UPLAND MESOLITHIC BRITAIN;
A SYSTEMIC PERSPECTIVE

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**TABLE I**: Pollen frequency values rounded to the nearest whole number.

* = Mesolithic occupation level sample
INTRODUCTION

Archaeological studies of the Mesolithic sites and "find spots" of the Marsden and Saddleworth moors of the central Pennines have been ongoing for over a century, though only recently synthesized in a modern fashion (Barnes 1982). Pollen studies of upland Pennines Mesolithic site context deposits, however, were limited to the southern Pennines (Radley et al 1974) until R.L. Brown undertook pollen analytical investigations at three sites in the central area in 1979 (Brown 1982). Though more sites were sampled, Brown restricted her research to the pollen analysis of the deposits of Dean Clough 1, Rocher Moss, and Dean Clough 1 is one of the series of sites reported on by Buckley (1924): Rocher Moss South 2 is the site reported by Stonehouse (1972); and Warcock Hill South is one of the Warcock Hill district sites Buckley examined but is not the one he or Switzur and Jacobi (1975) refer to as Warcock Hill South (Stonehouse, pers. comm). The sampled Warcock Hill South was more fully excavated by Stonehouse in 1975-1980 and, when published, will probably be re-named the Turnpike site. The sampled site is less than 200 yards distant from that reported by Buckley and it has the same type of industry and material culture assemblage. It is thought the two represent contemporary occupations. The name Warcock Hill South has been retained here because it is the site name used by Brown in her published work. However, Buckley's site is the provenience of the radiocarbon date (O1185).

I became interested in the pollen records involved for rather mundane reasons. First, I was curious to determine if application of the swirl flotation extraction technique could successfully recover analyzable quantities of pollen from deposits Brown was unsuccessful with at Rocher Moss South 2. Second, I wished to determine the comparability of pollen records recovered by this technology with those Brown had obtained using the technique Tallis (1964) advised for mineral soil deposits. I collected and analyzed mineral soil samples from the level of the Mesolithic remains
at Rocher Moss South 2 and Warcock Hill South and I was able to recover
analyzable pollen from each of two samples from each site with little
difficulty. As I proceeded to work on the problem of comparability of my
results and Brown's, however, I found it was necessary to re-assess the
fashion in which her data had been organized.

Brown (1982) follows the traditional practice, well exemplified in
Tallis (1964) and Radley et al (1976), of considering each sampled profile
as a segregate unit of analysis prior to inter-site comparison and inter-
pretation. I applied the method of identifying populations of samples
that cross-cut the individual profile sequences. My approach is a more
regional one, and is basically justified on archaeological rather than
botanical or palaeoecological grounds. Though the content of the data
base examined is palynological, I appreciated the fact that the focus of
temporal control for these samples is the character of the associated
archaeological and sedimentological record. Throughout the upland
Pennines, Mesolithic sites are invariably observed immediately beneath a
blanket of ombrogenous peat in the upper 1-3 cm of mineral soil. Sediment
samples may thus be placed into three gross temporal groups: those from
peat superimposed on Mesolithic occupation deposits, those of the occupation
stratum. Pollen spectra of these three populations of samples can be more discretely
stratified in terms of relative depth and palynological similarity.

Application of this method yielded satisfactory results in that I
was able to demonstrate that the samples I had analyzed from the Mesolithic
occupation
at Warcock Hill South were palynologically comparable to
those Brown had analyzed from Dean Clough and Warcock Hill South. However,
the reorganization of the data provoked re-evaluation that the Marsden-
Saddleworth pollen sequence was distinct from those which have been
developed for the southern and northern Pennines at comparable elevations.
As the distinctions have significant archaeological as well as palaeo-
ecological relevance the purpose of this article is examination of the available Marsden-Saddleworth pollen sequence as a whole, and discussion of its implications.

THE POLLEN SEQUENCE

The data of a sequentially organized series of pollen spectra can be expressed in a variety of ways, each justified by its value in providing grounds for interpretations relevant to a particular kind of problem. Three problems were recognised here as of primary relevance: (1) assessment of the hypothesis that the three sites involved data to the temporal horizon of Mesolithic occupation of Britain; (2) assessment of the hypothesis that Mesolithic occupation of the uplands was related to the occurrence of a relatively unforest ed landscape suitable for the exploitation of ungulate game species; and (3) assessment of the hypothesis that the occupations of the three sites were not exactly synchronous. To deal with the former two problems effectively, the data was calculated as percentages of the total land pollen (TLP) sum and the arboreal taxa frequencies were calculated as percentages of the arboreal pollen sum (AP) exclusive of Corylus and Salix. This produced data arrays comparable to those of Tallis (1964, Radley et al 1976) and the data set used by Godwin and others for interpretation of the vegetational history and chronozones of the Quaternary in Britain (Table I).

