Basketmaker II Subsistence

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1. Introduction

In 1986 we (Matson and Chisholm 1986, 1991) we reported on four lines of evidence pointing to maize agriculture being important for Basketmaker II subsistence on Cedar Mesa, Utah, (Figure 1). They included settlement patterns, coprolite analysis, midden analysis, and stable carbon analysis (Aasen 1984; Chisholm and Matson 1994; Lepofsky 1986; Matson 1991, 1994). We also briefly summarized other BM II information which led to the conclusion that the BM II in general was largely based on maize agriculture. Here we summarize the major subsistence evidence from midden, coprolite, and stable isotope analysis, focusing on that which has become available since circa 1990, and evaluate how it compares with the limited information earlier reported on Cedar Mesa.

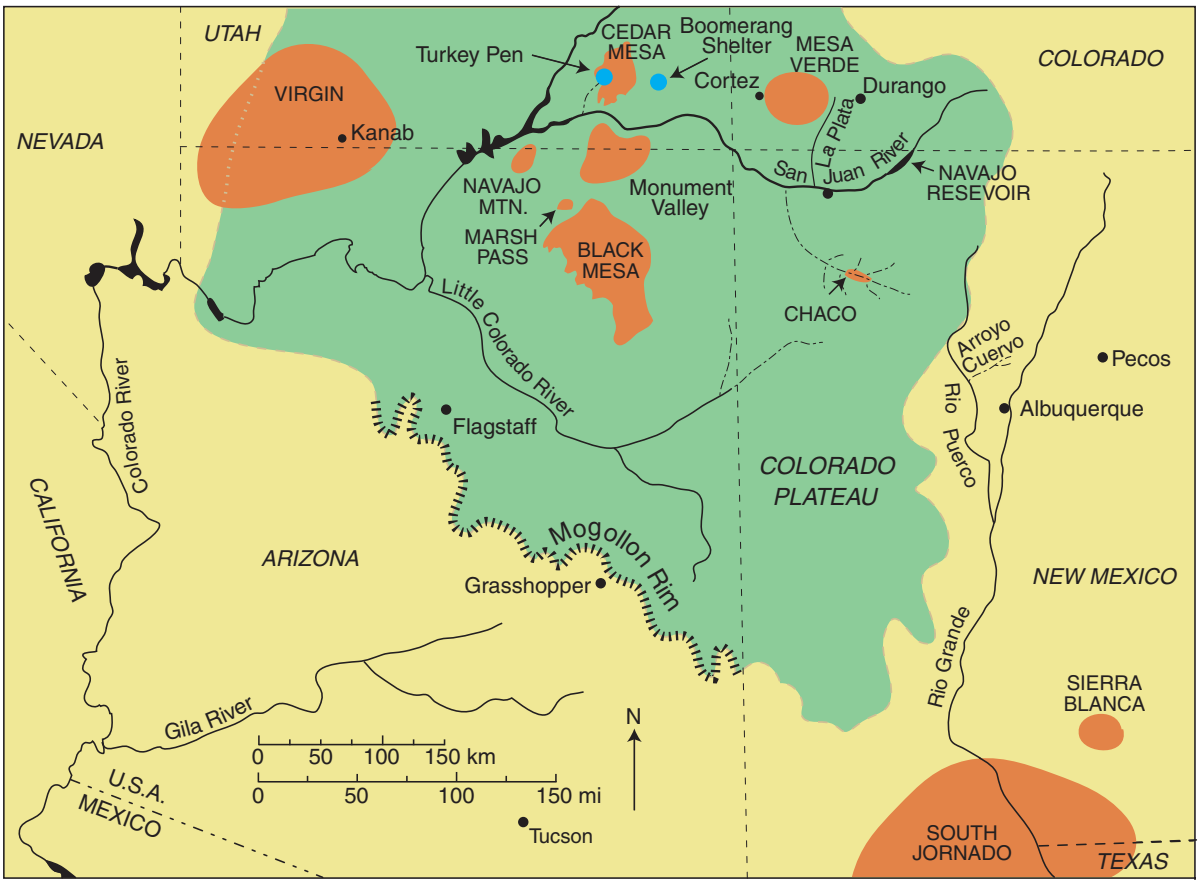


Figure 1: Locations of sites discussed here

2. Coprolite Analysis Results

Aasen (1984) analyzed 29 Basketmaker II coprolites from the Turkey Pen site in Grand Gulch in 1972 (Figure 2a). Maize was present in 25 of 28 human coprolites; no other plant subsistence material were present in half of them, and *Pinus edulis* was the most common in 7 samples. By weight maize was also the most abundant, with *Oryzopsis* (now *Stipa* of some authors), Cheno-Ams (Chenopods and Amaranths, undifferentiated), *Cucurbita* and Chenopods also all present in three or more coprolites (Aasen 1984). Aasen (1984) also reported maize pollen in 14, *Cucurbita* in 7 and beeweed (*Cleome*) in five. Five of the six radiocarbon dates for the 1972 samples range between 1800-2100 B.P., definitely earlier than the A.D. 200-400 mesa-top Grand Gulch occupation (Matson 1991, Matson, Lipe and Haase 1988). We noted that the Turkey Pen coprolite pattern was very similar to the Pueblo coprolites from Hoy House (Scott 1979), Antelope House (Fry and Hall 1986) and Basketmaker III and Pueblo coprolite pattern summarized by Minnis (1989), with the possible exceptions of more abundant *Pinus spp.* and lack of beans at Turkey Pen.

Since Aasen's investigations, further Turkey Pen coprolite analyses have been produced, including those of Aasen (1986) Reinhard (1985, 1988, 1992; Reinhard and Jones (1987) and Rylander 1994). Most are of coprolites recovered during a "clean up" operation after an extensive vandalism event (Powers 1984). Thus, there is no assurance that all these coprolites are Basketmaker II, let alone that they date to the same 1800-2100 BP of the Aasen's study.

