Cultural Transformations in Southwestern Prehistory: New Insights from Old Collections

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Summary

Several major transformations shaped U.S. Pueblo Indian culture history between 1500 BC and AD 1300. These included 1) shift to dependence on maize; 2) emergence of the “full Formative” cultural complex; 3) collapse of the regional influence of Chaco Canyon; and 4) eventual depopulation of the northern U.S. Southwest. Collections and data gathered over 30 years ago in southeastern Utah by the Cedar Mesa Project have the potential to contribute significant new insights into each topic. This can be realized by 1) applying new methods of analysis to Cedar Mesa materials and 2) relating Cedar Mesa data to more recent evidence from across the northern Southwest.

1. Agricultural origins: The early pre-pottery agricultural populations of the northern Southwest are assigned to the Basketmaker II (BM II) culture. Are these people migrants from farther south who brought maize with them, or descendants of local Archaic period hunter-gatherers? We will investigate this question by analyzing mitochondrial DNA obtained from human coprolites which are well-dated to BM II contexts.

2. Formative stage complex: The “full Formative” complex, including pottery, substantial houses, addition of beans to the diet, and specialized corn-grinding equipment, appears in the northern Southwest at about 500 A.D. What preceding conditions gave rise to these changes? Collections from the Cedar Mesa Project provide opportunities to examine aspects of subsistence and social life in that preceding period — 100 B.C.-500 A.D. in BM II. We propose 1) an experimental study of use of limestone in stone-boiling to evaluate its effects on lysine availability from maize and on cooking efficiency relative to the use of pottery and 2) analysis of artifacts and features from a defensively-located site as part of an evaluation of the role of warfare in the late BM II period.

3) Chaco Canyon influence and collapse: We propose 1) to map and obtain tree-ring dates from exposed timbers at two sites that appear to have Chacoan “great house” architecture, to determine if they represent an extension of Chacoan influence to Cedar Mesa; 2) assemble recently-gathered tree-ring dates from Cedar Mesa and adjacent areas to determine if there was a significant decrease in population during the middle AD 1100s, coincident with the Chacoan “collapse” and a profound area-wide drought; and 3) analyze dates and sources of Kayenta-style pottery in Cedar Mesa collections to determine if there was movement of people from northeastern Arizona into southeastern Utah coincident with the drought and the collapse of Chacoan influence.

4) 13th century depopulation: The northern Southwest was depopulated in the late A.D. 1200s, and it has been suggested that this process started in western areas such as Cedar Mesa. Tree-ring dates from Cedar Mesa and adjacent regions will be assembled to evaluate the timing of depopulation. How did depopulation occur? Recently developed ceramic attribute analytical techniques will be applied to our existing collections to determine whether mesa-top settlements were abandoned before the canyon “cliff dwellings”.

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Program of Research

Objectives
As outlined in the summary, we have four major objectives: 1) further understanding of the agricultural origins of the Southwest; 2) the development of the “full Formative” adaptation, including possible enhancement of protein availability from maize through stone boiling with limestone, and the role of defensive in BM II settlement locations; 3) the nature of Chaco influence on Cedar Mesa, and its relationship, if any, to the Kayenta-style pottery from the south and to a possible occupations hiatus in the mid-1100s; and 4) the nature of the 13th century depopulation, both within Cedar Mesa and of the Mesa Verde area in general.

Context
Summary of Cedar Mesa Project.
Having briefly introduced the problems to be (re)investigated using mostly existing collections made during the Cedar Mesa Project, we now turn to a brief introduction to this project (Lipe and Matson 2007). Cedar Mesa is part of a “classic” research area of southeastern Utah, best known for the discovery in the 1890s of Basketmaker sites stratified below later Pueblo materials (Blackburn and Williamson 1997; Kidder 1924; Matson 1991). In the early 1970s N.S.F. funding enabled us to conduct an extensive regional survey focused on an 800 sq km area ranging between 1700m (5600 ft) and 2070 m (6800 ft) in elevation, with most of the vegetation being either pinyon and juniper or sagebrush flats. This area was divided into 20 drainages, five of which were sampled at a 7% rate by quadrats 400 m on a side, with a total of 76 quadrats being surveyed yielding 357 sites (Lipe and Matson 1971; Matson and Lipe 1975, 1978; Matson et al. 1988, 1990). These were mapped and completely collected by provenience units of about 1m$^2$.