It should be remembered that the basic structure of this pollen sequence was established on grounds not normally employed in British pollen studies. Thus the units of the pollen sequence are not the traditional pollen zones. The gross units are the populations of post occupation, occupation and pre-occupation deposits; samples and the finer units are sub-populations with similar palynological records. The relative stratigraphic position of samples of different sub-populations within a gross
relatively younger sub-populations, not absolute depth or the comparability of these pollen spectra to those of the pollen zone sequence of the British Isles. This method of construction yields a strictly localized pollen sequence. It was totally possible that the Marsden-Saddleworth pollen sequence might bear no relationship to that of other Pennines districts or even the British Isles pollen sequence.

The post-Mesolithic occupation deposits yield pollen spectra of three sorts, one of which is also represented in samples of the Mesolithic occupation level deposits. The two youngest of these sub-populations (A and B) are distinctively characterized by Gramineae: Calluna pollen ratios of 1:2 or higher. They can be differentiated from each other by contrasting values for birch pollen \( \bar{x} = 12\% \text{ of AP} \) \textit{via} \( \bar{x} = 23.5\% \), but both sub-populations are variable as regards relative proportions of AP: Coryloid: NAP and the relative frequency of Quercus and Alnus in the AP record. The five samples involved would all be identified as members of a single statistical population on the basis of a homogeneity chi square test (Moshman 1965), but this could be the result of the small number of samples involved. For the moment, I prefer to identify them as separate sub-populations because the distinction in birch pollen frequency may have some significance as a clue to the range of paleoecological conditions under which blanket peat development may be maintained, as it will be noted that the sub-populations are spatially disjunct. The most ancient sample collected from the post occupation deposits (DC 38) contains a quite different pollen record than the others collected from the peat. The proportional relationship of Gramineae: Calluna pollen is about 1:1 and the frequency value for Quercus is much reduced. In addition, it has a much higher frequency value for Alnus than the samples of the immediately younger sub-populations of pollen records.

In all three of these aspects, this most ancient post-occupation sample is comparable to two of the seven pollen sample records of the
occupation stratum. The three thus are identified as a sub-population (C) which transgresses the gross stratigraphic-temporal boundary marked by the formation of blanket peat at these sites.

The other five Mesolithic occupation stratum samples fall into the next most ancient sub-population of pollen records (D), which is characterized by lower Alnus and higher Quercus values than the other Mesolithic occupation stratum sub-population. It is particularly relevant to the discussions of vegetation patterns during the Mesolithic to note that the frequency values for Coryloid pollen in this group of samples vary through time, as does the percentage and relative proportions of Gramineae and Calluna pollen in the TLP. The two relatively late samples of this sub-population have quite high Coryloid pollen values, as is the case for the earliest sample of the succeeding sub-population. These samples also have very little Gramineae or Calluna pollen and a Gramineae:Calluna pollen ratio of ca. 1:2. All but samples of this sub-population, however, have Coryloid pollen values comparable to those of samples of the pre-occupation deposit and all, like them, have Gramineae:Calluna pollen ratios exceeding 1:2.

Two pollen spectra of samples of pre-occupation deposits at these sites are members of the same sub-population as the oldest of the Mesolithic occupation stratum (D). The remaining four pre-occupation deposit samples have two common palynological characteristics: a near total lack of Calluna pollen and a fairly to quite high proportion of NAP in the TLP. The mean AP value for samples of this sub-population (E) is lower than is the case for other populations, but the standard deviation is broad and overlaps with that for the mean AP value of younger sub-populations. The samples of this group, however, present very highly variable frequency values for AP taxa. In part this may be an artifact of the low proportional representation of AP in the TLP, but in part the samples of this sub-population seem to present the classic characteristics of pollen spectra
DATEING THE MESOLITHIC OCCUPATION STRATUM

Basically, the Mesolithic occupations can be dated by any one of three independent means which, hopefully, would yield congruent results.

In order of increasing probability of accuracy, these are cross-dating on the basis of artifact assemblage typology, palynological cross-dating by biostratigraphic correlation, and radiocarbon dating of associated organic material.

One radiocarbon date is available from the Mesolithic occupation stratum at each of the sites. For Rocher Moss South 2, Dean Clough 1 and Buckley's Warcock Hill South, respectively, they are $3880 \pm 100$ (Q1190), $5645 \pm (unpublished)$ and $7260 \pm 340$ (Q1185) B.C.E. (Barnes 1982:30). The probability of single radiocarbon dates accurately representing the antiquity of associated artifacts is, of course, not as high as would be true if a population of such dates had been analyzed. In the present situation, the matter is complicated by the fact that the C-14 sample from Warcock Hill South was collected prior to the development of radiocarbon dating and curated until analyzed (Switzer and Jacobi 1974). However, dates of similar range are available from a dozen Mesolithic sites in the upland Pennines, and are consistent with others from Britain and continental Europe. Thus direct radiocarbon dating suggests the three occupations were disjunct in time and cover a range of at least 2,000 years.

The artifact assemblage at each of three sites is classified distinctiv

as a Rod Dominated type, that from Dean Clough 1 as a March Hill type, and that from Warcock Hill South as a Broad Glade type. The chronology of Mesolithic type assemblages advanced by Mellars (1974) and supported by Jacobi (1976) would date Warcock Hill South to the earlier phase of the Mesolithic occupancy of Britain, temporally equivalent to the span of time represented by the variety of non-geometric microlith industries of
The problem here is that in the Penrith narrow blade assemblages they are do not document to total satisfaction for the upland Penina. Though associated radiocarbon dates do not disprove the interpretation, they are represented at none sites which have produced radiocarbon dates.

