# TABLE OF CONTENTS

**Introduction**
Sally J. Cole ........................................................................................................ 3

**Durango-Animas and Upper San Juan Rivers, Colorado and New Mexico**
Farming at the Edge of Paradise: Basketmaker II Emergence in New Mexico's San Juan Basin
Leslie M. Sesler and Timothy D. Hovetzak .................................................................................................................. 9
Refining the Chronology of the Durango Basketmakers
Mona C. Charles ........................................................................................................ 21

Pushing the Limits and Tormenting Corn Seeds: Cultural Adaptations and Climatic Change in the Upper San Juan During the Basketmaker II Period and Beyond
Benjamin A. Belloardo .............................................................................................. 33

**Southern Chuska Valley, New Mexico**
Basketmaker II in the Southern Chuska Valley, New Mexico
Timothy M. Kearns ..................................................................................................... 49

**Moab and the Canyonlands, Utah**
Basketmaker Chronology near Moab, Utah
Grant Fabrini .............................................................................................................. 73
Basketmaker-Age Woven Perishables of the Moab Region
Sharyl Kinear-Ferris .................................................................................................... 81

**Comb Ridge, Cedar Mesa, Navajo Mountain, and Grand Staircase, Utah and Arizona**
Early Farmers at the Earth's Backbone: Basketmaker II in the Comb Ridge Area
Winston Hurst, Francis E. Smiley, and Michael R. Robbins ........................................ 89
New Insights from Old Collections: Cedar Mesa, Utah, Revisited
William D. Lipe, R. G. Matson, and Brian Kemp ....................................................... 103
Basketmaker II Occupation of the Navajo Mountain Region
Phil R. Geib and Kimberly Sparr .................................................................................. 113
The Basketmaker II Horizon: A View from the Grand Staircase
Douglas A. McFadden ................................................................................................. 119
NEW INSIGHTS FROM OLD COLLECTIONS: CEDAR MESA, UTAH, REVISITED

WILLIAM D. LIPE, R. G. MATSON, AND BRIAN M. KEMP

ABSTRACT
Basketmaker II period collections made in the 1970s during the Cedar Mesa Project are being re-examined with new questions and in some cases with new analytical techniques. Included are DNA analyses of human and turkey coprolites, palynology of the latter, and studies of biface production technology and of a defensive site lithic assemblage. Experimental studies will assess the effects of stone-boiling with limestone on maize nutritional qualities. Regional subsistence data synthesis indicates the maize-dominated Cedar Mesa pattern is typical of the northern Southwest.

INTRODUCTION
Cedar Mesa is a highland located in San Juan County, Utah, just north of the San Juan River. In the late nineteenth century, excavations by Richard Wetherill and others in the dry shelters of canyons in and around Cedar Mesa resulted in the first evidence of a distinctive Basketmaker culture stratigraphically below the later “Cliff Dweller” (Pueblo) remains (Blackburn and Williamson 1997; Spangler et al. 2010; Hurst and Turner 1993; McNitt 1957). In recent times, the well-preserved cliff dwellings and rock art of Cedar Mesa, as well as its spectacular scenery, have made the area an internationally known destination for backcountry visitors (Petersen 2002; Tassoni 2001; Roberts 1996; Zwinger 1978).

One of the values of curating archaeological collections is that they can often be studied by new analytical methods not available at the time of the original research. This opens up the possibility to address new research questions not considered earlier. Here we report briefly on recent investigations of Basketmaker II (BM II) period materials originally collected in the early 1970s during fieldwork in southeastern Utah directed by Lipe and Matson as part of the Cedar Mesa Project (Lipe 2007; Lipe and Matson 2007; Matson 1991; Matson et al. 1988, 1990). The project was primarily carried out through surface surveys, but limited excavations were done at several sites. Except for some specimens being studied by Matson at the University of British Columbia, the Cedar Mesa Project collections and records are curated in the Museum of Anthropology at Washington State University (WSU).

