<Cedar Mesa Adaptations;>
<change and continuities>

I <Introduction>

In the previous chapters we have analyzed the Anasazi occupations on Cedar Mesa with respect to previously established ideas and hypotheses along with avenues of investigations that appeared during this process, but we did not systematically compare the occupations with each other. Nor did we compare them in detail with other results from other regions, nor evaluate the Anasazi occupation as a whole. In this chapter we bring together these comparisons and attempt to place the Cedar Mesa manifestations in their proper place in southwestern archaeology.

To begin, we compare and contrast our final interpretations of the Anasazi occupations, from numbers of artifacts, to locations of sites and population sizes. With this comparative information at hand, the nature of society on Cedar Mesa is investigated. Particular attention is paid here to differences in aggregation and the limited feasible possibilities if one has a society which is both matrilineal and matrilocal. Our attention then turns to possible explanations of the repeated
abandonment of Cedar Mesa, in particular the possible exhaustion of arable land and the possibility that climatic changes were related to the occupational discontinuities. The Cedar Mesa patterns are then briefly compared with other well known Anasazi settlement patterns. We conclude this volume with a brief summary of our findings and point out areas that could be profitably investigated in the future.

II <Comparison of occupations>

While we have made comparisons between occupations previously, here we focus on the similarities and differences among all three, rather than the detailed inspection carried out in the previous chapters. The variables used to compare the occupations are the size of the collections, the nature of the architectural features, and the number of sites and site classes. This comparison is followed by a brief review of selected important site types and their distributions on the elevation and dense pinyon-juniper variables. A review of the different distributions on the mesa, focusing on differences from that expected above is next turned to. Finally the populations estimates calculated previously are briefly compared.

In terms of gross numbers of sites, both the Basketmaker
II and Pueblo occupations resulted in 130-odd components identified in the 76 quadrats, compared with only 49 Mossbacks components identified for the Basketmaker III period. These numbers are relatively in accord with the length of occupations, a not too well supported estimate of 200 years for the Grand Gulch Phase, a very well supported 200 years for the Pueblo period, and one of 75 to 100 years for the Mossbacks. The situation in the canyons, though is very different with the Mossbacks either rare or absent (absent in fact in Hardscrabble and only 1 site found in West Johns) with Grand Gulch components making up over half of the sites in every case (Table III-1), and with datable Pueblo sites concentrated in the last Pueblo (Redhouse) Phase.

The distribution of lithic tools, differs significantly between the Pueblo and Basketmaker II periods, indicating significant differences. While over two-thirds of the identified, separable Basketmaker II components had enough tools to analyze (12) less than half of the Pueblo components fell into this class. On the other hand, there were more (17 compared to 12) Pueblo sites with more than 100 lithic tools. The range of number of tools is much less in the Basketmaker II than in the Pueblo period with the interquartile range for 92 Pueblo sites being 5 to 77 and that for 122 Grand Gulch sites 14 to 61, closer to the median on both the low and high ends. The position of the
Mossbacks occupation is unclear, given the multicomponent nature of a high proportion of many Mossbacks assemblages. This greater range in the Pueblo period is related below to a greater diversity in habitation site size.

Some of the most obvious contrasts are in the numbers and kinds of features found during the different periods. About half the Grand Gulch Phase sites have sandstone slabs features present, with hearths out numbering cists. Ash hearths occurred on one quarter of the sites, but they often occurred in large numbers. Trash and/or burned sandstone and limestone areas were found on almost half of the sites, and the burned limestone and sandstone areas were found only on this period. Only a quarter of the Grand Gulch sites had features indentified as pithouses. On first glance these features are found in various arrangements and not highly correlated.

This relatively wide variety of features is contrasted with the simpler pattern of features found in the smaller, but more confused Mossbacks sample. Neither the ash hearth or burned midden was noted, with the features most commonly found being sandstone slab hearths, cists, honeycomb cists and pithouses. Both cist forms appeared to be associated, at least usually, with pithouses, so that only the slab-lined hearths were frequently found away from dwellings.
The Pueblo occupation resulted in a much wider variety of features, with both masonry and slab based features present, as well as pithouses, or presumed kivas. Slab-lined hearths and cists were also common, as well as structure trash areas. All of these were found on sites with habitation structures, while only hearths were frequently found on sites without habitations, although a few features indentified as cists were also noted. Jacal was frequently noted on sites with habitation sites, both with slab based and masonry structures. It is in this period too, that the very visible cliff dwellings and numerous masonry graneries seen in the canyons belong. Ash hearths are also found during this period, but usually associated with habitation sites.

The differences between the periods, in lithic tools, number of sites, and number and kind of features are correlated with the functional site classifications. The Grand Gulch sites were classified into four types, habitation sites, limited activity sites, campsites, and lithic reduction sites. Limited activity sites and habitations are at opposite ends of the continuum, with limited activity sites usually having little more than ash hearths present, while the 50-odd habitation sites had the full range of architectural features present, although only about half had features identified in the field as pithouses. The campsite class was unique among the
occupations and appeared to have an intermediate duration of occupation, and typically had a sandstone slab feature, or two, present. As pointed out before, some of these campsites were among the very largest sites belonging to this phase. On the other hand, one pithouse appeared to be the limit for the habitation sites, at least as we recorded them in the field, which limited the range in habitation site sizes, and consequently, as reported above, the range in number of lithic tools collected.

In contrast with this distribution of site classes, in the succeeding occupations, almost all sites were classified into habitation sites or limited activity sites, with the campsite site class virtually disappearing and the lithic reduction site class occurring only in low numbers. For the Mossbacks period, the majority of the sites were classified as habitation sites, although that may be partly an artifact of our conservative classification methodology and the low archaeological visibility and identity of this period. In contrast, slightly less than half of the Pueblo sites were classified as habitation sites, almost the same proportion (and absolute number) as found in the Grand Gulch Phase. In no case during the last two occupations, did a non-habitation site have large numbers of artifacts present. In contrast with the relatively constant size (a single pithouse) of the Grand Gulch phase habitation sizes,
there are large differences in the last two periods caused by the present of multi-dwelling sites probably combined with different occupation durations.

There is, then, a real contrast in kinds of sites, between the first occupation and the succeeding two (putting aside the cliff dwelling phenomena). In the first, there is a wider range of site kinds, with less emphasis on a single residential site, and with the largest diversity in collection sizes being in the limited activity campsite class. In the last two occupations there is a much greater contrast between habitation and limited sites, but a corresponding greater variety in site size in the habitation class.

The explanation of the diversity in collection sizes among campsites probably has to do with natural resources, some of which were used annually over long periods of time, in contrast with habitation sites, which probably had short uselives. Thus a resource area regularly used for a few weeks each year, over the 200 year Grand Gulch occupation (such as Hardscrabble 11?) might result in larger surface assemblages than in many habitation sites. Such situations apparently did not occur in later times. Other explanations are needed to account for habitation site diversity in later times.

<Settlement Patterns.>
Comparison of site class locations on our two most sensitive measures of agriculture potential, elevation and percentage of dense pinyon-juniper coverage, shows some differences, but an overall similarity between occupations. We will first look at elevation and pinyon-juniper.

The elevation of habitation quadrats (Figure XII-1) shows a broader, lower distribution for the Grand Gulch Phase, a high narrow one for the Mossbacks, and a slightly broader and lower one for the Pueblo period. All, however, are in accord with maize horticulture, with medians of 1948 m (6390 ft.), 1984 m (6510 ft.) and 1966 m (6450 ft.). The ranges in two of the three occupations are considerable, with a midbreath of around 100m, but the varying factors of exposure, deep soil and so forth, undoubtedly are partly responsible.

If we reflect about the development of maize, the relative low elevation of the initial Cedar Mesa occupation is what would be expected. Maize probably evolved from Teosinte through human selection (Beadle 1980, Galinat 1971). Teosinte is a low latitude drought-intolerant species that is not resistant to cold temperatures. In fact it will not even flower in the long days found in the temperate zone summers. Over time maize developed into a drought resistant, cold tolerant species, that uses the long temperate summer day fully. All these developments
had to have occurred to some extent before maize could have been successfully used as a main staple in the Colorado Plateau. None of these changes may have occurred for the low elevation use in Northern Mexico, or use in the Southwest in the Basin and Range province. Thus we would expect that the maize used during the Grand Gulch Phase will not be as cold tolerant, or as drought resistant as later varieties. This would lead to a lower elevation use, and possibly more selective use of the area. The lower elevation of the Grand Gulch habitations, then, is what would be expected in this situation. Not only is the general distribution lower, but the high end truncation fits this as well. Of course, a slightly colder climate would also result in a similar lowering of elevation.

The absence of bean cultivation during the Grand Gulch phase, an absence also well known from other Basketmaker II areas (Guernsey and Kidder 1921, Eddy 1966, Morris and Burgh 1954), may also result in a distribution lower in elevation. With the absence of beans, the Grand Gulch culture may have been more dependent on non-cultigens for protein, or more specifically, lysine, than succeeding Anasazi. These efforts may have resulted in the campsite class, many of which are located in areas suitable for both wild grass gathering (mainly Indian Rice grass) and hunting. Since this important class of sites is located in relatively low elevations and since the winter habitations
sites were undoubtedly located to minimize total distance to all important resources and sites, the presence of the campsites may have acted to reduce the elevation of the habitation sites.

In contrast to the campsite class, all other limited activity sites are found at the higher end of the elevation range (Figure XII-2). Three-fourths of all Pueblo limited activity quadrats are above 1900m (6200 ft.), half of the Mossbacks, above 2000m (6560 ft.), but with a possibly misleading lower quarter of 1827m (5995 ft.), and an even lower first quarter of 1800m (5890 ft.) for the Basketmaker II period. It is clear that the later limited activity sites are located in the higher elevation ranges. The differences among the occupations we interpret as the result of the Pueblo occupation being almost exclusively rainfall farming field stations, while sites of other functions are mixed in this class in earlier periods.

This interpretation is supported by the exposures and by the amount of dense pinyon-juniper coverage, a proxy measure for deep-soil and high amounts of effective moisture. Field stations would be expected to be located in areas of dense pinyon-juniper, and the median in the Pueblo period is 80% coverage and 85% in the Mossbacks Phase (Figure XII-3), fulfilling our expectations. The Grand Gulch Phase limited activity sites, on the other
hand, have a median of only 76% and a very low first quarter of 23%, presumably because of the presence of non-agricultural sites, such as lithic reduction and hunting camps. Note that this median is still much higher than the 52% of the Grand Gulch campsite class.