MAGNETOMETRIC TRADITION ANALYSIS, Swinton and Jacob (1979) argued the detectability of the Penrith narrow industry with any others of apparent

The narrow blade tradition with others of the narrow tradition and narrow blade assemblages are in fact younger then broad blade assemblages.

Harrow blade over broad blade assemblages. Longitudinal evidence that

of the Harrow HII type are there case examples of stratification of

levels have been observed in a stratigraphic relationship to assemblages

1977). No sites are recorded in which rod mounted narrow blade occupation

high ground in the central Penina and Cleveland (Swinton and Jacob)

the Mesolithic, though sites of the rod mounted type are known only from

England western parts of the narrow blade industry dating to the later part or

and Harrow and Harrow HII narrow blade assemblage sites are accredited as northern

The occupation of which continued into the boreal period.

Marrowock HII South and later be comparable with Marrowock site 1.

which include two inserted point and thistle. A cluster distinct from that

longing stratification. Forming a cluster distinct from that

and Marrowock site 1, with which its radiocarbon date also

marrowock HII, which resemble those of Steel and Curr

the industry was based on flint worked and other broad blade elements

differed markedly from the other upland broad blade sites.

The Marrowock tradition. However, Swinton and Jacob (1979:33) note
cover a potentially quite long span of absolute time. The typological
distinction between the Narrow Blade and Broad Blade assemblages from
upland Pennines sites is clear. But from available radiocarbon evidence
some Narrow Blade assemblage sites in the Pennines could be as old as
some late Maglemosian Tradition or as young as some Neolithic sites in
Britain.

Determination of the relative antiquity of site occupations through
assessment of associated pollen spectra and biostratigraphic correlation
with stratified pollen sequences controlled by radiocarbon dating is a
dating method which is well advanced and highly refined in the British
Isles. Though absolute dating of the pollen zones involved is rather less
secure than is the situation in lowland districts, certain characteristics
of the pollen sequence of the period of upland Mesolithic occupation are
very well known in the southern Pennines (Radley et al 1974) and the
northern Pennines (Turner and Hodgson 1979). In the southern Pennines,
Radley et al (1974) demonstrated that the same pollen sequence can be
recovered at sites of Mesolithic occupancy as occurs beyond such sites,
though the timing and exact vegetational changes represented in local
sequences varies in response to site elevation. Human land management
and economic practices are argued to influence the timing and character
of pollen sequences from upland Mesolithic site districts in Britain
(Simmons 1975, Jacobi et al 1976, Simmons et al 1981), but not at the
scale of individual sites.

In the pollen sequences of both the northern and southern Pennine
regions, the relative significance of pine or birch pollen is greater
than that of alder pollen during the Boreal Period, as is generally the
case for the British Isles. The amount of arboreal pollen in the total
land pollen record varies widely, as does the relative proportion of
pine to birch as the Boreal Period (Pollen Zone VI) proceeds. But the
standard British pollen sequence marker for the termination
recognised in both regions.

At the southern Pennines Mesolithic site of Broomhead 5, where a pollen sequence provides information preceding, during and subsequent to occupation, the Flandrian I/Flandrian II boundary (recognised by the Pollen Zone VI/VIIa transition) occurs in pre-occupational levels. However, Tallis notes

"... many of the individual pollen curves exhibit marked changes immediately below the microlith layer, so that ... [such] differences may not reflect a natural Zone VI/VIIa boundary, but rather a discontinuity in deposition (or even actual erosion) toward the end of Zone VI or at the beginning of Zone VIIa". (Radley et al 1974:15).

At the other Mesolithic site studied (Dunford Bridge A) the pre-occupation stratum yields a pollen record in which the predominant arboreal type is Alnus, which is typical of Zone VIIa in the British pollen sequence and which is also the situation in the occupation stratum at Broomhead. This is succeeded in the occupation level by a relative decline in alder, elm and lime and an increase in oak pollen among the arboreal taxa. This pattern is typical of Pollen Zone VIIb, a later division of the Flandrian II chronozone, in the British pollen sequence.