In addition to this core study, three other investigations produced collections and information. All five drainage canyons were completely inventoried, with all 291 sites mapped. Then 115 of these sites were randomly selected for more extensive mapping and collection (Matson et al. 1990; Morton 2002). A total of 12 sites, almost all located within quadrats, (with a notable exception of the Turkey Pen site (Matson 1991; Powers 1984), located in Grand Gulch on the western edge of the survey area) were test excavated. Finally, the Tree-Ring Architectural Survey produced architectural maps and collections of 25 well preserved canyon sites ("Cliff Dwellings") from the Grand Gulch area or McLoyd’s canyon on the east side of the mesa (Bedell 2000; Bloomer 1989). In sum the project produced about 55,000 sherds and 100,000 classified lithics from 497 sites, which were documented by abundant notes, forms, photographs, and maps. A history of the project, given in Lipe and Matson (2007) and Lipe (2007) provides a listing of the many theses, dissertations, and publications that have resulted with an emphasis on those appearing post 1988, long after the NSF fieldwork had been completed.

Not a single certain Archaic site was identified, yet 130 quadrat sites were classified as Basketmaker II (BM II) sites, termed the Grand Gulch phase, which numerous tree-ring and radiocarbon assays indicate dates between AD 200 and 400 (Matson 1991; Matson et al. 1988, 1990). This time period was also investigated in a SSHRC supported investigation (Dohm 1994, Matson 1994, Matson and Brand 1994). After the BM II period the mesa was depopulated and reoccupied in late Basketmaker III times (AD 650-725), the Mossbacks phase, and 49 quadrat sites were classified as such. Again the mesa was depopulated and not a single Pueblo I site was found during any aspect of the project, although such sites are abundant on the eastern flanks of the mesa in Comb Ridge wash (Matson et al. 1988, 1990). In the AD 1000s the mesa was again occupied during the Windgate phase (AD 1060-1100?), a Mesa Verde ceramic tradition, which may have overlapped with the Clay Hills phase (AD 1100-1150), a Kayenta ceramic tradition. Either a decrease in population or a short hiatus occurred followed by the Woodenshoe Phase (AD 1165-1210) along with the reoccurrence of Mesa Verde
ceramics as the dominant form. This was followed by the terminal Pueblo III Redhouse phase (AD 1210-1270) which includes the latest Cedar Mesa tree-ring date of 1268, ending the Pueblo II-III occupation represented by 132 quadrat sites. Dates provided for the phases are based on evidence available in the 1980s, but may be revised by some of the studies outlined below.

**Methodology**


Cedar Mesa’s concentrated BM II occupation has contributed significantly to the current understanding that the BM II were committed maize agriculturalists, not modified hunters and gatherers. This evidence came first from Cedar Mesa settlement patterns (Matson 1991; Matson and Chisholm 1991; Matson et al. 1988, 1990), analysis of BM II coprolites from Turkey Pen (Aasen 1984; Matson and Chisholm 1991, 2007), Turkey Pen midden analyses (Matson and Chisholm 1991, 2007), and Cedar Mesa carbon isotope analyses (Chisholm and Matson 1994; Matson 1991; Matson and Chisholm 1986, 1991, 2007). More recent evidence from other BM II occupations demonstrates that this is true for BM II in general (Martin 1999, Coltrain et al. 2006, 2007, Matson and Chisholm 2007). That the BM II were not modified hunters and gatherers (as conventionally thought prior to our investigations) leads to the question of how agriculture arrived in the U.S. Southwest (SW) as it does not appear to have developed gradually *in situ*.