With a pattern much like the elevation plot, all periods show a similar concentration of habitation quadrats in dense pinyon-juniper (Figure XII-4), with all having medians in the 70 to 80% range. The Grand Gulch distribution is somewhat lower than the others, and this might be attributed to the development of maize, as suggested above, or the greater "attraction" of non-agricultural resources such as exploited via "campsites" which tend to occur in sparse pinyon-juniper areas.

The Pueblo distribution appears to have a broader second quarter than the Mossbacks, but this (Figure XII-5) is apparently partly attributable to the terminal Redhouse Phase. The Redhouse Phase has a median of only 69%, and an upper quartile less than the median of the quadrats which have sites belonging to the other three Pueblo Phases. The Mossbacks and three of the Pueblo occupations appear to be too similar to each other to distinguish between them on settlement pattern grounds, but the terminal Pueblo occupations, the Redhouse Phase, is clearly different. The occurrence of this phase in areas
of sparser pinyon-juniper than other Pueblo material, is in good agreement with its location at lower elevations and closer to known sources of water.

In all three occupations the densest concentration of habitation sites occurs on the northern and higher parts of the mesa. This tendency is most extreme for the Mossbacks Phase, which has no recognized habitation sites in Hardscrabble, and very few in West Johns, particularly when compared to the northern drainages (Figure IV-7). As indicated previously, the Basketmaker III period is rarely found among the canyons.

While the proportion of the archaeological remains found in the Hardscrabble quadrats that are Basketmaker II is very high, this parameter conceals the fact that the density there is very low (Figure IV-5). In contrast to other periods, the density of sites declines rapidly in the Upper Grand Gulch drainage along with the elevational trend, which suggests that the Basketmaker II "niche" did not include this area. The generally slightly lower and more southerly pattern is also reflected in the density of Basketmaker II material in West Johns, which was very sparsely utilized in the succeeding periods.

The Pueblo occupation, like the Mossbacks phase, is also concentrated in the northern three drainages, and in the higher elevations, although not quite to the same
extent. Again, this difference from the Basketmaker III pattern may be caused solely by the Redhouse phase, which is concentrated in lower elevations than the other three Pueblo phases. The general pattern for the Basketmaker III and Pueblo settlement patterns is for very sparse occupation in the south, which then rises rapidly half way along the mesa and continues at this density to the northern most quadrats.

The Grand Gulch pattern, on the other hand, while it shows the same low density is the lowest and driest portions of the mesa, becomes dense much sooner in the West Johns drainage. And, of course, it drops off in Upper Grand Gulch, indicating our sample of quadrats completely encloses the "fundamental niche".

In terms of the east-west direction, there does not exist any unexpected patterns for the Grand Gulch occupation, but both the Basketmaker III and Pueblo occupations are concentrated toward the east (Figures IV-9,11,14 and 15). Some of this higher density in the east than in the west at any given elevation, may be the result of the higher effective moistures associated with eastern exposures, compared with western ones, but some may also occur because of the resettlement of Cedar Mesa from the east. This may be particularly so for the Mossbacks, which has a geographical range that basically ends with the west edge of our sampling area on Cedar Mesa, and
apparently has a greater east-west differentiation than the Pueblo occupation.

In looking at our reconstruction of niche spaces (Figures IX-6, X-4, XI-4), we perceive a concentration of habitation sites in all periods at the top of the upside down U, in the area of high elevation, deep-soil, dense pinyon-juniper, in close agreement with the variable by variable analysis. This pattern is clearest for the Mossbacks (Figure X-4) but continues for Grand Gulch (IX-6) and Pueblo (XI-4). In the Grand Gulch phase, limited activity sites occupy a much wider range of environments, including some of the driest and lowest places (Figure IX-14).

The Mossbacks limited activity pattern is similar to the habitation pattern (Figure X-6), supporting the inference that most of these sites are field stations. Even the exceptions to the pattern can be interpreted as agricultural field stations, Hardscramble 4, as a sand dune farming area, Bullet 17, access to lower Bullet Canyon bottom alluvium (Figure X-6). This pattern, as contrasted with the Grand Gulch pattern, supports the previous inferences of a variety of functions being associated with the latter.

The Pueblo habitation site pattern (Figure XI-4) falls in between the other two, but with some of the extensions
from the Mossbacks (West Johns 17, Bullet 17) occurring, either because of the terminal Redhouse occupation, or canyon use, or both. Pueblo limited activity sites (Figure XI-6) are similar to the Mossbacks with the extensions to the dense pinyon-juniper zone, either related to sand dune farming (Hardscrabble 4, 14), hunting sites (West Johns 15, Hardscrabble 13) or canyon bottom farming (Bullet 17).

All these patterns fit with the idea that the dominant activity for all periods was rainfall dry-farming. The biggest surprise was the amount of concentration in the deep-soil pinyon-juniper community and the lack of emphasis on sagebrush, either ridgetop flats or sagebrush covered valleys.

The utilization of the canyon environment was most intense during the initial and terminal occupations. The first is expected, as Grand Gulch figured large in the initial discovery of the Basketmaker II (Pepper 1902, Kidder and Guernsey 1919, McNitt 1957). The definitive investigation of Basketmaker II by Kidder and Guernsey in the Marsh Pass area was also in the canyon context (Kidder and Guernsey 1919, Guernsey and Kidder 1921). This early work recovered materialcached in storage cists and located in canyonside rockshelters. We found enough cists and hardpan storage pits to verify this use was also general in Cedar Mesa canyons, although most had long since been potted. While the early workers did not report on other
kinds of Basketmaker II canyon sites, with the exception of rock art panels, we found a number of substantial, non-habitation sites in the upper reaches of canyons, particularly in Hardscrabble and Bullet. These sites appear to be roughly equivalent in duration and residential function to the mesa-top campsites and occur in areas with possible agricultural soil. Our tentative identification of these sites as agricultural related is far from certain, but fits such evidence as we do have.

The canyon rockshelter use as storage areas would make sense in terms of being the receptacles for the produce from the above canyon sites, and from lower canyon bottom flood-water farming. The use of these facilities as cache areas fits in with a seasonal use of the canyon environment. The use of some of these areas as cemeteries must be explained in some other fashion. If our judgement of the short life of the mesa-top habitations is correct, it may be that there was longer term association with seasonally used canyon areas. If the model proposed by C. Irwin-Williams (1973; 1979) is correct for Anasazi developments, the canyon would also have been the previous center of occupation. A model of development from San Jose Cochise, with lower elevation flood-water farming as the previous adaptation, might also result in the canyons as being considered the "traditional" center of activities.
In any event, the Grand Gulch Phase appears to have had an adaptation that relied more on canyon resources than the other two occupations as a whole. Many Grand Gulch limited activity sites lie between the mesa-top agricultural areas and the lower elevation canyon rims indicating the importance of the canyons. Still, to our surprise, the majority of sites and activities took place on the mesa-top, oriented away from the canyons, towards the mesa-top arable land.

The Mossbacks Phase, as mentioned above, is essentially absent from the lower elevation canyons. Sites are found, however, in the Upper Grand Gulch and Bullet Canyons indicating that the arable soils in the canyon bottoms adjacent to the densely inhabited mesa-top were used, while areas further away, were not. Even from our very limited numbers of Basketmaker III canyon sites we can be certain that the canyon environment was not a focus of intense use, or an important part of the "fundamental" niche.

The final occupation of Cedar Mesa has an equivocal relationship with the canyon. There is the strong, clear terminal Redhouse occupation, but it has covered up and obscured the previous Pueblo use. Tree ring dates suggest that an earlier mid-twelfth century use occurred, but its nature and extent is unclear. A similar mid-twelfth century use is well documented in Johnson Canyon, south of Mesa Verde (Harrill and C. Breternitz 1976). Similarly the
terminal habitation of northern Black Mesa is also associated with a cliff dwelling component in the early twelfth century. Could the abandonment of Cedar mesa by Kayenta ceramic users also have been associated with a cliff dwelling component? Or were these Mesa Verde ceramic users? This poorly preserved canyon use corresponds to a possible hiatus found on the mesa-top, and found, for certain, to the west in the Red Rock Plateaus (Lipe 1966,1970). With this exception until the early thirteenth century, the Pueblo canyon use was probably not all that important.

The canyon environment was very densely occupied in the terminal Redhouse Phase. Of the 23 randomly selected drainage canyon sites that had enough ceramics to tentative place them into one of the four Pueblo Phases, only two were classified to the earlier two phases, compared with 17 sites to the terminal Redhouse Phase. This distribution stands in sharp contrast with only 11 of the fifty mesa-top Pueblo habitation sites being classed as members of the Redhouse Phase. Thus while, if anything, the Redhouse Phase made up less than 25% of the mesa-top sites, over two-thirds of the datable drainage canyon sites belonged to this time period.

The actual number of sites (and thus people) involved, though, is unclear. Only 7% of each drainage was sampled
by quadrats, while each drainage canyon was completely
inventoried and sampled at variable rates, but usually at
15% or more, resulting in approximately twice the
proportion of sites found in the canyon being mapped and
collected as on the mesa-top. Thus even during the
Redhouse Phase, more sites may have been occupied on the
mesa-top than in the canyons. This picture, though, is
muddied by the ceramic analysis, which suggests that the
canyon Redhouse sites tend to be later in time than the
mesa-top members. An additional complication is the nature
of the well preserved canyon sites, which are long on kivas
and storage facilities, and short on habitation rooms,
suggesting that substantial portions of each community
regularly resided elsewhere.

The location of canyon sites during the Pueblo period
was only weakly influenced by the presence of arable soils
(Lipe and Matson 1975) as they existed in many situations
that do not today, and most-likely never, had any arable
soil. The corresponding concentration of mesa-top Redhouse
sites close to domestic water sources suggests that this
was a resource of interest at this time.

The constancy of the importance of the higher mesa-top
areas on Cedar Mesa, is offset by the initial and terminal
use of the canyons. In spite of the initial importance of
the former to the development of new world archaeology, and
the visible dominance of the latter to the casual visitor,
the canyon exploitations stand like bookends to the volumes of mesa-top occupation on Cedar Mesa.

When we turn to population estimates, we find that inspite of all the vagaries involved in archaeological work, the dominant unknown variable is the average duration, or use-life of habitation structures. Relative to the information about the other variables—site function, family size, precision of site total estimates—this variable is at another level of imprecision. While none of the other variables are exactly what one might call well known, good arguments can be made for all of them being likely within a range of, say, plus or minus 20% of the values used. In contrast we have plotted habitation durations, or site use-life, over a range of not less than 400% for all periods, and seriously discussed ranges of 100% and more.