Variance from the standard British Isles pollen sequence occurs in the southern Pennines, both at and off sites, in the persistence of high values for hazel pollen throughout the apparent horizons of Pollen Zones VI and VIIa. This is explained as a function of altitude, and possibly a consequence of human activities, by Jacobi et al (1976) and Simmons (1975). Complications in Flandrian II, and some Flandrian I, pollen records are also introduced by non-synchronous establishment of ericaceous heath which, in various upland locales, may follow upon the prior occurrence of grassland, hazel scrub, alder woods or mixed broad leaf deciduous forest.
Absolute dating of the Flandrian I/Flandrian II transition, and the subsequent Pollen Zone VIIa/VIIb transition, is rather a complex matter at upland Pennine locations. The generally accepted position is that the Flandrian I/Flandrian II transition occurred about 5,500 B.C. in Britain as a result of regional climatic change. However, the effect of a change to warmer climatic conditions would have been differentially expressed in vegetation patterns adapted to different elevations, with the probable result that vegetation (and thus pollen sequence) change was delayed at higher elevations. Turner and Hodgson's (1975:629) dating of the end of Flandrian I in the northern Pennines is sensible as well as in keeping with available radiocarbon dates. For the southern Pennines, the date of 5,400 B.C. is accepted for this transition by Jacobi et al. (1976:311) on the basis of the radiocarbon dated pollen record presented by Hibbert et al. (1971). However, the radiocarbon date for Broomhead 5 was 6,623 ± 110 B.C. The date was run on pre-treated wood charcoal directly associated with fire-fractured chert of the Mesolithic stratum of the site, which yielded a pollen record with Flandrian II (Pollen Zone VIIa) characteristics. The Pollen Zone VIIa/VIIb transition is widely recognized to have been non-synchronous in different parts of the British Isles, and in part this supports the argument that human behaviour is to some degree responsible for both its timing and character. At the Mesolithic site of Dunford Bridge B, however, the radiocarbon date on pre-treated hearth wood charcoal is 3,430 ± 80 B.C. The pollen record of Dunford Bridge A, 20 meters distant, strongly suggests this date applies to a point in time shortly following the VIIa/VIIb transition in the southern Pennines.

In short, the diagnostic palynological markers of the Flandrian I/II (Pollen Zone VI/VIIa) boundary are observed in both the northern and southern Pennine regions. In the latter, two Mesolithic occupation stratum deposits yield pollen records of apparent Flandrian II age, though
understanding of the absolute antiquity of this chronozone.

The diagnostic palynological indices of Flandrian I are nowhere evident in the pollen sequence of the Marsden-Saddleworth region. There is almost no pine pollen in any sample and the relative proportion of birch pollen to other AP taxa is invariably too low. Brown (1982: 37-88) suggests that the lack of pine pollen in the Dean Clough record does not obviate a Pollen Zone VI (Flandrian I) interpretation of the Mesolithic and earlier samples of that site, and considers a lack of pine on the landscape as a plausible central Pennines variation of the general British Isles Flandrian I record. However, the diagnostic palynological index of Pollen Zone VIIIa of the Flandrian II chronozone, dominance of the AP record by Alnus, is recognizable for sub-populations C and D, as well as the three youngest samples of sub-population E. On biostratigraphic grounds, this dates the Mesolithic occupation stratum pollen records of the Marsden-Saddleworth. They are not as old as the Pollen Zone VI/VIIa (Flandrian records are younger than those of sub-population E, which contain none of the diagnostic pollen indices of Pollen Zone VI or even the VI/VIIa boundary. They are not as young as the Pollen Zone VIIa/VIIb boundary, since the youngest sample of sub-population C was collected from the post-occupation stratigraphic unit.

The Pollen Zone VIIa/VIIb boundary is recognized as non-synchronous in Britain, so is not absolutely datable to a specific, limited, span of years. The temporal relationship of this boundary to Mesolithic occupations in any given area, however, is significant before, and others after, this event. Consideration of the question of whether these Marsden-Saddleworth area sites were occupied closer to or further from that boundary than sites in the southern Pennines, for example, would be helpful in determining relative temporal positions of Mesolithic occupations with similar or distinctive artifact assemblages.
There is some question as to whether the Pollen Zone VIIa/VIIb boundary is represented in the Marsden-Saddleworth pollen sequence at all. Certainly the typical pattern of increase in AP, and decline in both elm and alder values relative to oak, is not observed. However, alder values do decline relative to those for oak in the two oldest samples of sub-population B. Though the AP values are too low to indicate the local occurrence of expanding deciduous forest, which is the usual situation at the VIIa/VIIb boundary in British pollen sequences, these changes may evidence such forest expansion at some distance from these three Mesolithic occupation sites. This argument is countered, however, by the occurrence of a similar pattern of relationship between oak and alder pollen in the two most ancient samples of sub-population B. If deciduous forest expansion is to be inferred for the post alder rise records of the post-occupation stratum, it must be similarly inferred for the pre alder rise records of the pre-occupation stratum. As the occurrence of an episode of deciduous forest expansion prior to the alder rise is not recognized elsewhere, this seems an inappropriate inference. Thus the relative relationship between oak and alder values observed in the oldest samples of sub-population B are clearly interpretable as a local biostratigraphic equivalent of the VIIa/VIIb boundary.

On the basis of palynological cross dating, then, these Marsden-Saddleworth district Mesolithic sites were occupied during a fairly short interval during the span of time of Pollen Zone VIIa.

Since the accepted length of the VIIa interval in both the northern and southern Pennines is probably not more than the 2,300 year period following 5,500 or 5,000 B.C. these Marsden-Saddleworth Mesolithic sites, most likely "pollen date" in the 4,500-3,500 B.C. interval and may date to no more than a century or two of that span. Dunbridge A in the southern Pennines dates younger than those studied here on palynological evidence. But Broomhead 5 may not be older if an interval of time subsequent to the
Flandrian I/II boundary is, in fact, missing from that pollen sequence, as Radley et al suggest may be the case. Thus Mesolithic occupation of the Pennine uplands region may all be encompassed within the 4,500-3,000 B.C. span, or even the half millennium interval at the end of that period.