C. Irwin-Williams (1967) noted the similarity of the western BM II (which includes the Grand Gulch phase) with the San Pedro Cochise. Berry (1982) and Berry and Berry (1986) expanded on this similarity to argue that the San Pedro Cochise migrated on to the Colorado Plateau from the Basin and Range bringing their maize agriculture with them, even though at the time of writing it was not all that clear that the San Pedro were agricultural (although it is today). Matson (1991, 2003, 2006b) demonstrated that BM II consisted of two “ethnicities” with the Western having many links to the San Pedro Cochise. Bellwood (1997, 2001, 2005) suggested that this hypothetical migration originated in central Mexico and spoke an Uto-Aztecan (UA) language. This idea explains the presence Uto-Aztecan speaking Hopi and O’odam (formerly the Pima and Papago) as well as the origins of maize agriculture in the SW and the long string of UA languages from the SW into Mexico. This idea has been further developed by a number of researchers, including Hill (2001, 2002, 2003); LeBlanc (2003); Mabry (2005); Matson (2003, 2005), Carpenter et al. (2005). But how does one test this idea of genetic connections to central Mexico?

LeBlanc et al. (2007) have very recently shown that mitochondrial DNA (mtDNA) recovered from prehistoric contact material (cuds and aprons) is consistent with this idea as Mexican Uto-Aztecan speakers have a high percentage of haplogroup A, which is rare in most other contexts north of Mexico. The genetic techniques used were largely developed by Brian Kemp (2006; Kemp et al. 2007; Kemp et al. 2006; Kemp and Smith 2005) who obtained good results from a high percentage of 2000-year old coprolites (Kemp et al. 2006). We propose that Kemp analyze 30 Turkey Pen BM II coprolites from this well-dated and well stratified deposit (Matson and Chisholm 1991). Unlike the LeBlanc et al (2007) analyses, which used the relatively crude single nucleotide polymorphism (SNP) detection, Kemp will produce mtDNA hypervariable (HR) sequences, which allows a finer resolution (Kemp et al. 2006) and compare the results against the large SW and Mexican database of mtDNA (Kemp 2006). The finer resolution and greatly expanded sample size should lead towards a resolution of this important idea.

2) Transition to Full Formative:

a) Stone-boiling and maize dependence. The dependence of the Grand Gulch phase Basketmakers
on maize agriculture clearly indicates a Formative stage (Willey and Phillips 1958:144-147) type of adaptation. Yet some of the traits commonly associated with agriculture in North America—pottery and beans—are not present in the Grand Gulch phase sites. This is puzzling, given the central role of pottery vessels in preparing and cooking maize-based foods in Formative stage sites throughout North America, and beans as a source of protein for sedentary groups lacking access to wild game that characterized earlier foragers.

One of the archaeological "signatures" of Grand Gulch phase sites is an abundance of limestone fragments in habitation site middens (Matson et al. 1988). We propose to test the hypothesis (Matson 1991:7) that Grand Gulch phase people were using locally-available limestone for "stone-boiling" maize-based dishes (presumably in tightly-woven baskets). This would have represented a transition from previous food systems involving seasonally roasting or steaming freshly harvested maize to one more reliant on dried, stored maize—essential for year-around dependence on this crop. We will collect unaltered limestone pieces from sources on Cedar Mesa; heat them, and use them to boil whole ears, shelled kernels and corn meal. Suitability of this technique for cooking maize can be evaluated, and the limestone chunks thus used can be compared to archaeological examples to see if characteristics match.

If the experimental study indicates a likelihood that this stone-boiling was used prehistorically, we will undertake a pilot project to evaluate its possible nutritional effects. It is well-known that "lime-cooking" of maize increases the metabolic availability of some proteins, especially the low levels of lysine found in maize (e.g., Katz et al. 1974, 1975; FAO 1992; Stinson 1992; Myers 2006). This would have been important to an increasingly sedentary groups lacking another domesticated plant protein (i.e., beans). Brian Chisholm will assist us in choosing the proper technique to measure the availability of selected proteins in maize when cooked by stone-boiling with limestone as the heating element versus the same treatment using silicious stones.

