpretation of the dates in conjunction with the pollen diagrams is therefore made more difficult.

Basal pollen assemblage zone HM:1 shows that the vegetation during the period was predominantly Quercus Ulmus and Corylus woodland with Betula playing an importan role. Few herb taxa are noted, with a marked absence of cultigens of any type. Thos herb pollen types which do occur, originate in the mire (Cyperaceae). The date of 6330± 100 bp places the zone and the initiation of the peat accumulation in the middle of the Atlantic period (Godwin's pollen zone VIIa) - (Godwin 1940, 1956, 1975). The date and pollen spectra obtained are commensurate with the view that Atlantic vegetation consisted premarily of climax deciduous forest. The vegetation does, however, differ in some ways from other pollen data from southern England. Tilia has been widely shown to be an important, if not a dominant vegetative element in the forest. (Birks et al. (1975), Moore, Scaife 1980b) Although often regarded as a thermophilous element, Tilia has Continental affinities and it seems likely that as well as becoming less competitive northwards, it showed decline westwards in Britain. Ilex, a more oceanic/maritime element might be expected, but does not occur. Its absence in the pollen record may be due to its entomophily and consequen poorer pollen production than other tree and shrub genera, and poor pollen dispersic characteristics (Andersen 1973). Higher values of Betula are of interest and may be indicative of regenerated forest consequent upon clearance. Alternatively Betula scrub may have been of some importance in more exposed coastal areas.

Between 68 cm and 72 cm, a decline in the arboreal pollen element takes place, with corresponding increase in herbaceous taxa Of importance are the declining values of Ulmus and the incoming of ruderals and cultigens including cereal pollen. ^{14}C dating at 65 cm in the middle of pollen assemblage zone HM:2 places the zone within the Neolithic to Bronze Age for southern Britain (Burgess 1974). If the Ulmus pollen frequencies are calculated as a percentage of arboreal pollen and not as a percentage of total pollen as in pollen diagram 1, the decline is more clearly seen Two interpretations exist regarding the date and nature of the zone SH:1/SH:2 delimitation given.

i) If comparison with other pollen diagrams throughout Britain is made, at c 5000 bp (Smith and Pilcher 1973) a markedly synchronous decline in Ulmus pollen is evident. Various causal explanations for this phenomenon have been postulated. These range from climate change (Godwin 1956, 1975, Iversen 1941), differential pollen dispersion (Tauber 1967), anthropogenic clearance of forest for agriculture (Smith, A.G 1951, 1970) and the possible use of elm leaves as animal fodder by Neolithic peoples (Troels-Smith 1960) The underlying dated Atlantic zone described above is present and a 'primary Elm Decline' might be expected above if continued deposition of peat took place The decline in Elm pollen and the incoming of cereals similarly supports the idea for the first impact of forest clearance (Neolithic) for agriculture in the region. The date of 3100 $\pm$ 70 bp is, however, at first sight too young if the above interpretation is held. The peat from which samples for ^{14}C dating and pollen analysis were taken is extremely humified, especially at the base of the profile, such that a date of 5000 bp at 70 cm might reasonably be expected

ii) The younger date than expected for HM:2 and the definite change at 68-72 cm could indicate that a hiatus/break in deposition occurred at this horizon. This would result in deposits/accumulations of Neolithic age being absent in the peat stratigraphy. The pollen evidence would therefore indicate the nature of Bronze Age vegetation cover.

Pollen zone HM:3 shows evidence of forest regeneration with rising frequencies of Betula and Quercus, pollen of the former being dominant. Dating within the zone was not carried out. Samples were however, dated for the change between 52-48 cı from pollen assemblage zones HM:3 and HM:4 and a date of 2360 ± 70 bp was obtain at 50 cm. This places the zone boundary at around the time of the Bronze Age/Iron Age transition. A date of 2540 ± 80 bp at 35 cm is older and therefore inverted. Thi must cast doubt on these two dates, especially as they are separated by 15 cm of highly humified peat. The nature of this peat has made it difficult to ascertain whether or not rootlet contamination has been a primary problem causing the similarity of dates and the possibility of their being "too young". Pollen analysis has shown that the mire at this time was dominated by Cyperaceae, and macrofossil analysis (Scaife 1980 in AM Lab. Report No 3047) shows a dominance of rootlet and detritus peat. It is possible, therfore, that these dates may be young, as pre-treatment of the ^{14}C samples may not have removed all possible contaminants/younger material.