Another problem is that of Grand Gulch habitation sites. We have argued that for all sites we classified as habitation sites are winter dwelling sites, although not more than half of these are actually recorded as having surficial structures interpreted as such in the field. While we judge these sites to actually have dwellings, we also gave estimates using only those sites that were judged in the fields to have probable structural remains of pithouses. Our best Grand Gulch Phase population estimate
is the range of 500-1000, or an average site occupation duration of 6 to 11 years. If one allows for dwellings only where there are surface structural indications, a population of half as much results. As we pointed out previously, a number of paradoxes appear if one takes this latter position.

The Mossbacks Phase population estimates do not have this problem, as all sites classified as habitation sites have surface indication of dwelling structures. If we use a dwelling use-life of five to twelve years we obtain a population estimate of 400 to 1200 people. The reason approximately the same population range is obtained as in the earlier period with only about half as many habitation sites, is that the Mossback occupation only lasted about half as long as the Grand Gulch.

Treating the Pueblo period as a whole, and grouping habitation sites into small and large sizes, but considering each class to be occupied for similar lengths of time results in a population of 500 for a habitation use-life of 5 years, and 1250 for 12 years, not significantly different from the earlier two occupations. If we allow the large sites to be occupied twice as long as the small sites, which we judged to be more realistic, we find our population estimate of 500 (small sites 3.5 years, large sites, 7 years) to 1200 (small sites, 8 years, large 16 years) again encompasses our best estimates, although we
judge the higher end to be the most likely. While it would be of interest to examine the data for trends within the Pueblo period, our sample proved to be too small for meaningful comparisons between the four Pueblo Phases.

There is, then, essential overlap in population estimates for all three occupations. We expect that the lower estimates to be more likely for the earlier occupations, and the higher ones, be more likely for the later ones, on the basis of other evidence for increasing sedentarism, thus resulting in longer average site use-life. But no hard evidence for any significant difference is directly evident from the data used to calculate the population estimates themselves.

<Summary>

Except for the beginning and the end, habitation sites, and the majority of limited activity sites are located in the arable deep-soil pinyon-juniper area, testimony to the dominance of rainfall dry-farming as the main subsistence activity during the Anasazi occupations on Cedar Mesa. Even the population estimates are very similar attesting to the similarity of adaptation during all three Anasazi periods. The largest differences lie in the initial and terminal occupations. During the Grand Gulch Phase, the low lying, medium duration campsites existed, a class not found in the later two occupations. In addition there is a
Matson, Lipe and Haase (Jun. 90) XII-23

constant canyon presence not found in the other occupations.

The other exception, which proves the rule, is the terminal Redhouse occupation which dominates the Pueblo cliff dwellings and likely results from the last, desperate attempt of the Anasazi to stay in this area. We will examine some of the evidence for this last statement in the next section.

III <The Nature of Cedar Mesa Society>

Given the distribution and nature of the Cedar Mesa habitations, what can we say about the Cedar Mesa Anasazi society? Given the lack of detailed intra-site analysis and the controversy that the pioneering studies by Longacre (1964,1970a) and Hill(1965,1970c) generated one might consider that is a topic not worth investigating, particularly in the light of our earlier statement about not focussing on attempts to determine ideational aspects of past societies on Cedar Mesa (Lipe and Matson 1971a:135).

Many important aspects of society are non-ideational but in spite of the fact that much of our data was not collected to bear on these subjects a number of significant observations can be made. We do not mean to imply that the efforts of Hill and Longacre were futile, while not popular today, and not without methodological faults, as any intial effort must be, current work suggests that the basic
assumptions are viable, both in general as Flannery (1976: 251-4) has clearly pointed out, and on smaller scales as incidental research has (Washburn and Matson 1985, C. Irwin-Williams 1986). Instead their approach was simply not part of the Cedar Mesa project.

In examining the nature of Cedar Mesa society, the differences that occurred through time must be recognized. While at all times the population was dispersed into small "rancherias" (Jennings 1963:12), differences in degree did occur. During the Basketmaker II period dwellings in close proximity are very rare, although we argued for dispersed "villages". In both the Basketmaker III and Pueblo periods, either multi-dwelling habitation sites exist, or larger dwellings that suggest groups larger than nuclear families existed. In the extreme case, sites consisting of dwellings for three to five nuclear families, and defended storage in cliff dwellings for perhaps twice that, occurred.

For the Grand Gulch Phase, though, the basic economic group is clearly that of the nuclear family. With dispersed villages, if indeed, they did exist, a relatively low amount of economic interaction between families can be inferred. There is no positive evidence, at Cedar Mesa, or elsewhere, for community level integrative structures. The closest to this that may exist
in Cedar Mesa is the Canyon burial caves and the associated rock art panels. The evidence is clear that the main, and probably only, corporate group is the nuclear family.

The relatively isolated nature of the Grand Gulch period dwellings, is slightly modified in the succeeding period, where sites, such as Upper Grand Gulch 4-3 and North Road 11-4, are clearly the results of economic groups larger than the nuclear family. On the other hand, many other habitation sites appear to be the remains of single nuclear family dwellings. We argued previously that even the "isolated" small sites are probably part of dispersed villages, such as we postulated for the Grand Gulch Phase. Still, large organized villages do not appear, let alone ones with stockades.

The situation for the Pueblo period presents even clearer evidence for organizations above the level of a family, where sites are clearly the results of multiple families living together. Other sites, such as Prudden unit type pueblos, can not be positively identified either as the results of partially integrated, but still separate nuclear families, or as more integrated, fully corporate, extended families, but must be one or the other.

In the Pueblo period kivas, in Prudden unit sites, cliff dwellings, and in isolated cliff kiva forms, exist, indicating an integrative structure above the nuclear family level. Whether anything similar existed for the
Basketmaker III in this area is unclear. Given the brief duration of the Mossbacks occupation and the center of gravity to the east, it may well be that if such structures exist, they are located off Cedar Mesa, as we defined it for sampling purposes, somewhere further towards Comb Wash. It has long been considered that the prehistoric Anasazi in this area were probably matrilineal and matrilocal (Prudden 1918). Twenty years ago a dispute began over the archaeological investigation of residence, and by inference, kinship, rules (Longacre 1963, Hill 1966). In both the original concern with these issues and the more recent debate, the western Pueblos were used as analogue models for the prehistoric Anasazi. Here we wish to discuss this often implicit model in the Cedar Mesa situation to point out some features of this model that are not usually appreciated and to suggest some possible modifications.

To begin with the well known ethnographic model, as presented by Eggan (1950), matrilineality and matrilocality in relatively large and dense settlements are some of the well known core features. This is a situation where the husband goes to live in the wife's dwelling, which would normally be near the dwellings of other female members of the wife's lineage. Important property, such as structures and certain kinds of farming land, are inherited in the
female line (Bradford 1971). It is not surprising in these circumstances that the in- marrying spouse has a relatively weak link with his female spouse, and a stronger, and often more enduring relationship with female members of his own lineage. A married male needs to maintain close contacts with both his natal family, where he has many permanent rights and duties, and may indeed, be an important authority figure with important responsibilities, and with his spousal family where he also has rights, including that of farming his spouses land, but which are more of a usufruct nature. It is clear, then, for this kind of social arrangement to function well, the males' natal and spousal families must be in close geographical proximity to each other. This kind of situation is clearly met in the historic western pueblos. When archaeologists are dealing with situations without large-aggregated settlements this aspect should be carefully inspected, as we will do below, to see if the historic model is a viable option in other circumstances.

Another feature of the ethnographic model that is closely tied to the sorts of settlements existing today, and may not exist in other settlement varieties, is the sexual division of labor. In the historic Western Pueblos men do most of the horticultural work, particularly in the distant fields. Fear for the women's safety may be one of the reasons for forbidding women working at a distance from
the home (Steward 1955; Eggan 1950:130). In the historic western Pueblos the population concentration means that most fields are far from the dwelling.

In more dispersed settlements, such as found on Cedar Mesa, one would expect that most fields would be adjacent to the habitations, and we have demonstrated that habitation sites are located adjacent to arable soils. In such a situation one might expect females to work in the field along with the males, or even have primary responsibility for horticulture. Given the widely known relationship between horticulture and matrilocality, which goes all the way back to Morgan (Steward 1955), one has indirect evidence that women working in fields lies somewhere in the past of the Western Pueblos. Given the agricultural dependence exhibited in the Basketmaker II times, it is tempting to attribute the wide numbers of non-habitation, non-field station limited activity sites to "ritual" male activities, while the females grew most of the food. Julian Steward's (1955) model presents essentially this kind of origin for Pueblo matrilineality and matrilocality, which is also supported by Eggan (1950). With these two features of the historic Western Pueblos kept in mind, let us re-examine the Cedar Mesa data.

First, as suggested above, if distance from habitation affects the sexual division of labor, we would expect
female participation, at least on the nearby fields. Given this greater self-sufficiency of the female headed family, would this indicate even less stable marriages than those among present Western Pueblos? With this kind of pattern, distant fields might have been worked by the males, or if the seasonality did not overlap, by females through moving the family to the distant fields for short periods during the season that demand intensive work. These lines of reasoning indicate that the organization of work on Cedar Mesa was likely very different from the historic Western Pueblos.

A stable, localized matri-lineage that is matri-local demands the kind of concentrated population discussed above. If Prudden unit pueblos were localized matri-lineages, as proposed by Prudden (1918) and Fewkes (1919), there needs to be a high density of such sites so that the in marrying males would be able to maintain contact with their natal families. Thus, contrary to the apparent physical isolation and apparent self-sufficiency, Prudden units must have been integral parts of a continuous network of lineages exchanging males with nearby Prudden units, if these sites were localized matri-lineages. The small size of the Prudden unit, particularly the Cedar Mesa variety, would guarantee that they would be basically exogamous, no matter what norms existed, but a close connection with the natal Prudden unit
would definitely be a cultural tradition.

While it may be difficult to see how such an organization developing on the basis of small, scattered sites, such as we find in many areas during Pueblo II, the preceding Pueblo I period was a time of population concentration. These sites occurred in situations with limited land for agriculture, located in valleys (Lipe 1983) where emphasis on land ownership, such as exists in present Western Pueblos might have developed. Like wise, the existence of multi-lineage settlements would allow the development of such a social organization, which may have already been ideologically preferred. The Pueblo I situation may have also initiated exclusive male agricultural work on distant fields as well.

The maximum limit to the distance between Prudden units that were matri-local can be roughly estimated. If relatively constant contact with the natal matrilineage was to be maintained by the males, the same kind of distance limitations that Bradfield (1971) makes clear for corn fields would be in place. Thus a distance of 7 to 10 km between natal and spousal matrilineages would probably be the limit. A round trip distance of 20 km would probably be the maximum that could be regularly made on a single day and leave enough time for visiting and allowing ones duties and responsibilities to be carried out. Because of
Matson, Lipe and Haase (Jun. 90) XII-31
demographic factors, allowing for chance factors of the
correct sexes and appropriate ages for marriage to occur
(Martin 1973), the average spacing between unit type
pueblos must have been much closer.