b) BM II Warfare. There is accumulating evidence for the importance of conflict in BM II (Hurst and Turner 1993; Matson and Cole 2002), but only a single BM II defensive site is currently known, the "Rock Island site" (NR C9-5) on Cedar Mesa (Matson 1994, Matson and Brand 1995). It is an open question whether the conflict was between BM II and indigenous non-BM II people or among BM II people as the area filled up and the situation became circumscribed, or both. NR C9-5 (the largest BM II site located) was 40% collected, tested, dated and a preliminary analysis has been completed (Matson and Brand 1995). However, a complete analysis using the classification used elsewhere on Cedar Mesa is needed to determine whether the artifact assemblage differs from other BM II habitation sites in kinds of tools and/or lithic material (Keller 1975). These analyses may indicate whether different activities are associated with the defendable location and whether access to lithic resources was constrained, perhaps as a result of conflict with neighboring groups.

3) Chaco Influence and Collapse.

One of the signal developments in Puebloan prehistory was the rise and fall of a politically complex and culturally influential center at Chaco Canyon (and later at the Aztec complex in the San Juan Valley) between about AD 1040 and 1135 (Lekson 2006; Sebastian 1992). Starting about AD 1075 and ending in the 1130s, Chaco-style great houses were built at a number of community centers north of the San Juan River in southwestern Colorado and southeastern Utah (Lipe 2006; Cameron 2002; Hurst 2000). It has been suggested that several sites on Cedar Mesa have Chacoan great house characteristics (Kantner 2003), and thus may represent the farthest northwest extensions of Chacoan influence. The Cedar Mesa archaeological record has the potential to contribute exciting new information and insights toward understanding the expansion and rapid collapse of the "Chaco
Phenomenon” (Judge 1989, 1991) We propose several interrelated studies:  

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a) The Kayenta intrusion. The Clay Hills phase on Cedar Mesa represents a brief intrusion of Kayenta ceramics—and possibly of people—from the Kayenta area of northeastern Arizona, part of an expansion also seen farther west in the Glen Canyon area (Lipe 1970). Does this represent an actual migration of people out of the Kayenta area and if so, does it coincide with the expansion of Chacoan influence in the very late 1000s or with socio-political disruptions attending its collapse after about 1130 (Cole 2007; Lipe 2006)? The answers to these questions can shed new light on the inter-regional dynamics of the Chaco Phenomenon. To determine whether the Clay Hills phase represents an actual Kayenta colonization of Cedar Mesa versus some type of intensified exchange, Professor Donna Glowacki, will use neutron activation analyses to characterize the clays used in Kayenta-style sherds from an excavated Clay Hills phase midden, for comparison with local versus Kayenta area clay types and sources. Production of Kayenta ceramics on Cedar Mesa would indicate an actual colonization. Glowacki (2006) has just completed an extensive survey of pottery manufacture and exchange across the Northern San Juan region and has already done analyses of Mesa Verde tradition ceramics and clay sources from Cedar Mesa. R.G. Matson will direct a comparison of the use of lithic sources in Clay Hills to compare with other occupations. Bill Lipe will also re-evaluate Clay Hills ceramic assemblages in light of new dates for Kayenta tradition pottery types in order to refine the chronology for this phase.

b) Identification of great house sites linked to the Chacoan sociocultural system. This depends on the presence of architectural and site-plan traits that reference the major great houses at the primary Chacoan centers (Chaco Canyon and the Aztec complex), and on site dates that fall within the brief period of Chacoan expansion to the north (Lipe 2006; Kantner and Mahoney 2000). Two sites on Cedar Mesa (discovered after the Cedar Mesa Project fieldwork) have tentatively been identified as Chaco-style great houses—the Et Al. site and the Severance site (Kantner 2003). We plan to map these two sites in detail to determine (to the extent possible) their layout and architectural traits, identify potsherds on-site in order to refine their chronological placement, and to collect samples from exposed construction timbers for tree-ring dating at the Laboratory of Tree-ring Research at the U. of Arizona.