Macroscopic remains in 24 coprolites obtained from aceramic deposits exposed during the cleanup (Reinhard 1988, 1992; Reinhard and Jones 1987) show the same pattern as reported by Aasen (1984) with maize found in 23/24 (Figure 2b). Note that Aasen's order in Figure 2a is stratigraphic, while Reinhard's data order Figure 2b is not, however, both graphs show maize dominating followed by pinyon pine hulls. Aasen (1986) also briefly reported on 11 more coprolites from the same column reported on previously, and found the same pattern as earlier. Aasen eventually analyzed a total of 65 Basketmaker II Turkey Pen coprolites, and that she had scanned 250 from the clean-up operation and found maize in every one.

Cheno-Ams are more common in Reinhard's sample, present in 12 of 24 coprolites with *Cucurbita* and Indian Rice Grass (identified as "Grass seeds" in Reinhard and Jones 1987) each in 3 of 24 samples. Although the dominance of maize in both samples is obvious, and the occurrences of *Cucurbita* and Indian Rice grasses are similar, Reinhard reports less pinyon and more Cheno-Ams. Reinhard (1988; Reinhard et al. 1985) has a special interest in Chenopods, as a possible anthelminthic (anti-worm medicine) which might explain finding these more frequently than Aasen did, but only in quantity in one sample.

The presence of the *Phaseolus*, the bean, is unexpected in the Basketmaker II, and raises the question whether the sample (#12) is, in fact a Basketmaker II coprolites.

Reinhard (1988; Reinhard and Jones 1987) also reported on pollen analysis of 25 coprolites 18 of which had maize pollen present and 16, *Cleome* pollen, both in large quantities indicating ingestion of these plants, results similar to Aasen's pollen analysis of coprolites. West (1978) also analyzed 18 midden samples from the 1972 test and found maize pollen in every one and *Cucurbita* pollen in six.

Boomerang Cave, Butler Wash

Androy's (2003a, 2003b) important study of remains from Boomerang Shelter in Butler Wash (Figure 1,2b) reports on both macroscopic remains from 30 coprolites and microscopic remains from 10 of the 30. Of these thirty, 27 had maize present, 16 had pinyon nut shells and 1 had *Cucurbita* remains (Figure 2c). Cheno-Ams were found in 17 and sunflower was present in 8. Differences from the Turkey Pen results are