If this kind of organization existed on Cedar Mesa,
only the areas with the most dense unit type Pueblos would
be viable. During the Pueblo period, however, many people
were not living in unit type pueblos. Thus this variety
developed for exclusive unit type pueblos above can not
have been appropriate for all dispersed settlements.

While arable land around an aggregated population must
have been the kind of resource that would have been "owned"
or controlled, except for land relatively immediately
adjacent to habitation sites (Dyson-Hudson and Smith 1978)
the dispersed situation must have been quite different.
Thus the present day near-monopoly of land by kinship
groups would not have occurred. In such a situation one
can see nuclear families living near the female head’s
natal matri-lineage, but in a compromise location with the
males natal matrilineage. Over time, of course, such a
"new" location might evolve into a unit type Pueblo,
re-establish itself, or relocate at the female natal
matrilineage. During all three Anasazi occupations on
Cedar Mesa, the lack of aggregated settlements indicates
that there were environmental constraints which did not
allow aggregation. By extension, in many places on Cedar
Mesa, even "normal" sized unit Pueblos were not possible. The distributional data earlier indicates that the larger Pueblo sites were limited to the highest and most densely vegetated areas on Cedar Mesa. One would expect looser arrangements and more independent nuclear families, the further one moved away from these more densely settled areas.

Given the traditional archaeological belief that the early kivas were matrilineage ceremonial structures, (Prudden 1918; Steward 1955; Hill 1970c; Longacre 1970b) one would expect that the "senior" part of the matrilineage would be at this locus. The smaller habitation sites without kivas would usually be expected to be "junior" single nuclear families or extended families. Kivas also exist away from habitations, at least in canyon situations. As per other canyon occupations, these appear to date to the terminal Redhouse Phase.

In pre-Pueblo times, the lack of obvious multi-family sites makes such a social system difficult to discern. While some of the larger Mossbacks sites might have had a similar function as Prudden units, it is difficult to see it as an essential part of the social pattern. Actually, prior to aggregation, such as occurred in Pueblo I, it is difficult to see a rigid form of it developing, although such an ideological pattern might have developed. Within
the size of villages, as existed in Basketmaker II and III periods, with the dwelling sizes usually indicative of single nuclear families, one is hard pressed to see how the social organization found in the historic Western Pueblos could operate.

Something different than the usual Cedar Mesa pattern, however, must have been occurring in the cliff-dwelling situation. Here, there is more evidence for community organization and corporate defense. As reported above, the defense is clearly that of stored foodstuff, with graineries typically behind walls or on defended ledges, while habitation rooms and kivas are not. Coupland (1981) has pointed out this is typical of internecine warfare, where harvest times are safe periods, but, once crops are in, raids would take place.

If kivas are related to single matrilineages, the existence of multi-kiva cliff dwellings suggests the development of multi-lineage corporate groups. The lack of habitation rooms fits in with the association of habitation with fields and the lack of arable soil at many cliff dwellings. We would expect, then, that much of the time would be spent away from the cliff dwellings, near the fields. Still the cliff dwelling would need to be relatively close to the fields—within Bradfield’s five miles—otherwise the transportation costs would be too high.
Matson, Lipe and Haase (Jun. 90) XII-34

Immediately, a number of question arise about the cliff dwelling storage. Was all the food stored there, and moved out in small quantities to the dwellings near the fields? Or were only some emergency supplies kept there? What about dwellings in the winter? Would these be located in the canyon?

It is possible that some of these questions may be answered through our planned close study of the data gathered during the architectural-stereing study.

In addition to stored food, potable water also seems to have been defended. Not only are Redhouse Phase sites closer to known water sources than those of earlier times, but canyon sites are frequently located in places where there was no arable land, but where known springs occur. This suggests that drinking water was an important, limited resource in the terminal canyon period. We will return to this question when discussing possible reasons for the hiatus.

From both the perspectives of the historic Western Pueblos and the previous occupations on Cedar Mesa, the canyon occupation is aberrant, and ultimately, an unsuccessful adaptation. One has the impression of part of a generation desperately clinging on, but eventually abandoning the area, and along with their neighbors, the entire northern part of the four corners area.
Matson, Lipe and Haase (Jun. 90) XII-35

These various organizational possibilities are not presented in the belief that the Western Pueblo social organization was certain to have existed in Pueblo III or earlier times. Instead there are put forward in the belief that this social organization did develop sometime, is potentially investigatagble through archaeological methods, and that the standard ethnographic model is clearly unworkable in the Cedar Mesa case without substantial modification.

Another series of unanswered social questions have to do with the nature of the Mesa Verde and Kayenta ceramic interactions. While any numbers of substantial differences have been indicated as occurring between these different Anasazi branches, it is not certain that in this transitional situation that the ceramics indicate the full range of cultural differences. While the well preserved cliff dwellings and excavated late sites do indicate most attributes of the Mesa Verde culture, kivas with pilasters, etc, do we really have evidence of the Kayenta tradition, besides the ceramics?

This question can not be answered as positively with the evidence at hand. Careful excavation of a site or two dominated by Kayenta ceramics would answer this question more definitively. Some cliff dwellings do have attributes that are similar to those found to the south in the Kayenta heartland. We briefly the various possibilities for the
relationships between Kayenta ceramic users and Mesa Verde ceramic users below.

The most self-evident possibility is that of the ceramics indicating the existence of groups sharing the other cultural attributes. The Clay Hills Phase (Kayenta ceramics) was the period of maximum expansion of the Kayenta tradition north of the San Juan (Lipe 1970: 112-113). At this time (circa A.D. 1080-1150) Cedar Mesa was the furthest north and east of the continuous Kayenta ceramics region. To the west of Cedar Mesa at this time, Lipe (1970:112-122) reports that the contemporaneous Klethla Phase is not only Kayenta in terms of ceramics, but in also in other attributes as well. The Clay Hills sites at Cedar Mesa would simply be the eastern most extension of this cultural group.

There are a number of hints that this may be the case, such as Kayenta style entry boxes in canyon sites that may date to this period. As indicated above, however, no in depth study on this problem has been carried out, and it is likely that this would require excavation.

An alternative explanation is that the inhabitants simply traded in Kayenta style pots at that time, or perhaps made pottery of that style without conforming to other aspects of Kayenta social norms. If most pottery was not made on Cedar Mesa, it would be surprising for Cedar
Mesa inhabitants to trade for a majority of Kayenta ceramics, probably over substantial distances, and ignore adjacently produced Mesa Verde ceramics. The technical superiority of the Tusayan white wares and the more colorful Tsegi orange wares would suggest, though, that this is still a possibility.

If ceramics were not produced at either the domestic level, or at the local settlement level, it is difficult to visualize ceramics being produced north of the San Juan, as the Red Rock Plateau population density was far lower than that at Cedar Mesa. Thus, if Cedar Mesa Clay Hills inhabitants were not culturally Kayenta, one would have the unlikely situation that they would be the largest group of Kayenta ceramic users for quite some distance, perhaps all the way to the Skeleton Mesa or Black Mesa areas. On the other hand, Cedar Mesa is on the western edge of a large area densely populated by the Mesa Verde branch. Certainly, there are no indications that the Kayenta inhabitants of the Red Rock Plateau were engaged in large scale specialized ceramic production. It should be remembered that the Clay Hills ceramic assemblage does not just include the widely traded Tsegi orange wares, but also the Tusayan black-on-whites and corrugated wares.

While this trading scenario appears to be inherently unlikely, the distances to the Black Mesa and Skeleton Mesa areas are not so far as to make it impossible. Further, it
is also possible that some inhabitants of Cedar Mesa were not core members of either branch, allowing the easy acceptance or rejection of ceramics without much additional meaning.

The other alternative idea of Kayenta ceramics being produced by non-Kayentans on Cedar Mesa also has problems. Even if ceramics were not made domestically, a Pueblo population of around a 1000 would certainly encourage local production of, at least, utility ware. One might also imagine a small Kayenta group thus producing pottery for mainly Mesa Verde inhabitants.

Following Lipe (1970:135), the idea of acculturation to the Kayenta pottery style appears to be unlikely because of the coherence of the Kayenta pottery, i.e. Mesa Verde designs are not common on the Kayenta ceramics. Because of the less coherence of the Mesa Verde ceramics the opposite is not as clear, but the Cedar Mesa Mesa Verde ceramics of the Windgate and Woodenshoe Phases do not appear to have significantly more Kayenta influences than contemporary Mesa Verde ceramics further to the east.

All these lines of argument and evidence, weak though they are, indicate that the most likely source of the Clay Hills ceramics is the presence of Kayenta cultural groups on Cedar Mesa. Convincing evidence, though, would require excavation or, perhaps, technical analysis of pottery.
Because of the ambiguity of dating, whether or not Cedar Mesa was simultaneously occupied by Mesa Verde and Kayenta pottery users is not clear, although sites with relatively equal amounts of ceramics traditions do exist which does suggest extensive contact. Of course, such sites could also result from re-occupation of sites by the users of the other ceramic tradition. Further study of the question would require a project centered on it. In summary, for most of the Anasazi occupation, the nuclear family was the main economic unit. These were probably organized into dispersed villages during Basketmaker II and III times. In Pueblo II/III times lineage corporate groups are possible, but with a substantial portion of the population living away from the kiva oriented core. During the terminal canyon occupation, defense of stored foodstuff was clearly important, as well as control of water sources. Kivas were also located at these sites, though the number of habitation rooms suggest off site dwelling for many.

IV <Causes of Hiatus>

Of the two outstanding features of the Cedar Mesa Anasazi occupation, the continuity of function and discontinuity in time (Matson, Lipe and Haase 1986), it is the discontinuity that needs the most explanation. After all, constancy in a given environment is the null hypothesis, changes are what need to be explained--what
caused the repeated occupation and abandonment of Cedar Mesa? The common explanation is that the environment was not constant, either because of anthropogenic factors or climatic reasons. We examine both possibilities below, beginning with possible man-made reasons.

Shifting slash-and-burn agriculture may have been a factor in the repeated occupation/abandonment pattern. Stiger (1979) concludes that shifting cultivation was practiced prehistorically on Mesa Verde, a view that is supported by Wyckoff’s (1977) documentation of extensive deforestation there by Pueblo II times. Shifting cultivation in pinyon-juniper plant communities presumably would allow horticulturalists to take advantage of high levels of plant nutrients available after forest clearing (cf. Brady 1974:158-159).