c) Obtaining community pattern data. Chaco great houses typically serve as community centres for surrounding dispersed communities. Less than 1 km from the Et al. site is Bullet 12-1, one of the largest Cedar Mesa sites in terms of population as indicated by 15 hearths (Matson et al. 1990), but with very little architectural evidence and only a modest assemblage in spite of being dispersed over a large area. It belongs to the Windgate phase, circa AD 1060-1120 the time associated with Chaco influence. B12-1 is unique among Cedar Mesa sites, leading to the question whether it is a very short duration site associated with the building of the Et al. site or perhaps with seasonal festivals carried out there. Most Chaco Great Houses are in areas of relatively dense occupation, so temporary sites are not needed. Although we estimate (Matson et al. 1988, 1990) that the Pueblo population of the sampled area was around 1000, some of these would be living 15 km or further from the Et al. site, likely necessitating some temporary habitations. This idea would be evaluated by comparing the ceramic complex from B12-1 with that from the Et al. site and a careful comparison of the assemblage and feature information from B 12-1 with other more clearcut Windgate habitation sites. If B 12-1 was involved in “feasting” (Dietler and Hayden 2001), one would expect more and larger bowls and less storage ceramics than in “ordinary” sites. Mills (1989) analyzed both complete vessels from the Southwest and the sizes of Cedar Mesa vessels (as indicated by rim radius measures) which will provide a baseline. Thus, this investigation would be mainly an analysis of the existing B12-1 collection and notes and photographs, not additional fieldwork, except for a site visit or two.
d) Identifying a possible occupation hiatus on Cedar Mesa. A possible reason for the precipitate decline in Chacoan influence in the mid-1100s is the occurrence of a major drought episode from about AD 1135 to 1180 (Benson et al. 2006; Lipe 2006; Dean and Van West 2002; Meko et al. 2007). Because Cedar Mesa is agriculturally marginal relative to the central Mesa Verde region to the east, its population should have been especially sensitive to this drought. Hence, demonstrating a population decline or hiatus on Cedar Mesa in the mid-1100s would provide new evidence regarding the severity and geographic extent of the mid-1100s drought. Chronological re-evaluation of Cedar Mesa ceramics (referred to in 3-a above and 4 below) will help resolve this question, as will an evaluation of all Pueblo II-III tree-ring dates from southeastern Utah, many of them obtained after the Cedar Mesa Project chronology was established.

4. Pueblo III period population and settlement pattern dynamics.

The depopulation of the Northern Southwest in the late AD 1200s is a classic problem in Southwestern prehistory (Kidder 1924; Lipe 1995). In the central Mesa Verde region to the east of Cedar Mesa, the 1200s saw a buildup of population; a settlement shift from mesa-top to canyon and canyon-rim locations; an increasing movement of people from small dispersed homesteads and hamlets into villages of 50 or more people; and a rapid final depopulation in the late AD 1270s and early 1280s (Varien et al. 1996, 2007; Varien 1999, 2002). It has been argued 1) that depopulation began somewhat earlier in western areas such as Cedar Mesa than in the central Mesa Verde region (Lipe 1995; Glowacki 2006) and 2) that populations in the western area, including Cedar Mesa, did not participate in most of the settlement shifts occurring in the more densely-populated central Mesa Verde area (Varien et al. 1996). The proposed differences between the central and western Mesa Verde areas have substantial implications for understanding the dynamics of social and cultural interaction across the Northern San Juan area and of its eventual depopulation. For example, if most of the Cedar Mesa population continued to live in small settlements on the mesa top until the end of occupation, this would suggest that warfare was not as important a factor in the west, relative to the more populous areas farther east. The following studies will contribute to a better understanding of these dynamics.

a) Refining the chronology. Following the literature of the time, the initial (1970s) classification of Pueblo III period Mesa Verde tradition pottery on Cedar Mesa did not distinguish the earlier P III type McElmo B/W from the later type Mesa Verde B/W. This led to a less-than-optimal chronology for the Woodenshoe and Red House phases. Lipe, with the assistance of Diane Curewitz (a WSU Ph.D. student with extensive experience in Southwestern ceramics) will re-classify Mesa Verde tradition decorated pottery from the larger Woodenshoe and Red House sites, using both a refined typological approach and one based on analysis of time-sensitive attributes (Hegmon 1992). Chronological assignments of the pottery styles will be based on the most recent dating evidence (Wilson and Blinman 1991; Ortman et al. 2007).