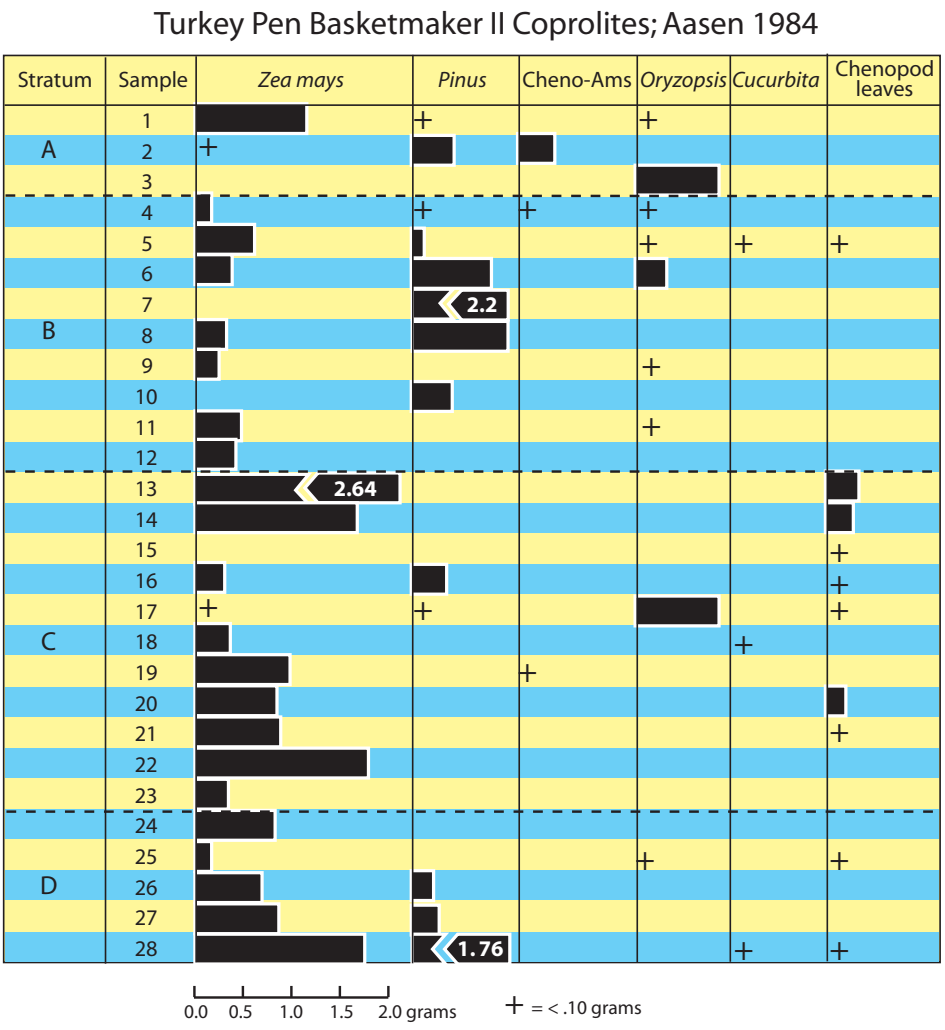
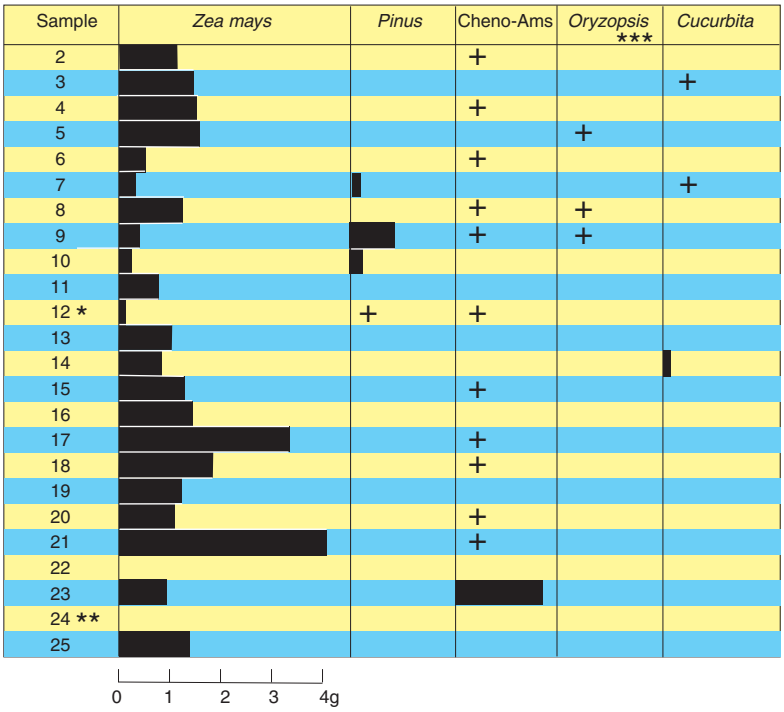


Figure 2a: Aasen's Analyses

interesting, the lack of *Mentzelia* (none found) and *Oryzopsis* remains (present only in 5). The reasons for these differences are not clear, as both are found in other Anasazi contexts. On the other hand, *Rhus* (Sumac) seeds were found in 10 coprolites, the first such concentration noted in Basketmaker II, although Minnis (1989) finds modest quantities in later Anasazi coprolites. Androy offers the same seasonality interpretation for his material as Aasen and we have for the Turkey Pen coprolites, spring and fall, indicating a year-round use of maize.