The Cedar Mesa Project (CMP) surveys indicated that Archaic period occupation was light (evidence consisted only of Archaic-style points found on...
HUMAN AND TURKEY COPROLITES FROM THE TURKEY PEN SITE

In 1972, as part of the CMP research, R. G. Matson excavated a single test pit at the Turkey Pen site (42SA3714; also 42SA5109) in Grand Gulch (Matson 1991:90–101). This pit sampled an extensive Basketmaker II dry midden depositing 200 B.C. to A.D. 450. A 50 x 50 x 140 cm column of the midden was isolated and bagged by stratigraphic layer (Figure 1). The coprolite analyses noted here were conducted on samples from this midden column or from deposits encountered while isolating it.

Large parts of the Turkey Pen midden were heavily dug over in 1979 by professional looters (Powers 1984). The site’s popular name stems from an isolated racquet structure that may well have been used to pen turkeys, but probably was not built until the Pueblo II or III period.

Brian M. Kemp and Cara Monroe have initiated analyses of mtDNA from Basketmaker II human coprolites found in the Turkey Pen midden. Several hypotheses about the origins of Basketmaker II populations are, in principle, testable by these analyses. Initial indications are that the kind of genetic information being obtained can test these ideas and preliminary data has revealed genetic continuity between Basketmaker II populations and contemporary Pueblo groups, among others (Kemp et al. 2009). The observed patterns, when verified by further research, will undoubtedly result in novel observations and lead to new ideas about Southwestern population history.

In collaboration with Phil R. Geib, Kemp is also currently analyzing Archaic coprolites from Old Man Cave (Geib and Davidson 1994), located just east of Cedar Mesa. This Archaic “baseline” is crucial for evaluating the degree to which incoming farmers impacted the gene pool of the Southwest and/or indigenous foragers of the Southwestern adopted farming technologies. This line of inquiry builds squarely off Kemp’s dissertation research (Kemp 2006), as well as a recent article (Kemp et al. 2010).

Brian M. Kemp, Cara Monroe, and WSU undergraduate student Scott Wyatt have also analyzed mitochondrial DNA (mtDNA) extracted from turkey (Meleagris gallopavo) coprolites collected from the midden in 1972 (Wyatt et al. 2009; Speller et al. 2010). As is true for humans, mtDNA is strictly maternally inherited among turkeys and is particularly abundant in most cells. These characteristics make mtDNA an ideal molecular marker for studying in ancient remains, artifacts, and coprolites (Kemp et al. 2007; LeBlanc et al. 2007). Concurrently, Camilla Speller and colleagues from Simon Fraser University analyzed mtDNA from turkey bones dating from the A.D. 600s through the 1400s from a number of sites located across the Southwest (Speller et al. 2010).

In both the Basketmaker II samples and those from later periods, a single turkey mtDNA lineage (termed “aHapl”) was found to dominate at all sites, represented in 116 of the 143 (~81 percent) successfully analyzed archaeological specimens (Speller et al. 2010). This long-term and wide-spread conservation of a single female line indicates controlled breeding and hence domestication of these turkeys. The “Southwestern domestic” haplotype (“aHapl”) is genetically less closely related to most lineages found in contemporary populations of the endemic Southwestern Merriam’s turkey (M. g. merriami) than to lines found in populations of the Eastern (M. g. silvestris) and Rio Grande (M. g. intermedia) subspecies; these birds presently reside east and southeast of the area occupied by Ancestral Puebloan groups. The aHapl haplotype is the least common lineage found among Merriam’s turkeys today and may represent descendants of birds that “escaped” from domestic flocks sometime during prehistory (Speller et al. 2010). Identifying a geographic and genetic source for the Southwestern domestic line is obviously a topic for additional research.

FIGURE 1. Stratigraphy of midden column at Turkey Pen Site, Grand Gulch, with C-14 dates (after Matson 1991:Fig. 2:33 and Speller et al. 2010: Fig. 51)

Wyatt, Monroe, and Kemp also obtained (from the US National Museum) tissue samples from turkeys collected in the early 1900s of the now-extinct central Mexican subspecies \textit{(M. g. gallopavo)}. Analysis of the mtDNA of these birds links them very closely to modern commercially bred and marketed turkeys (Speller et al. 2010). This is consistent with historical accounts that the Spanish took Mexican turkeys to Europe, where they became popular; European breeds then became the basis for turkey husbandry in North America (Speller et al. 2010). The turkeys kept prehistorically at the Turkey Pen site and elsewhere in the Southwest thus appear to record a domestication event separate from the Mexican one. It is possible that future genetic research will identify additional domestication centers of the turkey, which is consistent with practices of animal and plant domestication in the Old World (see Zeder et al. 2006).