b) Evaluating settlement shifts. Chronological comparisons of pottery assemblages dating to the AD 1200s from sites on the mesa top versus sites located in the canyons will allow us to determine if the shift to canyon locations was as dramatic on Cedar Mesa as in the central Mesa Verde area to the east. Tree-ring dates from the region surrounding Cedar Mesa will also be assembled to obtain a tighter chronology for the timing of construction of sheltered "cliff dwellings" in the canyons of southeastern Utah.

c) Evaluating demographic shifts. A refined chronology for the Woodenshoe and Red House
phases should enable us to use existing site data to evaluate whether or not Cedar Mesa population remained high or declined during the mid-1200s, whether the area was effectively depopulated by the mid-1260s (significantly before the central Mesa Verde area), and whether habitation site size increased or stayed constant during the 1200s.

**Communication of Results**

**Academic Community.** The several problem-oriented studies listed above will be the basis for papers delivered at scholarly meetings and eventual journal articles or book chapters. In addition, SSHRC funding will enable us to make available the most recent versions of basic data and analyses resulting from the Cedar Mesa Project. This will enable other researchers to do new analyses of our data in the future. The vehicle for doing this will be an extensive upgrade of the existing long descriptive technical report on the Cedar Mesa Project. All the figures in the current report need to and will be redone. Data will be added from the 1991 SSHRC supported investigations (Matson and Brand 1995), as well as from the Site Testing and Architectural Surveys. Matson has re-run, using different software (in the main), the core ceramic analyses in Chapter VII and has found no significant differences, although more data can now be incorporated. All of the lithic and ground stone data tables have already been updated, but there are still some ceramic collections from the the tested and tree-ring architectural sites that were not classified to the same standard as the rest. The latter would be brought up to date as a consequence of the proposed research on Pueblo material. These enhancements would enable us to make all our Cedar Mesa data, analyses and interpretations available, whether as a published monograph, CD, and online appendices, or some combination thereof.

**Policy Implications.** The “Curation crisis in archaeology” (Bawaya 2007) is currently much discussed, as museums try to cope with the costs of maintaining ever-increasing archaeological collections. The Cedar Mesa Project records and collections, because they document a representative sample of a relatively large (and archaeologically important) region, makes a significant contributions to this debate. Its history of use (Lipe 2007; Lipe and Matson 2007) as well the studies proposed here, show that it can continue to be a valuable research resource indefinitely. Recognizing this, the U.S. Bureau of Land Management (who manage the public lands in the Cedar Mesa region) has already expended over $120,000.00 (and committed additional future funds) to digitize field catalogues, copy paper records onto acid-free paper and repackage artifacts. The Cedar Mesa Project is also a good candidate for inclusion into the “Archaeoinformatics” project (http://archaeoinformatics.org/index.html; Snow et al. 2006) being developed by a consortium of five institutions to make digital archaeological data from major projects more widely accessible. The research proposed here will make a strong statement about the value of preserving and disseminating data from large, well-designed archaeological projects as well as providing information for the ongoing cultural resource management programs of the Bureau of Land Management.

**Educational Implications.** Public understanding of the archaeological record doesn’t “just happen”, it typically depends on research results that are brought into publically accessible form by teachers, media specialists, journalists, and even backcountry guides. There is enormous general interest in Southwestern archaeology, and Cedar Mesa has been featured in a number of books on Southwestern archaeology (e.g., Blackburn and Williamson 1997; Roberts 1996; Zwinger 1978). The research proposed here will undoubtedly contribute to a number of future popular treatments of Southwestern archaeology.
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4. Research Team, Proposed student training and Previous output.