The upland eolian soils of Southwest Colorado and Southeast Utah (Arrehenius and Bonatti 1965) are relatively high in nutrients (as our own tests have indicated) and are not rapidly depleted under modern cultivation (K. Petersen, per. comm.); crop growth is apparently limited by water and temperature (Shuster 1981; Petersen 1984). The only modern rainfall dry farm on Cedar Mesa has been cropped for at least 15 years, although beans and wheat, rather than maize, are the main crop. Oral tradition in the Colorado-Utah dry-farming zone asserts, however, that crop
yields are highest in the first few years after clearing. Barth(1980) has pointed out factors that would favor forest clearance and shifting cultivation in areas like Cedar Mesa. He reports that soils underneath pinyon trees in western Colorado have nutrient levels two to 20 times greater than in adjacent shrub-covered areas as well having a differential accumulation of sandy eolian material under trees. Once trees were killed, this loose sand may have acted as a moisture-absorbing and conserving mulch to allow crops to take advantage of the initially high nutrient values of forest soils.

Limited dry-farming experiments by the Cedar Mesa Project showed that pinyon and juniper trees could easily be killed by torching individual trees, with the aid of a few dry branches or shrubs piled at the base. Our impressions were that the labor investment was no greater, and was probably less, than would have been expended in clearing sagebrush without metal tools. A further possible advantage of pinyon-juniper plots is the lack of shrubby weeds there that proved so tiresome in Shuster’s(1981) experiments. Burning of the trees would also make additional nutrients available, at least for the first few years. As we have demonstrated above, ad nauseam, habitation sites of all periods, and almost all limited activity sites of the Basketmaker III and Pueblo occupations are found closely associated with dense
pinyon-juniper, indicating that farming did occur there. The most successful of our limited horticultural experiments was a slash-and-burn, deep-soil pinyon-juniper plot along the mesa divide giving empirical support to this argument.

It is not only possible, then, but probable, that forest clearing would have provided Anasazi horticulturalists with high yields, at least for a few years before nutrients declined and the loose sandy mulch blew, or eroded away. This "payoff" could only be collected every several hundred years, because of the long time required for a mature pinyon-juniper forest to be re-established (cf. West 1978; Stiger 1979). An added benefit of shifting cultivation would have been the enhancement of edible annual and, both small and large, game density in the early stages of plant succession that followed field abandonment (Bye 1976; Ford 1984). Observations of our experimental fields suggests that this stage would continue for at least 10 years.

What is the possibility that shifting cultivation could have effectively used up the available forested arable lands during the 75 to 200-year time span we infer for Cedar Mesa occupations? If we liberally assume that half of the land having dense pinyon-juniper forest above 1890m (6300 ft.), which is the general lower limit of habitation
sites, was arable, approximately 18000 hectares in the study area would be suitable for this kind of farming. As we have pointed out above, the deep-soil, the pinyon-juniper measure is an over estimate of arable land, as it does not take into account such factors such as exposure, cold air drainages and soil deep enough to cover the bedrock, but not enough to store sufficient water for rain-fall farming.

If we have an estimate of arrable forest land, we need only estimates of land needed per person and the uselife for a field to combine with our population estimates and duration of occupation to see if shortages of arable land may have occurred. A number of reports on traditional southwestern horticulture practices exist, and they allow us to estimate the land needed per person.

Woodbury (1961:38) reporting on estimates for the late nineteenth century Hopi indicates that they consumed about 700 lbs of maize per capita (note including infants) and obtained a yield of some 670 lbs (301 kg) per acre of maize. According to one report, the Hopi were farming between 3 and 4 acres per capita and planting about 55 percent of it in maize. Bradfield (1971:21) argues for two acres of maize per person and about one half acre in vegetables for traditional farming. Woodbury concludes (1961:38) that a minimum of two acres per person would have been necessary in the Point of Pines area. Pennington
(1963:63) reports slightly smaller amounts of land per person for the Tarahumar. These figures indicate that an estimate of one hectare (2.48 acres) per person would not be too far off, assuming that two thirds or more would be planted in maize.

For a population figure, all these occupations may have had 1000 individuals, although this is probably a generous estimate for the Grand Gulch Phase. If we use this figure, at any given time 1000 hectares would be under cultivation. It is difficult to estimate field uselife. Bradfield (1971:18) argues "that 'shifting cultivation'...never played any significant part in Hopi agricultural practice". This conclusion is based on the observation that Ak Chin fields are renewed by flood waters and dominate Oraibi Valley where he did his study. There is no equivalent situation at Cedar Mesa, and flood water farming appears to be the exception rather than the rule. Sand dune fields, however, are not permanent (1971:18) and this kind of field may be closer to the usual plots on Cedar Mesa than Ak Chin fields. Uselife is an area where controlled experimental evidence such as that obtained by Shuster (1981) is badly needed.

If we try five years as uselife, or the "high payoff period", we find that over the 200 year occupation span of the Basketmaker II or Pueblo periods, 40 hectares per
person will be used (200/5=40 one hectare fields). This figure multiplied by the 1000 population value suggested above results in 40,000 hectares being used, more than twice as much as we estimate is available. If one uses 10 years as a uselife, one ends up with 20,000 hectares, still slightly more than our estimate. A field that lasts ten years is not a very shifting field. One could well have a situation where only part of the fields are slash-and-burn, so that lesser total amounts of land are needed. West’s data (1978) suggest that it is unlikely that forests would regenerate fully on the first fields cleared by the end of a 200 year period. If a fully regenerated forests were needed for this sort of slash and burn agriculture, the Anasazi may well have run out of productive woodland for agriculture.

Notice that the Basketmaker III period would only be in similar straits if the field life was five years (75/5=15=15000 hectares). Given the more constricted niche of this period less area was probably arable at this time as well, than in the other two occupations.

The "high payoff" period may not have been limited by depletion of nutrients, but possibly by weedy scrubs as Shuster (1981) suggests. While the Cedar Mesa environment differs from the area that Shuster did her experimental farming and this problem should be much reduced from her experience, her study indicates a significant reduced
problem could still be a major one.

Obviously more investigation of this topic is needed, but these results indicate that man made environmental changes caused by shifting, slash and burn cultivation might well have affected the duration of occupations and abandonments. These kinds of changes, combined with an inconsistent climate, which we examine next, may well turn out to be the explanation of the occupational discontinuities.

Variation in amount or seasonal distribution of precipitation must have affected farming potential in this marginal environment; effective moisture would have varied with temperature through changes in evaporation. We have also previously mentioned that cooler temperatures might decrease the growing season at higher elevations to limit farming, a distinct possibility for the Grand Gulch period. We expect that occupation of Cedar Mesa was most favored when the soils were fully charged with water in the late spring and when summer precipitation is high. The charging of the soils could occur through a deep, late snow bank or by spring rains.

The optimal climatic regime would be during times of abundant spring or winter precipitation when abundant summer precipitation was also occurring. Occupation would be least favored when either or both seasons had low
Matson, Lipe and Haase (Jun. 90) XII-47

precipitation.

Since Cedar Mesa occupations/abandonments are greater than 75 years duration, the proper climatic variations to be inspected are those of "low frequency" (Dean 1982) or "episodic" (Barreis and Bryson 1965). These are the variations which last decades to centuries within which particular climatic patterns dominate. There are two recent paleoclimatic reconstructions of Southwestern climate that emphasize variability on this scale, Euler <et al.>1979, and Petersen (1981,1983, n.d.), as well as a third which correlates tree ring indices and the number of tree ring dates (Berry 1982).

Euler <et al.> (1979: Figure 5) provide a paleoclimatic curve graphing regional effective moisture through time. They reconstruct periods of low moisture and major erosion at A.D. 250-450, 750-975, and 1300-1600. Second order droughts and erosion occur during briefer intervals centered at A.D. 50, 600, and 1150. Times of general high moisture (which include the second order droughts) are from 100 B.C. to A.D. 150, A.D. 500 to 725, and A.D. 100-1275.

This climatic model thus agrees well with Cedar Mesa occupations and abandonments after A.D. 500. The BM III and Pueblo occupations occur during the later portions of favorable periods (perhaps as a lagged response to regional population growth, or adaptive change related to favorable climate) and terminate with the unset or unfavorable
conditions. The BM II occupation, however, falls entirely within a major drought episode and between favorable periods.

A close reading of Petersen’s reconstruction (1981, 1983) of paleoenvironments in southwestern Colorado yields the following episodes: 1) 250 B.C. -- A.D. 500. Generally high temperatures, declining through time, with an extremely cool period ca. A.D. 500; summer rainfall low; winter/spring moisture generally high, but with profound drought about A.D. 500. 2) A.D. 600--750 relatively warm, especially early; both winter and summer precipitation high. 3) A.D. 750--950 warm with brief cool interval ca 900; summer precipitation high; winter/spring and probably annual low rainfall; 4) A.D. 1000--1150 warm, both winter/spring and summer precipitation high. 5) A.D. 1150--1300+ cool after 1200, very cool after 1300; summer rainfall declining and low after 1150/1200; winter/spring precipitation very low in mid or late 1100s and 1250-1400.

Petersen’s model generally has more climatic information but less precise dates than Euler <et al.> Given these differences there are generally good agreement between the two after A.D. 500. So agreement for the post A.D. 500 period with the Cedar Mesa occupations is expected and occurs. Moreover for the pre A.D. 500 period there is good fit, even to the declining temperature fitting with the
high elevation truncated Grand Gulch phase settlement distribution. The BM III Mossbacks pattern is slightly higher in elevation than the other two occupations and this too agrees with the warmer temperatures found by Petersen. Finally the late Pueblo Redhouse Phase lowering in elevation agrees with Petersen's cooling trend. The drying pattern found at the same time fits well with the demonstrated attachment to springs reported above for the terminal Pueblo occupation, as well as a more impressionistic evaluation of the terminal Canyon occupation. Petersen's model not only agrees well with the Cedar Mesa pattern but also with the similar pattern seen in the Red Rock Plateau to the west (Lipe 1966;1970). A slight contrary note, however, is introduced by Brooks(1974) study at Horseflats, mentioned before, to the northeast of Cedar Mesa, where a Mesa Verde Pueblo III occupation was found(Figure XI-14). This occupation included numerous water devices and occurs at an elevation well over 2100m (7000 ft.).

Berry (1982) has compared decadal standardization tree ring indices in the southwest with a number of dated sites to see if there is a correlation between the ten year average tree ring widths and changes in the archaeology. Berry (1982:103-104) cites reports that indicate large negative departures are associated with dry years and large positive departures are associated with wet years. While
somewhat crude compared to the previous two schemes in terms of climatic reconstruction, the dating precision is far superior.