Boomerang Shelter dates relevant to this material range from 2350-1350 B.P. with a concentration between 2000 and 1500 B.P. (Androy 2003b:16). Boomerang Shelter is at a relatively low elevation (1500m) with no higher elevation areas nearby, perhaps accounting for the differences in result from Turkey Pen, which has much higher elevations immediately adjacent, although the sites are at similar elevations. Androy (2003b:99) interprets his findings as demonstrating not only the importance of domesticates, but that many of the wild plants are weedy annuals, likely concentrated on agricultural fields, so that their abundance in the diet are also the result of agricultural activities.

Turkey Pen Coprolites; Reinhard 1988, 1992



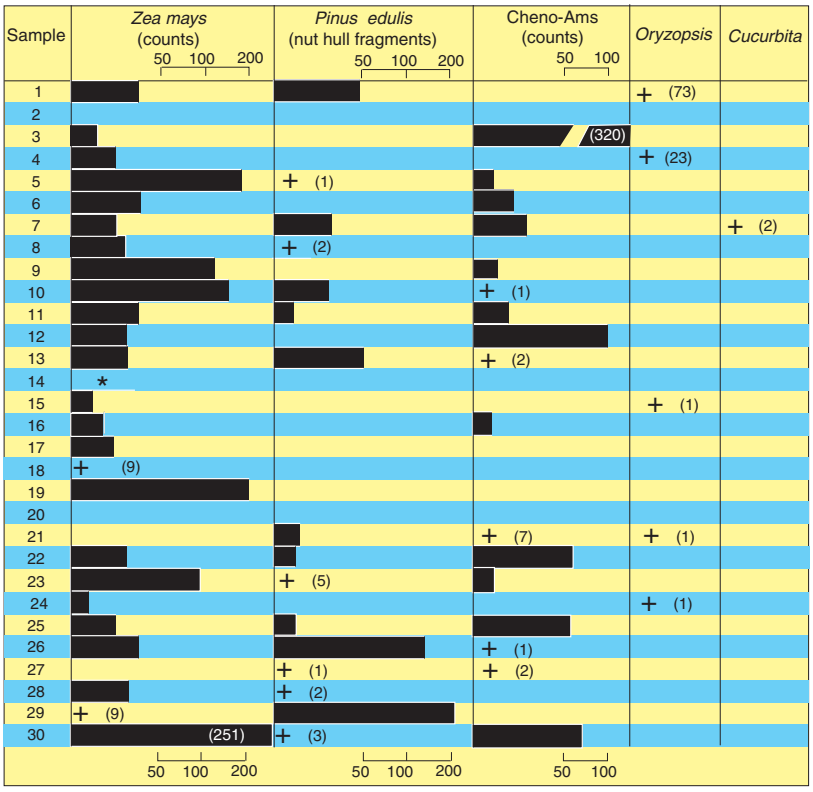
* This coprolite has a bean present, possibly not BM II

** The only dietary material identified in this sample is opuntia

*** Reinhard identified this class only to "grass seeds"

Figure 2b: Reinhard's analysis

Boomerang Coprolites; Androy 2003



\+ = present <10

* no macrofossil identified, but abundant maize pollen present

Figure 2c: Androy's Analyses

Summary of Coprolite Analyses

These additional coprolite studies support the main findings of Aasen's study, which indicate that the Cedar Mesa Basketmaker II relied heavily on maize agriculture, with squash also present as an secondary agricultural product and with pinyon being the most important wild product. The numerous additional studies of the Turkey Pen coprolites confirm the originally reported pattern. The important coprolite study from Butler Wash, shows the same basic pattern is found there for the Basketmaker II as at Turkey Pen, although some interesting differences exist among some of the secondary important wild crops. Androy (2003b) points out that much of the constituents are either agricultural products or weedy annuals, likely to be abundant on abandoned agricultural plots. He also reports meat in 17 of 30 coprolites, with cottontails being the most common identified faunal remains, pointing to "garden hunting". From this perspective, agricultural activities are larger than indicated by the amount of domesticates in these coprolites. Besides maize, only Cheno-Ams are possible C4 plants, although *Opuntia* uses the CAM pathway and may look like C4 in the isotopic analyses.