If comparisons with archaeological evidence and soil pollen analyses are made, then a Middle Bronze Age date seems more likely for the transition from HM:3 to HM:4 The large number of Middle Bronze Age passage and entrance graves (Ashbee 1974) attests to the extensive impact of man at c 1500 BC The absence of soil or pollen analytical investigations of these barrows means, however, that it is not at present possible to ascertain whether they were constructed in a forest environment or open heathland as exists today. Soil pollen analyses spanning Iron Age and Romano-Britisl contexts show the openess of the environment at that time (Greig and Keeley 1981, Greig in Dimbleby et al., 1981, Dimbleby in Dimbleby et al., 1981). These pollen diagrams can be correlated with zone HM:4 where a more or less treeless environment is inferred from the pollen evidence. This evidence would suggest that the period of Betula and Quercus regeneration occurred during the Neolithic and/or early Bronze Age.

If the evidence from the ^{14}C dates is accepted despite the inversion of the two uppermost assays (HAR - 3724 and 3723), then the following chronology may be inferred from the Higher Moors pollen diagrams.

HM:1 Initiation of peat accumulation in the Atlantic (VIIa) period, possibly due to rising sea levels at this time
Climatic change at the end of the Atlantic/sub-boreal caused the cessation of peat growth, therefore causing a hiatus in the pollen and peat stratigraphy

HM:2 Re-initiation of peat accumulation in the Bronze Age period (prior to 3100 bp for the middle of the pollen zone). The extensive activities of man during the Bronze Age are evidenced by the presence of passage and entrance graves and cist graves. Evidence of forest clearance and cereal cultivation is also present. Partial deforestation may have resulted in the formation of peat by creating higher water tables (Moore and Willmott 1976).

HM:3 Later Bronze Age regeneration of woodland, dominated by Betula scrub. At 50 cm, (410 bc) extensive clearance of remaining forest took place which may correspond with the beginning of the Iron Age The vegetation remained generally open from this period until the introduction of exotic tree species around 1700 AD (Lousley 1971).

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RADIOCARBON DATING CERTIFICATE

Sample sent for analysis by:

R G Scaife
c/o AML

CODE 389:

Result:

Higher Moors series

1 HARWELL REF.	2 SENDERS REF.	3 TYPE	4 DELC13 (%/10)	5 AGE bp (YRS)	6 bp-1950	7 COMMENT REF.
HAR-3695	DH75CM	Peat	-29.4	6260. ± 90.	4310.bc	

Comments:

AML 796632

From Basal deposits of bog, showing forested environment (75 cm).

Higher Moors, Saint Marys, Isles of Scilly.

This certifies that the sample given above has been analysed for RADIOCARBON at this laboratory. The results, expressed as DELC13, AGE bp and bp-1950, are given in accordance with the method outlined in the accompanying Notes Sheet, NS/1/75, to which due reference should be made.

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RADIOCARBON DATING CERTIFICATE

Sample sent for analysis by:

R G Scaife
c/o AML

CODE 389:

Result:

Higher Moors series

1 HARWELL REF.	2 SENDERS REF.	3 TYPE	4 DELC13 (%/10)	5 AGE bp (YRS)	6 bp-1950	7 COMMENT REF.
HAR-3694	PH65CM	Peat	-29.0	3100.± 70.	1150.bc	

Comments:

AML 796631

From initial forest clearance phase, spanning 65cm.

Higher Moors, Saint Marys, Isles of Scilly

This certifies that the sample given above has been analysed for RADIOCARBON at this laboratory. The results, expressed as DELC13, AGE bp and bp-1950, are given in accordance with the method outlined in the accompanying Notes Sheet, NS/1/75, to which due reference should be made.

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(ref. TCB2 24/ 4/80)

RADIOCARBON DATING CERTIFICATE

Sample sent for analysis by:

R G Scaife
c/o AML

CODE 389:

Result:

Higher Moors series

1 HARWELL REF.	2 SENDERS REF.	3 TYPE	4 DELC13 (%/10)	5 AGE bp (YRS)	6 bp-1950	7 COMMENT REF.
HAR-3723	PH50CM	Peat	-29.0	2360. ± 70.	410.bc	

Comments:

AML 796630

From phase of final deforestation (50cm)

Higher Moors, Saint Marys, Isles of Scilly

This certifies that the sample given above has been analysed for RADIOCARBON at this laboratory. The results, expressed as DELC13, AGE bp and bp-1950, are given in accordance with the method outlined in the accompanying Notes Sheet, NS/1/75, to which due reference should be made.