In comparing his chart with the Cedar Mesa pattern, we find the most extensive departures starting in 1270, fitting the abandonment almost exactly (1982:105). The rest of the Pueblo time pattern is not as close as one would like, with a large negative departure just before A.D. 1100 and another broad negative departure between A.D. 1130 and 1160, corresponding to a possible hiatus during the Pueblo period. Large positive departures occur between 1050 and 1080, when Cedar Mesa was probably first occupied and again just after A.D. 1100 and around 1200. So for the Pueblo period the correspondance is impressive for the abandonment, but only fair for the rest of the time, with a large negative departure when we infer a large population present. For the earlier periods we turn to the local Natural Bridges indices (Berry 1982:107) as there are varying length of early tree ring lengths which would make an averaged one of dubious reliability. For the Basketmaker II time period, a high positive departure is found at A.D. 200, with a second narrow peak in the late 200’s, followed by a very negative valley at about 290 and a broad high peak of positive departures at about 310 to 345. This time period ends with a couple of negative
events, a valley at about A.D. 360 and a period past 400 that is generally negative. The beginning and the end of this time period show an impressive fit with Cedar Mesa occupation, but the A.D. 290 negative valley is not obvious in the archaeological record.

The Basketmaker III period occupation is neatly bounded by deep valleys at about A.D. 620-630 and A.D. 710-720. While this fit is very nice, there is no clear indication why some of the periods in between Basketmaker II and Basketmaker III or between Basketmaker III and Pueblo II/III were not optimal. In all fairness, tree rings are not good measures of long term trends and thus would not show if these periods were generally dry. Tree rings should show shorter periods of climatic change, though, and this is what Berry is seeking. For the the Cedar Mesa data, then Berry’s method seems to produce too many signals, forcing one to explain as "insignificant" departures as large as those that are correlated with archaeological events. The other side of the coin is, of course, that the dates of the climatic events are far more precise than the other two schemes discussed and all Cedar Mesa abandonments have large negative departures associated with them.

In summary, the tightness of the fit between the climatic models, particularly between Petersen’s and our archaeological data, make it obvious that climatic factors are largely responsible for the timing of occupations and
abandonments of Cedar Mesa. Simply put, when conditions were favorable for rain-fall agriculture Cedar Mesa was intensely occupied, when it was not, the mesa was abandoned. With the current models, though, there remains a lot of room for more precision and robustness; i.e. the climatic models sometimes appear to be more substantial from a distance than they are from close up, as the differences between them make evident. Still, there appears to be a convincing fit in general, even if the particulars are bound to change. The shifts for the worse, possibly combined with the deterioration of the crop land because of slash-and-burn practices, may have acted with catastrophic quickness.

The general lag in occupation for the last two periods is easily explained by Cedar Mesa’s peripheral location to other population centers. Other intervening areas would be filled in first. The Basketmaker II occupation, the first agricultural based adaptation on the Colorado Plateau would not occur at once, and thus one would expect a lag in that case as well, even if in this instance, Cedar Mesa did end up being one of the population centers for this period.

V <Comparison with Other Regional Patterns.>

Does the Cedar Mesa pattern of settlement and abandonment occur elsewhere in this part of the Colorado
Plateau? How does it compare with other regional patterns? Can we say something about the Anasazi adaptation in general? These questions can all be investigated by comparison of our results with that of others, mainly those from the Red Rock Plateau and Glen Canyon, Natural Bridges, Black Mesa, and a federal mandated survey to the east, and finally, with Berry's 1982 Anasazi synthesis. Since the Cedar Mesa Project in many ways had its origin in the Glen Canyon work; in particular Lipe's work in the Red Rock Plateau, and it is that area that we have the most personal experience, we begin there (Lipe 1966, 1970).

Extensive salvage work was done in the Glen Canyon, and we have a fair understanding of the patterns found in the Red Rock Plateau, to the west of Cedar Mesa, because of the analysis carried out by Lipe (1966, 1970). This is a much lower area than Cedar Mesa with little area above 1680m (5500 ft.). (Bill, you mention 512 sites, yet you only cite some 80 in your 3 phases, could you explain?). Only small areas of pinyon and juniper exist, although extensive sand dune areas occur, as well as large slickrock water collection areas, and some permanent water sources.

Lipe (1966, 1970) finds three main occupations, Basketmaker II, Pueblo II and Pueblo III. As reviewed earlier, the Basketmaker II material, which Lipe classified as part of the White Dog Cave Phase, is very similar to the Cedar Mesa material and dates to the same time. Even the
range of site types is similar, although with only 17
components of this phase identified, detailed comparisons
are not very fruitful.

Like Cedar Mesa, Pueblo I is absent, but unlike Cedar
Mesa, so is the Basketmaker III. Thus the Basketmaker III
occupation essentially ends at Cedar Mesa, with other known
sites at this time being located to the east. The first
Pueblo occupation, the Klethla Phase, is dominated by
Kayenta ceramics and dated by Lipe (1966, 1970) to A.D.
1100-1150. This initial Pueblo occupation would thus begin
at the same time as the Cedar Mesa Clay Hills Phase, but
after the Windgate Phase. This temporal relationship is
supported by the near absence of Black Mesa black-on-white
in the Klethla (Lipe 1966:181) and Clay Hills Phases, but
its substantial presence in the preceding Windgate Phase
on Cedar Mesa. The apparently greater amounts of Flagstaff
black-on-white on Cedar Mesa Clay Hills sites (Lipe
1966:181) suggests a possible longer duration of that phase
than for the Klethla Phase. Using the criteria for
establishing ceramic dates on Cedar Mesa, the Klethla Phase
would have a termination of around A.D. 1035-40 rather than
1150. The close similarity of the Clay Hills and Klethla
Phases suggests that there are basically the same ceramic
phenomena, and additional work, as suggested earlier in
this chapter, on the nature of the Clay Hills Phase, may
indicate that they are identical.

Lipe interpretes the next 50 or 60 years as a hiatus on the Red Rock Plateau(1966,1970). The succeeding Horsefly Hollow Phase is dated to A.D. 1210-1260 and consists of both Kayenta and Mesa Verde ceramics. Thus this occupation partly corresponds to the Redhouse Phase, but includes a Kayenta component not present on Cedar Mesa. Neither Pueblo phase has anything really equivalent to a unit Pueblo, although kivas and defensive sites are found in Horsefly Hollow Phase. The largest site had five substantial rooms with hearths, seven insubstantial rooms, one kiva, and six storage structures, is the only possible exception. The impression one has of these sites is a closer similarity with the terminal canyon occupation than with the mesa-top occupation.

In addition two special "integrative" sites were located. While none fell into the quadrat survey, several similar sites are found on Cedar Mesa. So, with the exception of the late Kayenta aspect to the Horsefly Hollow, the Red Rock Plateau pattern appears to be a subset of what is found on Cedar Mesa(Figure XII-6). The Pueblo II/III hiatus found on the Red Rock Plateau indicates the possible contemporaneous one on Cedar Mesa may be more than an artifact of the data.

Even the population concentration in the Horsefly Hollow Phase, fits the decline in elevation found in the
Redhouse Phase (and Petersen's climatic model indicating cooling at this time).

Other parts of the Glen Canyon area do indicate some differences from the pattern found in the Red Rock Plateau. The Basketmaker II occupation is concentrated in the Red Rock Plateau, and thus does not differ from that reported above. The absence of Basketmaker III and Pueblo I in the Red Rock Plateau is repeated throughout the basin, although some sites of these periods are found to the south (Miller and Breternitz 1958a, 1959b; Stein 1966). In contrast with this absence of occupation, numerous sites have been found with dates between A.D. 1050 and 1270 (Lipe and Lindsay 1983).

There are clear differences between the west and east sites of the Colorado River, with the west side not being occupied after about A.D. 1150, while occupation continued on the east side (Lipe and Lindsay 1983). In all areas this Pueblo II occupation is dominated by Kayenta ceramics. This suggests a rapid colonization of this previously "empty" area by groups from the southern Kayenta heartland.

The post A.D. 1200 period finds a retraction of Kayenta settlement to the east side of the river, with Mesa Verde ceramics being found in abundance only in the Red Rock Plateau. In all areas there is no evidence but for the most ephemeral Anasazi occupation after about A.D. 1270.
The initial Pueblo occupation is characterized by dispersed, small settlements, with few sites even reaching Cedar Mesa sizes. The portions of the Glen Canyon that remained inhabited after A.D. 1200 increased in population and may have served as refugia for groups from the west side of the Colorado River. Settlement size increases, storage increases, and there is a concentration of water control devices in the lowlands (Lipe and Lindsay 1983).

The events seen in both the Red Rock Plateau and in the greater Glen Canyon area, complement the patterns seen in Cedar Mesa, although in more extreme form. It is clear that the events on Cedar Mesa are in accord with what are found to the west and southwest. Let us turn next directly to the north to a survey on upper White canyon, including Natural Bridges (Hobler and Hobler 1978), Figure(XII-7).

The White Canyon survey was carried out in 1960 and 1961 and concentrated on inventoring the canyon sites with a less complete survey of the areas between the canyons. A total of 200 sites were located. Using a relatively restrictive definition of Basketmaker II sites, only seven such sites were located, four open sites and three rockshelter sites. These manifestations are judged to not significantly vary from the Red Rock Plateau White Dog Phase (Hobler and Hobler 1978:12) and thus must be very similar to the Cedar Mesa Grand Gulch Phase. The next period, seen by the Hoblers as continuation of
the earlier occupation, is called the Basketmaker
III/Pueblo I period. Some fifty sites are included in this
period, and concentrated on deep soil divide, or ridge-top
areas, in the pinyon-juniper (1978:12). The majority of
the sites on the most important ridge, are found at an
elevation between 1890 m (6200 ft.) and 2044 m(6700 ft.).
Only six canyon sites had Basketmaker III pottery and no
"pure" rockshelter components were found. Some slab lined
structures were noted on open sites and most were
interpreted as probable habitation sites.

The above pattern agrees well with the Cedar Mesa
Basketmaker III pattern except for a slightly lower
elevation. But what of the Pueblo I designation? Actually
no Pueblo I material was located and the Pueblo I
designation was added because of the belief that the
Basketmaker III continued into Pueblo I times, or in other
terms, Pueblo I traits did not extend into this
area(1978:12). This argument is not supported by any
dates. In light of the Pueblo I presence with all the
"typical" attributes in Comb Wash and the lack of Pueblo I
dates in Cedar Mesa Basketmaker III or the Ute 95
excavations, this stance is not credible today. So the
pattern found in the White Canyon area is a near duplicate
of the Mossbacks pattern.