**RELATIVE INTERSITE DATING**

Relative dating of the three site occupations must take the depth of the pollen samples below the peat-mineral soil contact into account as well as their pollen spectra. At all upland Pennine sites, the bulk of culturally introduced materials (mainly flint debitage and fire cracked rock) are recorded in the first centimeter below this contact in a black, greasy, highly organic mineral soil "transition zone" stratum. A rare item may be observed in the first centimeter within the peat, a minor fraction of the assemblage is observed between one and two centimeters depth in mineral soil, and almost no cultural material or charcoal is found between two and three centimeters depth. Samples WH 25 and DC 39 were collected by Brown from the first centimeter below the peat - mineral soil contact from the transition zone stratum. A transition zone did not occur where she sampled at Roches Moss South 2, but did occur at the two sampling stations I excavated at that site in June 1982. At one (RM 1) I sampled within the narrow transition stratum in the first centimeter below the peat. At the other (RM 2) I sampled just below it in the second centimeter below the peat. At WH 1 and WH 2 I took samples from the base of the transition stratum at both sampling stations, just above the level represented by Brown's WH 27. The WH 27, WH 1, WH 2 and RM 2 pollen records, then, were stratigraphically positioned in such a way that they are associated with the level of the minority or recovered cultural materials at each site, while the WH 25, RM 1 and DC 39 records are associated with the bulk of the archaeological record.
that of DC 39 in sub-population D indicates these two sites were not occupied at the same time. As Dean Clough I lies about three miles north-west of Warcock Hill South, these data alone cannot demonstrate such a relative chronological relationship, however, since two such spatially disjunct locales could yield temporally equivalent pollen records which are distinctive. Sample WH 30 from Warcock Hill South, however, is also a member of sub-population D and its stratigraphic position relative to WH 25 and WH 27 documents that this sub-population must be older than sub-population C. Thus though the artifacts at Dean Clough I lie in the same stratigraphic relationship to the peat - mineral soil contact as those at Rocher Moss South 2 and Warcock Hill South, they must in fact have been deposited at an earlier time.

Brown (1962:88) dated Dean Clough I as the earliest of the three also, but by a completely different method. Assessing the vertically organized variations in the pollen sequences of each site individually in the frame of reference of Radley et al (1974), she concluded that the lower part of the Dean Clough sequence, which contains less alder pollen, should be dated to Pollen Zone VI and the upper part, including the occupation level sample, to the alder rise horizon of Pollen Zone VII. Similarly, she assessed the entirety of the records from Warcock Hill South and Rocher Moss South 2 as being post alder rise and therefore the Mesolithic levels at those sites were younger in Pollen Zone VII than was the situation at Dean Clough I. Brown's means of organizing the regional pollen sequence, however, implies a significantly older absolute antiquity for Dean Clough I - essentially at the initiation of the Flandrian II chronzone - while the method employed here implies a much smaller temporal gap between the Dean Clough, Warcock Hill South and Rocher Moss South 21 occupations.

VEGETATION PATTERNS

In contrast to the situation in both the northern and southern Pennines,
forested during or reasonably soon after the horizon of Mesolithic occupation of Britain. Tree pollen accounts for less than 40% of the TLP in all samples of the pollen sequence, and the mean AP value for each sub-population lies in the 10-30% range. Nor is there any obvious relationship between the period of occupancy at the sites and a particular vegetation pattern. Though Warcock Hill South and Rocher Moss South 2 seem principally to have been occupied at the time herbaceous vegetation was areally least prominent, Dean Clough 1 occupation was apparently earlier and occupation at Warcock Hill South may have persisted later.

Vegetation pattern modification apparently occurred during the occupation of these sites, however. At a point in time prior to their occupation, the ratio of grass to heath pollen dropped from ca. 40:1 to ca. 3:1. Though this ratio is variable at the different sites during the bulk of the occupation period, it stabilizes at 1:1 before the end of the occupation interval. A significant increase in the proportion of Coryloid pollen in the TLP, followed by an Alnus increase in the AP, also occurs during the Mesolithic occupation interval of the pollen sequence. None of these changes are directly correlated with the inception or termination of occupancy at a given site, but they might be related to the inception or termination of regional residency during the Mesolithic occupation of the area.

The emerging picture is that these sites became occupied not too long after the predominantly grassy plateaux of the Marsden-Saddleworth area, invested with birch - alder thickets and hazel scrub, were invaded by occasional oaks and patches of heath. Hazel scrub, alder and heath all continued to expand their densities relative to grass during occupation, but before occupation was terminated at these sites the relative density of alder was greater than that of hazel scrub or oak in the shrub - tree canopy and the proportion of the herbaceous canopy represented as heath was about equal to that represented as grass.
Simmons (1975:6) has argued that upland Mesolithic populations used fire to reduce the proportion of deciduous forest cover relative to that of hazel and alder as a land management practice effecting an increase in the available habitat of exploited ungulates. This would have been unnecessary in the Marsden-Saddleworth area as there was no deciduous forest. But the proportion of hazel and alder habitat was increased during Mesolithic occupation. Turner (1964) argues that pollen records in which increases in Coryloid values occur relative to both AP and TLP are best interpreted as an anthropogenic effect of tree removal. This is the situation which obtains in the Marsden-Saddleworth pollen sequence during a part of the occupation interval, but not at its inception or termination.