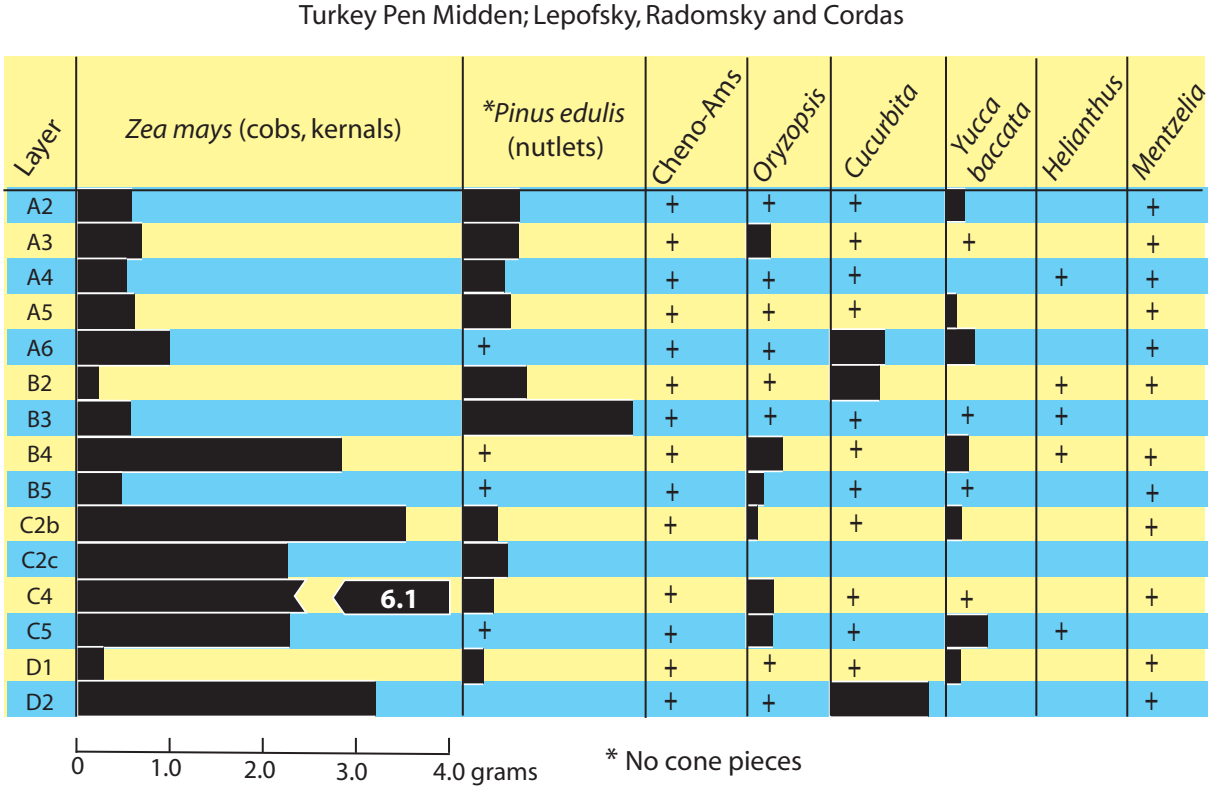


Figure 3: Midden Analyses

3. Midden Analyses

Recent midden analyses at Turkey Pen support Lepofsky's (1984) we summarized early (Matson 1991; Matson and Chisholm 1991). Studies by Radomski (1999) and Cordas (2000) were carried out on samples originally pulled for study by Lepofsky (1984). All three analyses are combined here (Figure 3) in a summary fashion, providing a total of fifteen samples compared with the original 7 examined by Lepofsky (1984). Note that pinyon is represented only by nutlet fragments.

The most important findings of this much-extended sampling are the dominant presence of maize remains, the nearly universal presence of pinyon nut shells and the nearly constant presence of squash, which is only occasionally recognized in coprolites (3 of 28 in Aasen's 1984 study). It is also striking how

the upper level samples appear to have nearly as much pinyon nut remains as maize (which is also evident in Aasen's coprolite study). Whether or not this is a reflection of actual importance in these layers, or a result of the high density nutshells preserving better, there does appear to be relatively equal weights of these two important resources in the upper layers of the midden according to these analyses. *Yucca baccata* is also abundant in the midden analyses (and not usually identified in coprolite analysis) and is another CAM pathway plant.