Some 69 open Pueblo II/III sites were found, primarily
located in the same environmental location as Basketmaker III, but spread over a broader elevation range (1978:15). No early Pueblo II pottery was found. Sites appear to be similar to those found on the nearby Cedar Mesa. Some 71 Pueblo II/III sites were found in the canyons. Like Cedar Mesa, there is an over abundance of kivas and storage rooms, as well as defensive structures on at least five sites. Like Cedar Mesa, many cliff dwellings were located in the absence of arable soils, and like Cedar Mesa, the canyon occupation is late Pueblo III (1978:64) with the most recent tree ring date being A.D. 1251. There are also hints of a mid-twelfth century canyon building episode, with a cluster of non-cutting and cutting dates at A.D. 1130-1155 (1978:Figure 38,Table III).

The settlement pattern and timing of occupations appears to be very similar to that found on Cedar Mesa. There are some differences, however, in ceramics and possibly in initial dates. The Clay Hill Phase appears to be less well represented in White Canyon with only three sites clearly having a dominance of Kayenta black-on-white ceramics (1978: Table IV). The Windgate Phase was either reduced or absence in the White Canyon area, as Mesa Verde dominated sites are not recorded as having Black Mesa black-on-white, Cortez black-on-white, or San Juan Red Ware present. These differences may be the result of an initial occupation by the Clay Hills tradition rather than
Windgate. Of course, some of the ceramic differences may be the result of different classification procedures. In any event, the initial Pueblo II occupation in the White Canyon area appears to be slightly later than that at Cedar Mesa.

While interpreted very differently, the patterns seen in the White Canyon area are very similar to those found at Cedar Mesa, supporting the validity of those results, and the associated interpretations. Let us now turn to the south to Black Mesa where so much work has been done in the last fifteen years.

The extensive work carried out on the north end of Black Mesa for coal mine mitigation needs no introduction here. While field work had been completed at the time of writing, analysis continues. A number of different summaries of settlement pattern have been prepared over the years, and for comparison purpose we have relied on Andrew(1982) and Klesert and Layhe(1980).

Black Mesa shares a number of environmental features with Cedar Mesa, but there are also some important differences. Lying about 90 km to the south of Cedar Mesa, the Black Mesa Coal lease area covers a similar elevation, ranging from 1830 m (6000 ft.) to a little over 2130m (7000 ft.). It includes highland pinyon-juniper and areas of deep-soil sagebrush and grasslands. These similarities are
offset by the presence of extensive, unincised drainage systems on Black Mesa, mainly the tributaries of Moenkopi Wash in the coal lease area. The nearest roughly equivalent drainages to Cedar Mesa are those to the east, Comb, Butler and Cottonwood Washes. A second important difference is in the nature of the soils. In contrast with the nearly constant eolian soils, which change only in depth, on Cedar Mesa, there are both eolian and alluvial deposits, with some of the later having material derived from the shale and coal layers in the Mesa Verde sandstone and Manco Shale, decreasing its agricultural value.

As discussed previously (Chapter V), the initial occupation on Black Mesa was that of the Basketmaker II, now dated to approximately the same time as that elsewhere (Smiley 1984). In terms of the upland-lowland contrast proposed by Phillips(1972) as to whether sites are located with respect to the low lying, broad washes, or to the upland pinyon-juniper dry-farming areas, these sites are concentrated toward the flood plains (Andrews 1982:41). There are some indications that the dates for the Black Mesa Lomolai Phase (Basketmaker II) are earlier than for the Grand Gulch Phase, and the difference in degree of concentration of habitation, (into clear villages) as well as less standardized and developed house structures. All these possible differences are interesting and worth further investigation, but the main point is a similar initial
occupation without clear antecedents, of the Basketmaker II at about the same time and at about the same elevation, as on Cedar Mesa. We would date that occupation continues to no later than A.D. 400, based on the Smiley (1984) revised dates.

After that time there is a hiatus in the Black Mesa lease area, with no Basketmaker III present, at least as of 1982 (Andrews 1982). Some sites are known off the lease area, to the south and west at lower elevations. This hiatus is in sharp contrast to the short, but dense occupation on northern Cedar Mesa.

The next occupation is in late Pueblo I, the Dinnebito-Wepo Phases, dated at A.D. 850 to 1050, with initial dates problematical. According to Klesert and Layhe (1980:52) the concentration of habitation sites is to be found near the washes. This period is a time of great architectural variability. Occupation is apparently continuous from the early part of this time until abandonment, probably around A.D. 1140.

The succeeding Pueblo II phases (in the scheme followed here which extends Pueblo II until A.D. 1150), the Lamoki and Toreva Phases mark "the maximum spatial extent of the trend to upland adaptations " (Klesert and Layhe 1980:54). By no means, though, were the lowland areas abandoned. The typical "large habitation site" was a Prudden unit of
relatively small size, possibly no different than those found on Cedar Mesa. The terminal Lamoki Phase appears to have the same pottery types as the Clay Hills Phase, with the Lamoki Phase having more Black Mesa black-on-white suggesting overlap with the Mesa Verde ceramics found in the Cedar Mesa Windgate Phase. Occupation duration during Pueblo II on Black Mesa, at any given site, was short probably around 25 years, again showing close similarities with Cedar Mesa (Klesert and Layhe 1980:55).

The ebb and flow of habitation on Black Mesa are a fascinating counter point to our findings on Cedar Mesa. The very close similarity suggests similar effects, and supports both Petersen's climatic model and our synthesis, as well as Berry's overall synthesis reported below. Interesting differences include the "lowland" orientation of the Basketmaker II, the absence of Basketmaker III, and the development of the Pueblo I through Pueblo II as well as the absence of a Pueblo III occupation.

The presence of Pueblo I, given the broad washes and high elevation, agrees with its location elsewhere, at Mesa Verde (Badger House) and at Dolores (Bill, what ref.?), although not other Pueblo I phenomena, such as in Comb Wash. The expansion out of the lowlands on to the uplands, which takes place off Cedar Mesa, occurs within the lease area, at the same times, given a possible 15 year lag at Cedar Mesa. This difference, then, reinforces the pattern
seen on Cedar Mesa. Likewise the combination of possibly slightly earlier dates, and the "lowland" orientation of the Black Mesa Basketmaker II is in agreement with the model proposed above for the Basketmaker II on Cedar Mesa and the evolution of maize from Teosinte.

The absence of Basketmaker III from the highlands, however, is in clear contrast. Is this a difference in "Mesa Verde" and Kayenta Basketmaker III adaptations, or simply a function of the size of nearby population ready to move into the uplands? Similarly the absence of the Kayenta Pueblo III from Black Mesa is in agreement with other areas, but why would Cedar Mesa continue to be occupied (or, alternatively, to be reoccupied), while this part of Black Mesa was not? Is it the presence of the canyons on Cedar Mesa? We are certain these and other questions will be investigated in the future as the Black Mesa material becomes analyzed in a more integrative fashion.

The only direction we have not turned to is the east, where one large federal mandated survey was carried out (Thompson 1978) which, in so far as can be determined, is broadly in agreement with the results reported here.

Another report of interest is that on Big Westwater Ruin, some 35 km directly east of Cedar Mesa (Lindsay 1981). This cliff dwelling has a single kiva and a number
of habitation rooms, storage rooms, to a total of about a dozen, and defensive features. While the authors suggest a lengthly Pueblo II origin, and a burned destruction by mid-Pueblo II times (Lindsay 1981:219) the absence of any Black Mesa black-on-white and the near absence of San Juan Red Wares, indicates a post Windgate Phase initial occupation (1981:Table V). The destruction that ends this initial occupation is tree ring dated at A.D. 1147 to 1207.

The ceramics indicate an initial occupation not far short of the first tree ring date. Thus the first occupation appears to date in the early twelfth century, at one of the critical changing times, and one of the two cliff-dwelling construction times.

Site destruction occurred again by "mid-Pueblo III times"(1981:219), and the site was probably abandoned around A.D. 1250. The second occupation is noted for defensive features, and the large scale raising of turkeys in one section of the site. Big Westwater ruin agrees with the pattern of canyon use seen at Cedar Mesa and further east at Johnson Canyon (Harrill and C. Breternitz 1976).

Our brief survey of surrounding areas indicates that the Cedar Mesa patterns of occupations/abandonments in the highland are closely tied to similar events elsewhere. It is difficult to judge these occurrences as "isolated" events on the periphery, when similar events occur elsewhere on the Plateau, including Black Mesa, which is
geographically, if not environmentally, central. The question of how common, or indeed, universal, are such dislocations is raised by Berry (1982). Since these issues are critical to our understanding of cultural processes in the Southwest culture area, we will briefly review his key points and the relevance of the Cedar Mesa findings to them.

Perhaps Berry's most important discovery was that "There is a sharp decline in the number of dated sites--approaching zero--between <every recognized stage of the Peco classification>(emphasis in the original)" (1982:100). The dated sites Berry refers to is from the Quadrangle Series of the Laboratory of Tree-Ring Research (Bannister, Hannah, and Robinson 1966), using only those sites that have cutting dates association with architectural features. The pattern found is striking (Figure XII-8), and at clear variance, as Berry points out, with the conventional summaries of Southwestern cultural evolution.

Several criticisms can be made of Berry's study, of which questioning the nature of his sample is one of the most important. While he did not select his sites from the Quadrangle Series, but used them all, most of the sites were excavated some time ago, and for a variety of purposes. Thus one can argue that the periodicity found is
the result of some built in bias to find "typical" sites, or some other factor which selected a bias for sites dated at only certain period. It would seem that some selection procedure would need to be demonstrated to take this critique seriously, or simpler yet, a set of data is needed to demonstrate that this pattern is, in fact, incorrect. Since few archaeologists control the entire Southwest, this "falsification" would undoubtedly be for a smaller area, a subset of the entire Plateau.

Such an independent "sample" might be the Cedar Mesa area and the adjacent Red Rock Plateau. It should be noted that none of the Post Basketmaker II information from Cedar Mesa was used by Berry, so that this is a valid independent test. If we compare the three patterns, Berry's synthesis, the Cedar Mesa Pattern and the Red Rock Plateau pattern, (Figure XII-9) we find a very impressive fit, given that the Pueblo I period is absent in the latter two.

Not only does the Berry pattern agree with that from Cedar Mesa, but it also agrees well with the review we carried out of the surrounding areas. This is not to say that it fits everywhere, but does give support to the notion that much of the Colorado Plateau was not continuously occupied and that the periodicity is not an artifact of sampling, but reflects synchronous discontinuous occupation in large portions of the Colorado Plateau. Or to turn it around, the Cedar Mesa pattern of
scattered small sites, and intermittent occupation, is "typical" of much of the Colorado Plateau, rather than being aberrant.