BreAnne Nott, a WSU graduate student, has analyzed pollen from Turkey Pen Basketmaker II turkey coprolites, and has found that many samples include maize pollen, often in abundance (Nott 2010; Nott et al. 2009). This is consistent with earlier analyses of turkey coprolites from this midden by Aasen (1984) and Arakawa et al. (2001). These results further indicate that the Grand Gulch turkeys were being treated as domestic animals. The turkeys were evidently living at the site alongside its human occupants, and likely were being fed maize. Also, a few eggshell fragments were collected during the “clean-up” of the 1979 looting episode (Powers 1984). These are probably from the Basketmaker II period occupation of the site, but a later Pueblo period context cannot be excluded.

**WHY IS LIMESTONE ABUNDANT ON BM II HABITATION SITE MIDDENS?**

A hallmark of BM II habitation sites on Cedar Mesa is the presence of limestone fragments on the middens (Matson et al. 1988). Limestone is very rare on the middens of later sites on Cedar Mesa. We have suggested that limestone was being used in stone-boiling maize, prior to the advent of pottery vessels that would allow liquid to be heated in a container set directly over the fire (Matson 1991:7). It is well known that processing maize in an alkaline environment enhances its nutritional value by making niacin, tryptophan, and lysine more available for human uptake (Katz et al. 1974; Matson 1991:7). Increasing these nutrients might have been important to the Cedar Mesa Basketmakers because they were highly dependent on maize (Matson and Chisholm 1991), but did not yet have beans as a supplemental source of vegetable protein rich in those three amino acids.

However, if limestone used in stone-boiling is to affect the nutritional qualities of maize, it must be heated at temperatures high enough to convert some of its calcite to soluble lime. This process begins at temperatures between 500 and 600°C, and proceeds at a rapid rate at temperatures near 900°C (Gourdin and Kingery 1975:137). Experiments with firing pottery (Blinman and Swink 1997) indicate that open fires fueled with dry juniper regularly reach temperatures of 800 to over 900°C.

Emily Holstad, a WSU graduate student, has conducted an experimental study of the effects of heating limestone and of whether stone-boiling with limestone has effects on the nutritional values of maize (Holstad 2010). She finds that when chunks of limestone from a Cedar Mesa geological source are heated to 600°C and then dropped into distilled water, the pH of the water shows a moderate increase. Chunks heated to either 700 or 800°C result in an increase in the water’s alkalinity to pH values between 11 and 12. When stone-boiled with limestone, samples of traditional varieties of maize showed significant increases in the availability for human nutrition of lysine, tryptophan, and methionine. In addition, samples of limestone from a Basketmaker II site on Cedar Mesa showed physical characteristics consistent with having been heated in the past.

**ANALYSIS OF BASKETMAKER II FLAKED LITHICS**

Matson and University of British Columbia graduate student Jesse Morin have reanalyzed the stone artifacts collected from the “Rock Island Site” (42SA4542; field designation NR C9-5). This is a large habitation site situated in a defensible location on a rock promontory at the juncture of two entrenched canyons; it was partially surface-collected in 1974, and two small test pits were excavated in 1991 (Matson 1994). The goal was to compare this assemblage with those from “ordinary” BM II habitation sites to see if this possible defensive site was distinctive in artifact inventory or lithic source materials. So far, the analysis indicates that the only unusual characteristic of the assemblage is a higher than expected frequency of drills and gravers in this greater than 9,000-piece collection.

Morin and Matson have also tested Phil Geibs (2002) inference that in BM II, indirect punches and wide compound pressure flakers were used to produce very thin, broad bifaces. Using attributes of flake-scar morphology, they were able to show statistically significant differences between BM II and Archaic bifaces from Cedar Mesa, in accord with Geibs’s model (Morin and Matson 2009; Matson and Morin 2010). William Bryce, a graduate student at Northern Arizona University, has also examined BM II projectile points from Cedar Mesa as part of an ongoing project comparing Eastern and Western Basketmaker point production technology (Bryce 2010).