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RADIOCARBON DATING CERTIFICATE

Sample sent for analysis by:

R G Scaife
c/o AML

CODE 389:

Result:

Higher Moors series

1 HARWELL REF.	2 SENDERS REF.	3 TYPE	4 DELC13 (%/10)	5 AGE bp (YRS)	6 bp-1950	7 COMMENT REF.
HAR-3724	PH35CM	Peat	-28.9	2540. ± 80.	590.bc	

Comments:

AML 796629

From open verbaceous vegetation (35cm)

Higher Moors, Saint Marys, Isles of Scilly

This certifies that the sample given above has been analysed for RADIOCARBON at this laboratory. The results, expressed as DELC13, AGE bp and bp-1950, are given in accordance with the method outlined in the accompanying Notes Sheet, NS/1/75, to which due reference should be made.

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Ref: NS/1/75

Notes on the method of reporting radiocarbon results in the accompanying certificate

1. Age bp (Column 5): is the Conventional Radiocarbon Age calculated using the following Standards and parameters.

   1.1 Half-life: The old (W.F. Libby) value 5570 years is used. This is in accordance with the decision of the Fifth Radiocarbon Dating Conference, Cambridge, 1962 and reaffirmed at similar meetings since. It is also a requirement of the publishers of 'Radiocarbon', that this half-life value is used in dates reported therein. 'Age bp' results can be converted to the most recent value of half-life, 5730 ± 40 y[1], by multiplying by 1.029.

   1.2 Modern Standard: The oxalic acid standard issued by the National Bureau of standards (NBS), Washington is used. Following the recommended practi 'Modern' is taken as 0.95 times the activity of the standard after correction for fractionation during its preparation. Reference standards are routinely checked against freshly prepared samples of the NBS oxalic acid.

   1.3 Background Standards: Samples prepared from Marble, Coke or Fuel Oil were used in the initial setting up procedure to determine the best mean value background figure. This is routinely checked against additional samples freshly made and using the full sample preparation process.

   1.4 Stable Isotope Correction: This is expressed as DELC13 (Column 4) and represents $\delta^{13}C$, the deviation per mil, of the ratio of the stable isotop $^{13}C/^{12}C$ of the sample from that of an adopted standard (PDB). The 'Age b value quoted (Column 5) is already corrected for the $\delta^{13}C$ value given in Column 4. If there is no measurement of $\delta^{13}C$, a value is assumed which causes zero correction to be applied in 'Age bp' calculation, ie $-25.0^{o}/o$

   1.5 Bristlecone Pine Correction: No correction is applied to the results given in the certificate table. The laboratory will be pleased to advise on possible appropriate conversions to true Calendar Ages should help be required. Lack of general agreement on which calibration curve to accept induces a reluctance to quote converted dates routinely on this certificate although a corrected value will be given (in the 'Comments' section) if specifically requested.

2. Accuracy of the measurement of 'Age bp' is expressed in the associated error term (± value) as ± 1σ (standard deviation) inherent to the measurement process It is not an error which can in any way allow for contamination of the sample or any judgement based on geologic or archaeologic grounds. It includes the laboratory's estimate of their own reproducibility ie 68% of all identical replicate samples are expected to give results within the limits of ± 1σ; 95% are expected to give results within ± 2σ. Inconsistent error terms, eg when similar samples are quoted as having significantly different ± values, are generally due to the variations in the yield of CO_2 from the samples supplied. Samples giving inordinately high error estimates because the sample size was below that normally required are usually accompanied by a comment identified in Column 7.

3. bp-1950 (Column 6): In accordance with the requirements of the publishers of 'Radiocarbon' this is reported as dates 'ad' or 'bc' after subtracting 1950 from the quoted 'Age bp' although, as stated in 1.5, no further correction to bring the result nearer to the true calendar date has been applied. To emphasise this point, lower case characters are used in the certificate table when specifying 'ad', 'bc' or 'bp' but it should be noted that this convention(1) is not yet acceptable for Radiocarbon date lists. 'Infinite' dates, eg > 40 000 y, are reported as 'bp' only.

References

1. Nature, Vol. 195, No. 4845, p. 984, 1962.

2. Antiquity, Vol. 46, p. 265, 1972.