Berry's interpretation of his data is equally as clear and forthright as his pattern, "It is not longer fashionable to link major Anasazi cultural events to climatic factors in a causal manner, and constructs that lean too heavily on migration are thought to verge on indecency. Nonetheless the data...provide strong evidence that climatically induced migrations occurred frequently in Anasazi prehistory." (Berry 1982:103). Obviously, earlier in this chapter we were unaware that we were approaching indecency. While there is no question about the existence of the periodicity of the Quadrangle dated structures, or of our data conforming to his model, there are always more questions about explanations.

While in the case of Cedar Mesa, the dates are clearly related to occupations, one wonders if Berry's dates are always so related. Well protected cliff-dwellings are much more apt to be investigated and dated than amorphous surface sites. Is there a chance that in some areas the date peaks reflect cliff-dwelling episodes? Further, times of construction produce lots of beams; so if a site is continuously occupied, but at one point receives a large population increase, would this result in two peaks, an
initial construction and then addition, with a possible interpretation of abandonment in between? Similarly is a time of large sites going to result in an influx of dates, while a time of small sites will be ignored? Two points need to be made clear about the nature of these questions, first, they do not question the existence of migration, although if these factors do exist, they effect the <scale> of migration, and second, the classic expansion of small sites in late Pueblo II times is well reflected in the date chart, thus this is not a global problem either.

Berry interprets the data as indicating migration from the Plateau to the Basin and Range Province, and to certain "refuge areas within the Plateau"(1982:108). As an example of the latter, Wupatki is seen as a Plateau refuge for the Pueblo II/III juncture. It is under the "refuge" conditions that the transformation from one period to the other occurs, to be spread out across the Plateau during the next period of climate amelioration. The refuge periods would be times of population aggregation and cultural mixing. Further Berry interprets most "break" times as droughts so that usually only higher elevations could be successfully dry farmed. Given the return to normal conditions, these high elevation areas would no longer be viable.

There is much from the above review of the Cedar Mesa surroundings that supports Berry’s model. Certainly the
pattern found on Cedar Mesa fits his date pattern, and must also have resulted from migrations, also agreeing with his explanation. Moreover, the anomalous Pueblo III pattern found on Horseflats (Brooks 1974) fits his climatic model better than it does Petersen’s, although we judge Petersen’s to be preferable, overall. One wonders about the scale of migration, though. In the Cedar Mesa case, are the "migrations" from Comb and Cottonwood Washes, as we have assumed, or are they from more distant and isolated refugia? Did large populations move from the Plateau to the Basin and Range Provinces, or just an occasional group? Are these large dislocations common to all places, or just to mid-elevation "highlands" such as Cedar Mesa?

In summary, the patterns discovered on Cedar Mesa appear to be the result of processes which cause similar or complementary patterns found in neighboring well studied areas. The Cedar Mesa patterns do not appear to be an aberration, but instead typical of north-west Colorado Plateau settlement distributions and history. There appears to be a close link, at least as close as can be determined, given the nature of climatic reconstructions, with climatic changes and settlement events. These same sort of periodic abandonments have been generalized by Berry(1982) to include the entire Anasazi tradition. Whether that is the case or not, his model does fit well
VI <Conclusions>

Cedar Mesa was occupied at least three and possibly four times between A.D. 100 and 1300. These occupations were separated by at least two hiatus, one from A.D. 400 to A.D. 650 and another from A.D. 750 to A.D. 1050. Another much shorter hiatus may have occurred in the twelfth century. At all times, rainfall horticulture was the dominant form of subsistence, and the largest group living in a single architectural set of features rarely exceeded a dozen or so. In spite of small sites the overall population on Cedar Mesa was substantial, ranging somewhere between 500 and 1500. The rise and fall of Cedar Mesa populations fit well with current paleoclimatic reconstructions, a feature that we did not expect for most of the years we were engaged in this analysis. This thumbnail summary of continuity in adaptation and discontinuity in occupation obscures a number of variations that remain outstanding issues which we will briefly review in chronological fashion.

The sudden occurrence of Basketmaker II on Cedar Mesa indicates an origin elsewhere. The evidence of substantial reliance on maize during this period (Aasen 1984; Chisholm and Matson 1986; Lepofsky 1986) is overwhelming, which leads to the conclusion that the development of maize
horticulture took place elsewhere. Where was this? Is it an \textit{in situ} development in selected parts of the Plateau as suggested by Irwin-Williams (1973), or a development from the San Pedro Cochise as suggested by Berry (1982: ), and supported to some degree by projectile styles. The questions of the origin of the Basketmaker II and whether it is a unitary phenomena are intertwined and the latter needs to be investigated before any general statements will be convincing.

The hiatus between Basketmaker II and III is not unique to Cedar Mesa, as Berry demonstrates. Where did this substantial Cedar Mesa population go? To Comb Wash, or some place more distant? Is the climatic model presented by Petersen, which apparently explains the timing of the abandonment, going to stand the test of time? It certainly appears that Cedar Mesa is on the western fringe of the Basketmaker III settlement. This is indicated by the absence in the Red Rock Plateau and the near absence found in the areas surveyed for the Grand Gulch expansion to the west of Grand Gulch (Lipe, Powers and Matson 1977). This finding, or, rather, a lack of finding, indicates there may be a temporal cline from east to west that should be investigated.

The end of the Basketmaker III again corresponds to the Petersen climatic model. Why was not Pueblo I present on
Cedar Mesa? Certainly it is present in areas with large washes, such as Comb Wash, and further afield at Dolores and Mesa Verde, let along Alkali Ridge. This radical switch from upland rainfall dry-farming to floodwater farming is dramatic, but the Milk Ranch Point (Green and Debloois 1978), suggest that it was not the only change in adaptation that was tried.

The next Cedar Mesa occupation is the local example of the well known Pueblo II highland expansion. The pattern found on Cedar Mesa fits well with that seen elsewhere, except perhaps slightly more dispersed. The earliest occupation is of the Mesa Verde tradition, perhaps around A.D. 1060, and that might be expected to be a climb out of Comb Wash. This inference is another possibility that should be investigated and is supported by ceramic trends seen on Cedar Mesa and at White Canyon (Hobler and Hobler 1978). One of the outstanding issues about the Cedar Mesa Pueblo II occupation is the nature of the Kayenta/Mesa Verde interaction. If the Windgate Phase people left before the Clay Hills makers arrived, there needs to be little interaction. If not, were the Clay Hills people really "Kayenta"? What would "Mesa Verde" and "Kayenta" mean in this situation?

Related to the question of the meaning of the ceramic traditions is the possibility of a mid-twelfth century hiatus. The tree ring dates from the canyons indicate a
cliff dwelling episode at this time, as found in Johnson Canyon (Harril and C. Breterniz 1976) and on Black Mesa. The situation on Red Rock Plateau can also be interpreted as an example of this "cliff dwelling" episode (Lipe 1966, 1970). While these outside patterns would suggest that a hiatus at this time on Cedar Mesa would be expected, our examination of the ceramic evidence was equivocal. Such a hiatus may well have occurred, but if it did, it was shorter than found in the Red Rock Plateau. Equally likely is a population decline on the mesa-top, with an emphasis on the canyons and migration to outlying areas. This picture is a weak reflection of the terminal Pueblo III changes in "niche".

The Pueblo III period appears to begin with the usual mesa-top rainfall emphasis and then develop into the terminal defense conscious, lower elevation and canyon emphasis. The lowering of elevation and concentration around water fits very well with the Petersen paleoclimatic reconstruction. We hope further understanding of this interesting period will result from further analysis of the canyon data, in particular, that from the tree ring/architectural study of 1974/75.

With the exceptions of the non-habitation sites in the initial Basketmaker II and the terminal Pueblo III occupations, the striking feature of Cedar Mesa adaptations
is its constancy. Not respecting 1000 years and at least two different cultural traditions, and at least three, separate occupations, the niche remains the same and most other functional attributes differ little. The other main feature of Anasazi on Cedar Mesa is the discontinuity. In that 1000 plus years Cedar Mesa was more often not occupied than inhabited, and in spite of this, when it was occupied the sample area supported a population of the order of what was found in the Hopi Mesas in the 1860’s. The gaps in the record indicate that the regional perspective argued for by Binford (1964) and which we thought we were following here, needs to be of a different scale to understand the Anasazi. Groups such as S.A.R.G. then, are not useful experiments, but necessary to fully explore southwestern archaeology.
<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Heading</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>XII-1</td>
<td>Elevations of Habitation Quadrats; Grand Gulch; Mossbacks; Pueblo</td>
<td>--</td>
</tr>
<tr>
<td>XII-2</td>
<td>Elevations of Limited Activity Quadrats; All Quadrats; Grand Gulch; Mossbacks; Pueblo</td>
<td>--</td>
</tr>
<tr>
<td>XII-3</td>
<td>Dense Pinyon-Juniper Coverage of Limited Activity Quadrats; All Quadrats; Grand Gulch; Mossbacks; Pueblo</td>
<td>--</td>
</tr>
<tr>
<td>XII-4</td>
<td>Dense Pinyon-Juniper Coverage of Habitation Quadrats; Grand Gulch; Mossbacks Pueblo</td>
<td>--</td>
</tr>
<tr>
<td>XII-5</td>
<td>Dense Pinyon-Juniper Coverage of Red House Versus other Pueblo Phases</td>
<td>--</td>
</tr>
<tr>
<td>XII-6</td>
<td>Cedar Mesa and Red Rock Plateau Occupation sequences; Occupation Periods and Hiatuses</td>
<td>--</td>
</tr>
<tr>
<td>XII-7</td>
<td>Location of White Canyon (Natural Bridges N.M.); Cedar Mesa; Westwater Ruin and Black Mesa Coal Lease Area</td>
<td>--</td>
</tr>
<tr>
<td>XII-8</td>
<td>Anasazi Sequence from Berry (1982: Figure 12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) From Jennings 1974:38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) From Guumerman and Euler 1976</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Developed in Berry 1982</td>
<td></td>
</tr>
<tr>
<td>XII-9</td>
<td>Comparison of Cedar Mesa, Red Rock Plateau and Berry's Anasazi Sequence</td>
<td></td>
</tr>
</tbody>
</table>
ALL QUADRATS (n=76)

GRAND GULCH (n=21)

MOSSBACKS (n=15)

PUEBLO (n=42)

Figure XII-2
Figure XII-3

ALL 76 QUADRATS

PUEBLO (n = 42)

MOSSBACKS (n = 15)

GRAND GULCH (n = 21)

% dense pinyon-juniper coverage
Figure XII-4

GRAND GULCH

MOSSBACKS

PUEBLO

0 20 40 60 80 100

% deep soil pinyon - juniper
CLAY HILLS, WINDGATE, & WOODENSHOE PHASES (n=23)

RED HOUSE PHASE (n=12)

% deep soil pinyon - juniper

Figure XII-5