**REGIONAL PATTERNS OF BASKETMAKER II SUBSISTENCE**

R. G. Matson and Brian Chisholm are currently continuing to synthesize evidence on BM II subsistence provided by midden, coprolite, and isotopic analyses done on materials from the Southwest in general as well as from Cedar Mesa and neighboring areas. Most pertinent to our Cedar Mesa research are the coprolite analyses by Reinhard (1992) of Turkey Pen materials recovered by Powers (1984), and of samples from nearby Butler Wash by Androy (2003). Macrofloral analyses of Turkey Pen midden samples by Radomski (1999) and Cordas (2000) support the results of earlier work carried out by Lepofsky (1986; reported in Matson and Chisholm 1991) and by Aasen (1984). Data from the Lepofsky, Radomski, and Cordas studies are synthesized in Figure 4.7.
of Matson (2006). This large corpus of data points to a maize-dominated diet being widely established in the northern Southwest by the last century B.C. Weedy plants associated with active or abandoned garden plots make up much of the non-domesticated plant resources. This pattern of many non-maize dietary items also being associated with farming activities, continues from early BM II into later periods. A subset of this regional synthesis was presented at the SAA meetings in 2007 (Matson and Chisholm 2007).

ACKNOWLEDGMENTS

Aspects of the research reported here were supported by grant No. 410-2008-1677 to R. G. Matson from the Social Sciences and Humanities Research Council of Canada, by the Auvil Fellows Program for Undergraduate Research at WSU, and by institutional funds provided by the Department of Anthropology and the School of Biological Sciences at WSU. Mary Collins and Diane Curewitz of the WSU Museum of Anthropology assisted in accessing some of the museum collections that were studied. Susan Matson drafted the profile that is the basis for Figure 1.

REFERENCES CITED

Aasen, Diane K.

Androy, Jerry

Arakawa, Fumi, Ian Buvit, Celeste Henrickson, David Hyde, Matthew Landt, Jonathan Meyer, Michael Spitzer, and Karisa Terry

Blackburn, Fred, and Ray Williamson

Blinnman, Eric, and Clint Swink

Bryce, William D.

Cordas, Emily
2000 The Analysis of Macroplant Remains from a Midden Deposit in Turkey Pen Ruin In Cedar Mesa, Utah. MS on File, Laboratory of Archaeology, University of British Columbia, Vancouver.

Geib, Phil R.

Geib, Phil R., and Dale Davidson

Goudie, W. H., and J. D. Kingley

Holstad, Emily

Hurst, Winston B., and Christy G. Turner II

Kat, Solomon H., M. L. Hediger, and L. A. Valleroy

Kemp, Brian M.


Kemp, Brian M., Cara Monroe, William D. Lipe, and R. G. Matson
2009 Genetic Analysis of Basketmaker II Coprolites from the Turkey Pen Ruins Site in Southeastern Utah. Paper presented at the Annual Meeting of the Society for American Archaeology, Atlanta, Georgia.

Kemp, Brian M., Cara Monroe, and David Glenn Smith

LeBlanc, Steven A., Lori Kreisman, Brian M. Kemp, Shawn W. Carlyle, Anna Dhody, Frances Smiley, and Thomas Benjamin

Lepofsky, Dana
1986 Preliminary Analysis of Flotation Samples from the Turkey Pen Ruin, Cedar Mesa, Utah. Report on File, Laboratory of Archaeology, University of British Columbia, Vancouver.

Lipe, William D.