It thus does not seem likely that Mesolithic occupation of the Marsden-Saddleworth area was specifically linked to the occurrence of particular plant or animal resources, or to the use of fire or some other method of tree removal from the area to allow its efficient exploitation by a population whose subsistence was focussed on ungulate hunting. Nor, since forests did not locally occur before or after occupation, does Mesolithic occupation of the area seem negatively related to forest occurrence. I believe, however, that neither of these matters were culturally inconsequential. What appears to me probable is that during the late Mesolithic the area became attractive to hunter gatherers because of the development of a variegated vegetation mosaic, rather than simply the existence of a variety of resources, the lack of a forest canopy, or the existence within the mosaic of a relatively large number of prime ungulate habitat hunting locations. This variegated vegetation pattern, however, had been established as the result of ecosystem modification processes acting upon the open grassland which continued as occupation went on and were ultimately to result in a different, but also less variegated, vegetation pattern: open heath. Though man did not halt the action of these processes, which were probably initiated by the opening of a late Mesolithic open grassland.
some point in the Atlantic, human populations could slow them for a time by use of fire as a land management practice. The result would be a change in the character of the components of the vegetation mosaic but maintenance, for a longer time, of its variegated nature. Thus I suggest that when the degree of vegetation variegation reached a certain level, the Marsden-Saddleworth area became attractive to late Mesolithic populations and when they could no longer maintain the vegetation pattern at a certain level of variability, the area was abandoned by those groups.

CONCLUSIONS AND DISCUSSION

This reanalysis of the palynological data presented by Brown and a small additional set appears to confirm Simmons (1975) position that most Mesolithic occupation of the uplands occurs late in the Mesolithic occupation of Britain. It does so, however, by development of the argument that all of the five upland Mesolithic sites subjected to pollen study are referable to Pollen Zone VII, and none need date about the time of the Flandrian I/II chronozone boundary. Acceptance of this argument requires rejection of the radiocarbon dates ostensibly associated with the archaeological records of a few sites. There is adequate reason to do so in the case of upland Pennine Mesolithic sites, as has been shown, but the point is less secure for the uplands of Britain as a whole. Acceptance of the argument also requires dismissal of the position taken by Switzer and Jacobi (1975) and Jacobi (1976) that radiocarbon dating documents the chronological significance of the distinctions between assemblages of the Broad Blade and Narrow Blade types in Britain. In the Pennine uplands, all three types of assemblages date within the same millennium of absolute time and may date to the same half millennium on the basis of their pollen records.

This study seems also to confirm the hypothesis put forward by Simmons (1975) and elaborated in Simmons, Dimbleby and Grigson (1981) that Mesolithic occupation of the uplands occurred within an unforested setting that may
that model of man-environment relationships as well. It suggests that in the Marsden-Saddleworth area, at least, neither the lack of forest nor the generation of prime ungulate exploitation habitat were major reasons for Mesolithic occupancy. There, Mesolithic occupation seems related closely to the period of time during which - either by natural or artificial means - hunter gatherer populations were able to live in the context of a varied vegetation pattern landscape.

Clearly, this study does not present adequate grounds to justify the conclusion that Jacobi's model of upland British Mesolithic chronology or Simmons' model of upland British Mesolithic cultural ecology are incorrect. But it does strongly suggest that they are to some degree imprecise, as those models do not accommodate evidence that occupation by populations utilizing all the typological varieties of Mesolithic tool assemblages was limited to a short interval and was not contextually related to an environment in which forest played any significant role. Thus at least one local variant to the general conditions stated by those models of the upland British Mesolithic situation seems to have existed, and this implies the existence of other plausible variants.

This raises two rather interesting archaeological issues. First, how can the existence of variations from the general rule posed by these models have escaped prior recognition? Since the publication of Clarks' *Excavations at Stan Canr* - an archaeological study of the Mesolithic horizon in Britain - has been a signal focus of archaeological research, and the past decade has witnessed publication of a suite of studies specifically concurred with archaeological analysis and interpretation of upland Mesolithic occupation of the British Isles. These works have been well addressed by both geochronological and paleoecological research, as well.

Second, what is the relevance of the identification and delineation of variations of the sort ostensibly expressed in the Marsden-Saddleworth district? Would it significantly alter our comprehension of British
Mesolithic archaeology to determine either that no other variations exist or that many others exist, or that such variations as do exist are temporally or spatially limited?