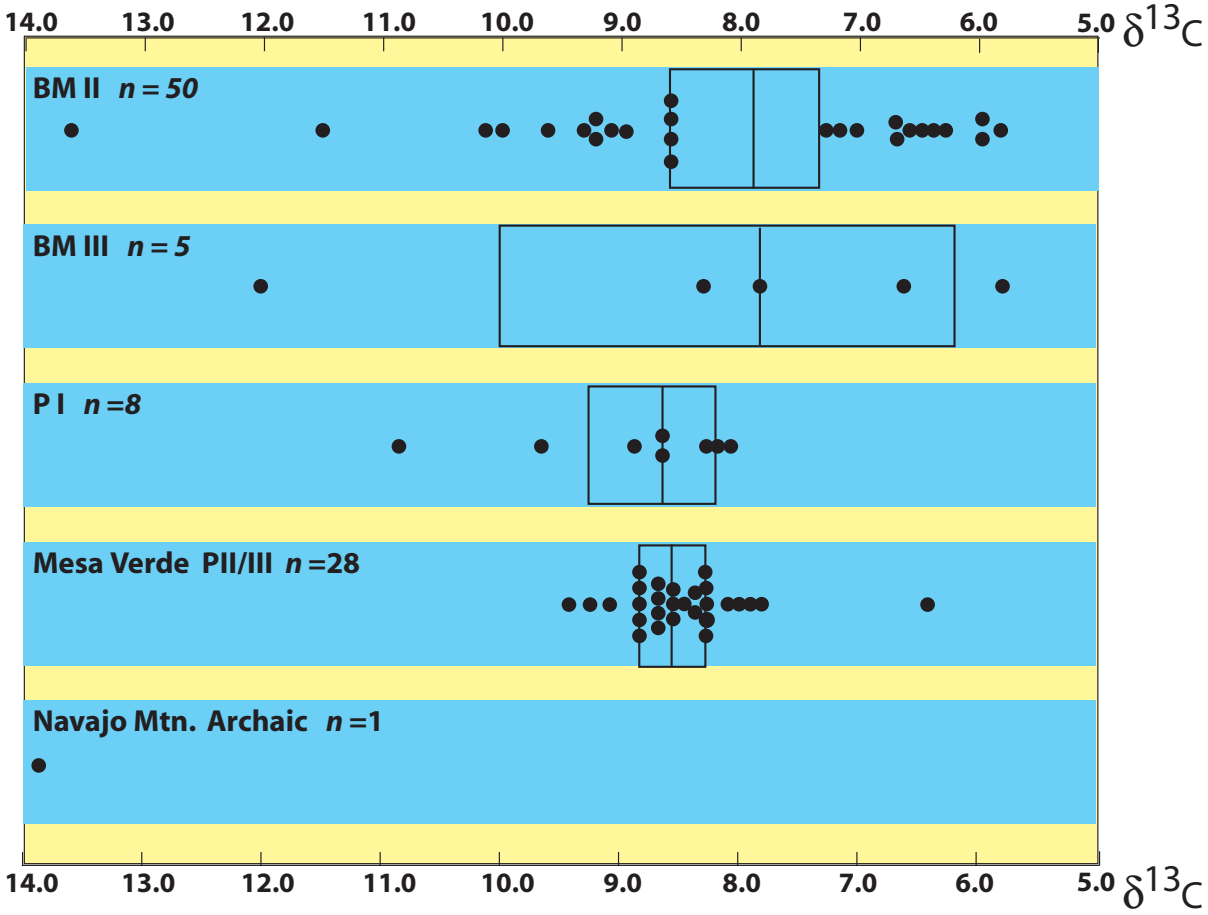


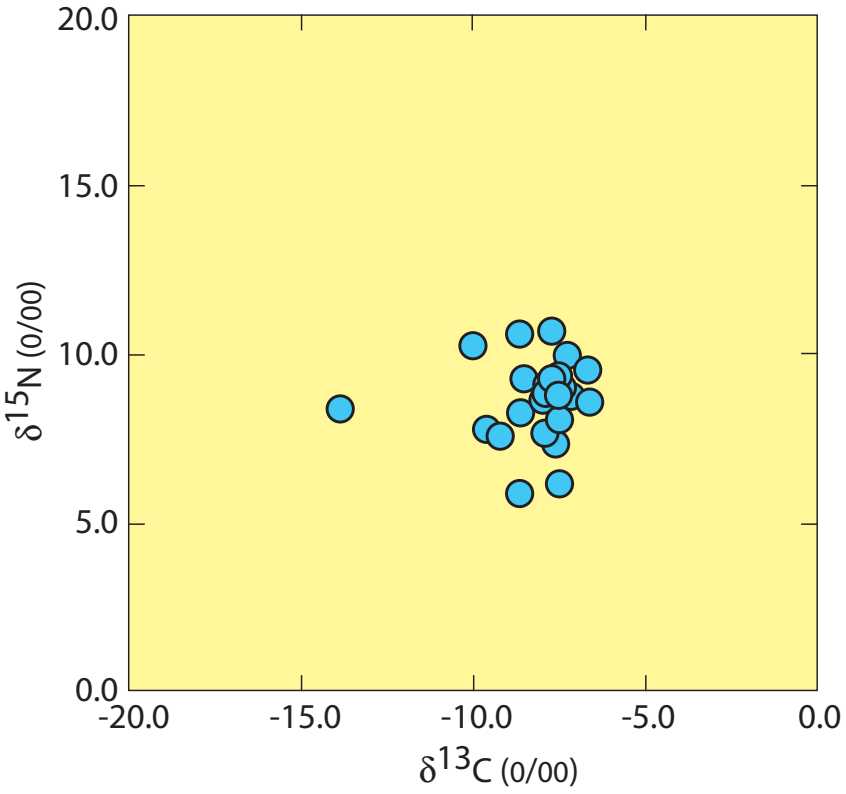
Figure 4: Carbon Isotope Ratios on the Colorado Plateau

4. Stable Isotope Analyses

Our analyses reported earlier (Chisholm and Matson 1994; Matson 1991, 1994; Matson and Chisholm 1991) indicate clearly that maize was an important constituent of Basketmaker II diet. Values for the BM II individuals sampled differ from the one Archaic Period (Navajo Mountain) sample analyzed. Similar results have been reported by a number of other studies (Table, Figure 4) for Basketmaker and subsequent periods in the Anasazi region. The interesting fact here is that there appears to be considerable uniformity across the Anasazi region during Basketmaker II and into subsequent periods, while Archaic Period samples are clearly devoid of a noticeable maize isotopic signature. For these samples that provided nitrogen data (Table, Figure 5) it is also evident that maize, not filtered through an herbivore (wild turkey?) but ingested directly by humans provided a considerable amount of the protein in peoples' diets. Studies in adjacent areas, such as the Steinaker Gap, Antelope Creek and Southern Jornado areas, show similar results with

people from similar times periods as BM II and later being high maize consumers and Archaic people using little if any maize, although the presence of Cheno-Ams in their diets would give a low C4 signature.

Figure 5: Average Stable Isotope Values for Sites



Conclusion

Through coprolite, midden and stable isotopic analyses it is clear that maize was an important constituent of human diets, from the beginning of Basketmaker II onward in time, throughout the Colorado Plateau and immediately surrounding regions, with minimal spatial differences. Figure 4 suggests that BM II actually had a higher consumption of maize than later periods. Is this dues to the absence of domesticated beans, and / or the presence of abundant farming areas for the first agricultural people? Clearly, questions remain about BM II diet, but not about the importance of maize in their diets.