Lipe, William D., and R. G. Matson

Matson, R. G.
1994  Anomalous Basketmaker II Sites on Cedar Mesa: Not So Anomalous After All. 
2006  Basketmaker II and Cedar Mesa. In Tracking Ancient Footsteps; William D. Lipe's 
Contributions to Southwestern Prehistory and Public Archaeology, edited by R. G. 
Matson and Timothy Kohler, pp. 45-63. Washington State University Press, 
Pullman.
Matson, R. G., and Brian Chisholm
1991  Basketmaker II Subsistence: Carbon Isotopes and Other Dietary Indicators 
2007  Basketmaker II Subsistence. Poster presented at the Annual Meeting of the 
Society for American Archaeology, Austin, TX. http://www.anth.ubc.ca/ 
Matson, R. G., William D. Lipe, and W. R. Haase
1988  Adaptive Continuities and Occupational Discontinuities: The Cedar Mesa 
1990  Human Adaptation on Cedar Mesa, SE Utah. Laboratory of Archaeology, 
University of British Columbia, Vancouver. http://www.anth.ubc.ca/research/ 
research-facilities/laboratory-of-archaeology-loa/pdf-library/matson-lipe- 
Matson, R. G., and Jesse Morin
2010  Differentiating Archaic and Basketmaker II Projectile Point Manufacturing 
Techniques. Paper presented at the Annual Meeting of the Society for American 
Archaeology, St. Louis, Missouri.
McNitt, Frank
1957  Richard Wetherill—Anasazi: Pioneer Explorer of Southwestern Ruins. University of 
New Mexico Press, Albuquerque.
Morin, Jesse, and R. G. Matson
2009  Differentiating Archaic and Basketmaker II Projectile Point Manufacturing 
Techniques on the Colorado Plateau. Unpublished manuscript, Laboratory of 
Archaeology, University of British Columbia, Vancouver.
Nott, BreAnne
2010  Documenting Domestication: Molecular and Palynological Analysis of Ancient Turkey 
Coprolites from the American Southwest. Master's thesis, School of Biological 
Sciences, Washington State University, Pullman.
Nott, BreAnne, John Jones, William D. Lipe, and Brian M. Kemp
2009  Palynological Analysis of Ancient Domestic Turkey Droppings from the 
American Southwest. Paper presented at the Annual Meeting of the Society for 
American Archaeology, Atlanta, Georgia.
Petersen, David
Powers, Margaret A.
1984  The Sulfate of Archaeological Data from Turkey Pen Ruin, Grand Gulch Primitive 
Area, San Juan County, Utah. Division of Conservation Archaeology, Contributions 
to Anthropology Series, No. 808. San Juan County Museum Association, 
Farmington, New Mexico.
Radomski, Elizabeth
1999  Continuing Analysis of Bulk Midden Samples from Turkey Pen Ruin, Cedar 
Mesa, Utah. Report on file, Laboratory of Archaeology, University of British 
Columbia, Vancouver.
Reinhard, Karl J.
In Diet, Demography and Disease: Changing Perspectives on Anemia, edited by P. 
Roberts, David
1996  In Search of the Old Ones: Exploring the Anasazi World of the Southwest. Simon and 
Spangler, Jerry, Andrew T. Yentsch, and Rachelle Green
2010  Farming and Foraging on the Southwestern Frontier: An Overview of Previous 
Research of the Archaeological and Historical Resources of the Greater Cedar Mesa 
Area. Antiquities Section Selected Papers, Volume IX, No. 18. Utah Division of 
State History, Salt Lake City. Available at Washington State University Library 
Research Exchange. https://research.wsulibs.wsu.edu:8443/spui/handle/2376/ 
Speller, Camilla M., Brian M. Kemp, Scott D. Wyatt, Cara Monroe, William D. Lipe, 
Ursula M. Arndt, and Dongya Yang
2010  Ancient Mitochondrial DNA Analysis Reveals Complexity of Indigenous 
North American Turkey Domestication. Proceedings of the National Academy of 
Sciences 107(7):2807-2812.
Tassoni, Peter Francis
Wyatt, Scott, Brian M. Kemp, Cara Monroe, and William D. Lipe
2009  Domestic Turkeys in the American Southwest: Imported Birds or an 
Independent Domestication. Poster presented at the Annual Meeting of the Society 
for American Archaeology, Atlanta, Georgia.
Zeder, M. A., E. Emshwiller, B. D. Smith, and D. G. Bradley
2006  Documenting Domestication: the Intersection of Genetics and Archaeology. 
Trends in Genetics 22(3):139-55.
Zwinger, Ann