A. Description of Research Team

The three principals are R.G. Matson, William Lipe, and Brian Kemp. Matson will be responsible for the overall administration of this research and is responsible for the quantitative information on the Cedar Mesa Project. Lipe started work on Cedar Mesa before the Cedar Mesa Project (Lipe and Matson 2007) and is now the literal keeper of the material as circa 95% of the collections now reside at his institution, Washington State University. Matson and Lipe are not now sure who was responsible for what (if it ever was) but their numerous co-authored publications (mostly resulting from their intensive interaction from 1970 to circa 1983), numerous student theses and dissertations (of which the lions share is Lipe’s) demonstrate the value of their interaction. In that regard, the results of the team is clearly greater than the sum of the two parts. The expected contributions of each are detailed below. Kemp’s contributions will be on the first and most important part.

The most important part of the current research is the determination of the genetic affiliation of the Grand Gulch Phase, the Cedar Mesa BM II. The question of the origin and adaptation of the BM II on Lipe’s part predates the Cedar Mesa project, and indeed, is a significant part of his dissertation (1966, summarized in Lipe 1970) and recently reviewed by Matson (2006a). As Matson became involved in the Cedar Mesa, he “inherited” the issue, and the multiple origins he saw are reflected in the plural (“Origins”) in the title of his 1991 book on the BM II, where he raises the possibility of the UA migration from deep in Mexico. It is only with the development of mtDNA analysis on ‘contact’ material, a development largely carried out by Kemp with the encouragement of S. LeBlanc that this hypothesis, first clearly presented by Bellwood, could be evaluated. The origin of the BM II has been an outstanding question since they were first identified, a century ago. Matson, Lipe, and Kemp will sort through the coprolites from Turkey Pen, and Kemp will undertake the demanding, highly technical analyses. The interpretation of the results will be largely dependent on the data base Kemp has developed with his dissertation, where this issue was one of the underlying goals. The first, and most important project is Kemp’s responsibility.

The investigation of stone boiling using Cedar Mesa limestone, will be directed by Lipe and Matson, with the possibility of some assistance from Brian Chisholm (UBC). Patricia Ormerod (MA UBC) has expressed interest in this, but a student from WSU might end up as the main researcher. Much of the experiment is relatively straight forward. However, the measurement of “free lysine” is controversial, and it is not a routine commercial activity, as far as we can tell, unlike “total lysine” which is. This is where we hope Chisholm can help us, although our results will clearly only be preliminary on this aspect.

BM II warfare will be investigated by an analysis of NC9-5, the Rock Island site, and directed by Matson. J. Morin, a Ph.D. student at UBC, has expressed interest in this task. He will produce the artifact classification and lithic identification under Matson’s close direction. Keller’s lithic source samples, along with NC9-5, are currently at UBC.

Lipe, whose recent research has included a significant amount of Chacoan material, will lead the analysis of the Chacoan section. He, aided by Glowacki’s technical analysis, will carry out the analysis of the Kayenta material, focussing on site B 10-7 (which was tested by Matson) and re-evaluate the Clay Hills ceramic assemblages.

Lipe and Matson will evaluate the two potential Great Houses, although Lipe’s greater expertise in this area will obviously give his ideas more weight. The comparison with B12-1 will also be carried out by both, with Matson’s experience in being the one responsible for mapping and collecting this unusual site, possibly giving him the lead in this area. The investigation of the possible hiatus in the mid 1100s is a subject both Matson and Lipe have a keen interest in and bring forward different skills and knowledge, with Matson’s quantitative ceramic analyses will certainly be intensely critiqued by Lipe.
In 4, Pueblo III population and settlement pattern dynamics, Matson and Lipe will both be involved in all three aspects, with Lipe’s greater Mesa Verde knowledge being an important resource. Although Lipe will (with Curewitz’s help) undertake the mesa-top versus canyon ceramic attribute analysis, Matson will take the lead in the actual comparison when the counts have been done.

As to the proportion of research time spent on this project versus other research activities, Kemp reports that this one should get his full attention. Matson notes that he hopes his current redrafting of the Crescent Beach volume will be completed by the time this proposal is evaluated, and that this project would be his main research, along with some additional research on BM II diet that he and Brian Chisholm have been working on for some time. Likewise, this would be Lipe’s foremost research, although he would also be continuing his involvements with Crow Canyon, public archaeology, and the central Mesa Verde area archaeology.