Responding to the first issue, I suggest that the establishment of general models of upland Mesolithic archaeology for Britain has been conditioned and reinforced by three specific factors. One of these is the systematic effort made to determine whether or not a correlation exists between clusters of radiocarbon dates and long-recognized typological variations in the Mesolithic material culture record. There seems little doubt that such correlations do in fact exist, and this suggests that the typological groups have chronological significance despite the fact that the number of site-specific radiocarbon-typological group associations is normally too small for adequate evaluation. However, the typological groups involved are not restricted to upland areas. Setting aside the thorny question of whether the difference between Narrow Blade and Broad Blade assemblages necessarily reflects cultural distinctions of any sort, the question of the degree to which the temporal patterning indicated by the correlations applies specifically to any given district remains open. To deal with the problem of potential variance from the general rule, fairly large numbers of sites of each district must each produce reasonably large numbers of radiocarbon dates.

A second contributing factor is the character of the paleoecological studies archaeologists have tended to reference and interpret - particularly the palynological studies - which provide information about the nature of paleoenvionmental conditions. What seems not generally appreciated is that these studies were not originally designed, or controlled, for the purposes they have been put to by archaeologists. What the archaeologist has been concerned to know is the character of the paleoenvironment which provided the biotic resources exploited and affected by the human population resident at Mesolithic sites. What the paleoecologist
has been concerned to know is (a) the nature and timing of patterns of successive ecological change, and (b) the contrasting influences of upland and lowland topography and physiography on such patterns of change. In this situation, archaeologists are interested in identifying a synchronically organized paleoecological condition which may or may not be variable over space to a quarter degree than the paleoecologist is interested to discriminate, while the paleoecologist is interested principally in identifying diachronically organized variation to a quarter degree of discrimination than may be archaeologically relevant. The information produced by the paleoecological studies can be interpreted as evidencing a general homogeneity of upland environmental conditions during given segments of the horizon of upland Mesolithic occupation in Britain, though Turner and Hodgson (1979) have recently applied methods which reveal more heterogeneity than has been previously recognized. But most studies do not actually allow a rigorous test of this interpretation, as they were not designed for such a purpose. Such a test requires assessment of the variability reflected in numbers of paleoecological records from different districts, each of which is temporally controlled by independent data. The traditionally employed method of establishing pollen sequences is not well suited to this objective. The method employed in the Marsden-Saddleworth study is suitable.

Finally, the general models seem influenced by the characteristics of an anthropological model of the cultural meaning and pertinence of particular forms of archaeological data. Since the time of Clark's (1952) pioneering effort to view the archaeological record in ecological perspective, there has been general acceptance of the position that the economic nature of prehistoric archaeological cultures is best characterized and exemplified by the interaction of environmental, technological and subsistence patterns. But Clark's ecological perspective was generated at a time when concern with the identification of the economic character of
processes by which economic patterns of various types are initiated, maintained and transformed was much less. Clark's ecological approach constitutes far more a method for accurate classification of the economic system of a prehistoric culture than a method for determining the nature of the subsystems which interacted processually to maintain that economy.

I suggest then, that we have generated general models without appreciable concern for the cultural variability they may cloak because of long standing interest in the problem of the credibility of typological variants as chronological controls, because of a lack of appreciation of the limitations of the methods traditionally utilized to yield paleo-environmental information, and because the ecological approach to archaeological interpretation of Mesolithic sites is designed to assess cultural variability at a general scale of resolution in the framework of the typology of economic systems. As a result of its use of a different method for identifying the character of a local pollen sequence, the Marsden-Saddleworth study was specifically designed to reveal whatever degree of inhomogeneity in paleoecological conditiona might exist in both space and time. It is pertinent, in this regard, to recognize that the method used for construction of the Marsden-Saddleworth pollen sequence is, in fact, an archaeological method rather than a paleoecological method. It is justified by an appreciation of the characteristics of the temporal significance of that body of archaeological-cultural record we term Mesolithic, not by an assessment of the relationships of the pollen record of this district to the frame of reference of paleoecological or even temporal patterns indicated by the pollen records of other districts. Paleoecological methods of pollen analysis do exist for this purpose, but were not employed here.

Yet, perhaps the recognition of possible variant forms of artifact assemblage-temporal relationships and cultural ecological relationships in the upland British Mesolithic is of little archaeological moment.
Certainly the identification of such a range of variation purely for the purpose of more precise description of the Mesolithic seems a somewhat sterile exercise, and one which may require investments of time, energy and funds which could be put to better use.

My response to this is that it depends on what it is we wish to know about the cultures of Mesolithic populations in Britain, and the degree to which we are convinced that other archaeological perspectives and approaches are theoretically and operationally sound. Consideration of ranges of variability is an essential aspect of the systemic approach, or processual method, of modern archaeological study. Founded on the theoretical assumption that cultures are organized as systems composed of subsystems which fulfill cultural functions, this approach requires assessment of variations in both the component elements and the interactive relationships amongst the elements of cultural subsystems for reconstruction of the reasons and the ways the subsystems effected their functional roles in the fashions evidenced by the archaeological record. The ecological approach allows us to recognize the general characteristics of systems and subsystems and identify those bodies of data which are pertinent for systemic analysis. Application of the ecological approach to British upland Mesolithic archaeology has documented the nature of that culture's economic subsystem (hunting-gathering) and demonstrated the occurrence of behavioural elements of that subsystem such as transhumant residence and subsistence dependence upon ungulate fauna. Further, it has demonstrated the occurrence of subsistence-settlement relationships of certain sorts, temporal-technological relationships of certain sorts, and patterns of man-environment relationships involving game management through habitat manipulation. Without doubt, continued study employing the ecological approach will reveal yet other elements and relationships which constitute components of the economic subsystem of upland Mesolithic culture in Britain, and perhaps the component elements and relationships of other
But there are matters of some interest that the ecological approach cannot resolve, or can resolve only through the adoption of assumptions which cannot be evidenced by its continued application. The ecological approach cannot, for example, resolve the question of why Mesolithic hunter-gatherers focussed their subsistence on a certain set of ungulates or how the transition from Upper Paleolithic technology to Mesolithic technology was effected. It can document the temporal correlation of environmental and economic and technological change in a controlled fashion. But the proposition that this correlation suggests the existence of a causal relationship is assumed within the methodological structure of the ecological approach. The approach, as a result, cannot function to produce evidence for or against the verity of that proposition. When the ecological approach was formulated and first argued as a valuable archaeological method, it was necessary to justify its assumptive constructs on the grounds of anthropological theory, ecological theory, common sense understandings of the character of man's position in the Natural History of the earth, and recognition that its application effected an organizational structure for a body of archaeological record that had previously been organizable only upon the basis of demonstrably weak principles. To a very great degree, this is still the case. Development of the systemic approach over the last two decades, however, has provided tools which can be employed as means of testing certain of the assumptions of the ecological approach through controlled organization and controlled evaluation of data. The systemic approach can be operationalized to deal with the sorts of explanatory questions posed above because it is specifically designed to examine such processual issues from the perspective of the data provided by the archaeological record itself, rather than a suite of assumptions.

This is not to say that the assumptive constructs necessary to the systemic approach are better justified than those which unably acceptance and application of the ecological approach. A number of polemical
arguments supporting this claim have been advanced, but it is not necessary to accept them in order to employ the systemic approach as a tool. Some archaeologists feel uncomfortable about utilizing methods which are argued from assumptions they consider of debatable character, perhaps, but in last resort all the scientific methods archaeologists employ are based on some debatable assumptions. The issue is, then, no less one of degree in this case than any other and each archaeologist must resolve that problem to his personal satisfaction. I happen to be an archaeologist who believes that the theoretical and logical justification of a scientific method is less important than the nature of the insights about the past that are revealed through its application, or the effectiveness with which its application produces a potentially significant structural organization of data. Conceived as a tool relevant to such a goal, I am content to argue the value of application of the systemic approach to analysis of the British upland Mesolithic archaeological record whether or not the resultant insights have a necessary claim to being valid in an absolute sense. And I certainly would not suggest abandonment of the ecological approach or any other scientific method in favor of a systemic approach. Each has its values and each has both appropriate and inappropriate applications. The systemic approach is more appropriate than the ecological approach if one is concerned with processual questions and the data base can be argued to be relevant to its application.

At present, the systemic approach cannot be applied to analysis of the archaeological record of upland Mesolithic culture in Britain. The problem is not theoretical but operational. Too little is yet known about the range of variability in the component elements and relationships of the cultural subsystems of this culture for effective analysis. This study has not demonstrated the applicability of the systemic approach, either. It has shown only that variation exists that has been revealed by the methods of study used to date. Thus it has demonstrated the potential of systemic
There is, however, another way in which this work may stimulate application of the systemic approach in Mesolithic research. This work presents results which have been achieved as a consequence of the employment of an archaeological method of pollen analysis. If systemic study of the economic subsystems of cultural systems are to proceed rigorously, and if it is acknowledged that such subsystems incorporate biotic component variables and relationships existing between biotic and behavioural variables, it is necessary to recognize the need for the establishment and development of methods for interpreting the cultural significance of biological data.

I have argued the proposition that the methods biologists employ for identifying the biological significance of the fossil record are not always well suited to determining its cultural significance previously (Schoenwetter 1981), and shall not repeat that here. If this research has made a contribution of lasting value to systemic studies of Mesolithic in Britain, it lies not in its demonstration of the occurrence of variability but in its demonstration that the development of archaeological methods for determining the variability of component biotic variables and relationships between component biotic and behavioural elements of a subsystem in a controlled way is not a particularly demanding problem. It does not require the expertise of "specialists", by and large, for most of the component variables and relationships of cultural subsystems are in fact behavioural, and the ecological approach can be fruitfully employed to identify which system elements are biophysical in character and the general nature of the relationships which obtain between such elements and the behavioural elements of the subsystem under study.

In sum, what this study seeks strongly to suggest is that a systemic approach to the study of upland Mesolithic culture in Britain is relevant, valuable and practical at present - particularly when undertaken in conjunction with studies which employ the ecological approach. The conceptual tools needed for such work may need a degree of sharpening or
but are not so much a technical problem as a problem that demands employment of imagination, distinctive perspectives and a willingness to chance the failure of an idea to perform operationally.
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