B. Description of proposed student training strategies.

The best training for a student is participation in the full range of research activities, from research design to communicating the results to academics and the general public. Of course, depending on each student’s background, and the nature of the research, the range of their participation will be variable. J. Morin, as a PhD student with substantial experience in B.C. lithics and some in paleolithic material in Asia, will participate at a high level in the BM II lithic analysis and source identifications. If he continues with the project to the Kayenta Clay Hill’s lithic source identification, he will be given the opportunity to design that project. Diane Cursewitz will either participate as a very new PhD or completing student, or both. Since she has been working with the Cedar Mesa collections at WSU on the Bureau of Land Management project, she is familiar with many aspects, which will make her participation on the ceramics much easier. Even though her dissertation is on SW ceramics, she does not have experience in classifying the ceramic types found on Cedar Mesa, so this will broaden her expertise. We expect that she will participate in a number of ways in items 3 and 4 in the proposed research, including authorship of papers and publications resulting from them.

From these very experienced students, we turn to the student assistant requested by Prof. Glowacki. Since her institution (Notre Dame) is strictly one of undergraduates, the kind of level of expertise expected for a PhD student can not be assumed, although Glowacki hopes that the student she has in mind will be available and asked about the possibilities of support for the student to attend a meeting to report on the research. Clearly, she is expecting a very high level of performance and involvement.

Similarly, the student assistant requested by Kemp is also an undergraduate. This student would learn about very technical aspects of this demanding analysis, a unique opportunity, but also one that would likely be “valid” only for a short period of time.

The limestone stone boiling experiment does not have a student designated for it as yet, and Patricia Ormerod (MA UBC), an employee of the UBC Anthropology dept. has expressed an interest. WSU typically has several Canadian graduate students attending. Currently these include Matt Glaude (Graduated from McGill) and Patrick Dolan (UBC). Only Patrick Dolan has interests which might be appropriate for this study and he is apparently working with the recently hired Colin Grier on a SSHRC research grant. We plan to give any WSU Canadian students priority if no UBC student is interest in this project, but not enough to endanger the investigation.

C. Description of previous and ongoing research results.

Brian Kemp states that: “Most recently I completed a study of mitochondrial DNA from quid samples from the Southwest (with Leblanc[LeBlanc et al. 2007]). The techniques used in that study are directly applicable to our proposed investigation. I am currently working on a project in which we are
R.G. Matson

studying genetic change over the last 2000 years in the central Peruvian Andes (with Tiffiny Tung at Vanderbilt University). This project builds upon the growing database of genetic variation in the Americas."

Lipe's recent research has focussed on the central Mesa Verde area, giving him a new perspective from which to examine the Cedar Mesa area. He has also been investigating the Chaco phenomena (Lipe 2002, 2006) which is directly relevant to item 3 of the current proposal. And his interest in the "depopulation" in the thirteenth century is long-standing with his 1995 article often cited by others discussing this issue. His long and continuing interest in Cedar Mesa is seen in many publications and presentations (too many to cite here, although many are in Matson and Kohler [2006 described in Matson's c.v.]).

Matson has already cited above many of his publications on BM II and Cedar Mesa (Matson 1991, 1994, 2003, 2006; Matson and Chiho[...]m 1991, 2007; Matson et al. 1988, 1990, etc.). Since reaching emeritus status in 2004, research on Cedar Mesa material has been ongoing, even while primary efforts were on other projects (Matson and Magne 2007; Matson and Kohler 2006; [both described in Matson's c.v.] and the Crescent Beach report under revision). The current proposal would provide the support to make this his main research activity and help resolve some longstanding southwestern issues, resolvable in part because of the unique characteristics of Cedar Mesa and the strategic decisions that Lipe and Matson made so long ago, and in part because of the special skills and knowledge of the current team. It will also bring the Cedar Mesa information to a stage that it can be widely used by other archaeologists.
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