Table: Site Averaged Data

LOCATION	TIME PERIOD	DATES	∂13C	∂15N	n =	REFERENCE
Navajo Mtn.	Archaic	3000 BC	-13.9	8.4	1	Matson & Chisholm 1991
Kanab	BM II	200 BC-AD70	-7.6	8.8	2	Zweifel et al 2006
Virgin Anasazi	BM II	AD 1 - 400	-8.0 ± 0.2	8.8 ± 0.7	4	Martin 1999
Black Mesa	BM II	AD 100 - 200	-7.6 ± ?	7.4 ± ?	2	Martin 1991
Cedar Mesa	BM II	AD 1 - 400	-7.7 ± 0.19	10.0	4	Matson & Chisholm 1991
Oldman Cave	BM II	AD 200 - 400	-9.1	9.9	2	Chisholm & Matson 1994
Talus Village, Durango	BM II	AD 83 - 423	-7.9 ± 0.2	7.7 ± 0.2	4	Coltrain et al 2006
Talus Village, Durango	BM II	BC 760 - 202	-9.6	7.8	2	Coltrain et al 2006
Marsh Pass, AZ	BM II	BC 499-AD 53	-8.0 ± 1.7	7.7 ± 1.3	31	Coltrain et al nd
Virgin Anasazi	BM III	AD 400 - 700	-10.0 ± 2.9	10.3 ± 2.3	2	Martin 1999
Mesa Verde	BM III	AD 400 - 700	-8.3		1	Decker & Tieszen 1988
La Plata R	BM III - P II	AD 441 - 1021	-6.6 ± 0.4	8.6 ± 0.5	10	Coltrain et al 2006
Marsh Pass, AZ	BM III	AD560 - 769	-6.3	8.1	2	Coltrain et al nd
Chaco Canyon	BM III - P II	AD 690 - 1208	-7.5 ± 1.0	12.1 ± 1.5	4	Coltrain et al nd
Virgin Anasazi	P I	AD 700 - 900	-9.3 ± 1.4	7.6	2	Martin 1999
Black Mesa	P I	AD 750 - 950	-8.6 ± ?	5.9 ± ?	5	Martin 1991
Mesa Verde	P I	AD 700 - 900	-8.5 ± 0.4		6	Decker & Tieszen 1988
Virgin Anasazi	P II Early	AD 900 - 1050	-8.6 ± 0.9	8.3 ± 0.3	6	Martin 1999
Virgin Anasazi	P II - III	AD 1050 - 1250	-7.5 ± 1.0	8.1 ± 1.2	3	Martin 1999
Black Mesa	P II	AD 1000 - 1150	-7.5 ± ?	6.2 ± ?	5	Martin 1991
Mesa Verde	P II	AD 1000 - 1100	-8.6 ± 0.3		9	Decker & Tieszen 1988
Mesa Verde	P II - III	AD 1000 - 1280	-8.4 ± 0.7		5	Decker & Tieszen 1988
Cedar Mesa	P II - III	AD 1060 - 1270	-7.3 ± 0.15	10.7	3	Matson & Chisholm 1991
15 mi radius of Cortez	P II - III	AD 900 - 1285	-7.1 ± 0.3	8.8 ± 0.5	25	Coltrain et al 2006
15 mi radius of Cortez	P II - III	AD 900 - 1285	-5.7	11.6	1	Coltrain et al 2006
Marsh Pass, AZ	P III	AD 1022-1293	-7.0 ± 0.5	7.8 ± 0.8	4	Coltrain et al nd
Mancos Canyon, Mesa Verde	P III	AD 1150 0 1280	-8.3 ± 0.4		10	Decker & Tieszen 1988
Sand Canyon Pueblo (Cortez)	P III Late	AD 1250 - 1280	-6.7 ± 0.4	9.6 ± 0.3	10	Katzenberg 1999
Village Testing Program (Cortez)	P III	AD 1150 - 1280	-7.4 ± 0.6	9.1 ± 0.8	8	Katzenberg 1999
Pecos Pueblo	P III	AD 1200-1300	-7.5 ± 0.3	9.1 ± 0.7	4/7	Spielmann et al 1990
Sierra Blanca	Lincoln Phase	AD 1200-1400	-8.4 ± 0.6		20	Katzenberg and Kelley 1991
Grasshopper Pueblo	P IV	AD 1275 - 1400	-9.09 ± 1.13		53	Ezzo 1991 (PhD)
Pecos Pueblo	PP I (P IV)	AD 1300-1400	-7.7 ± 0.4	9.3 ± 0.8	6/8	Spielmann et al 1990
Pecos Pueblo	PP II (P IV)	AD 1400-1450	-7.5 ± 0.3	8.9 ± 0.6	4/7	Spielmann et al 1990
Pecos Pueblo	PP III (P IV)	AD 1450-1550	-7.7 ± 0.3	8.8 ± 0.7	47	Spielmann et al 1990
Pecos Pueblo	PP IV (P V)	AD 1550-1600	-7.8 ± 0.5	9.0 ± 0.7	6/7	Spielmann et al 1990
Pecos Pueblo	PP V (P V)	AD 1600-1675	-7.6 ± 0.3	9.2 ± 0.7	4/8	Spielmann et al 1990
Pecos Pueblo	PP VI (P V)	post AD 1675	-8.5 ± 0.7	9.3 ± 0.5	8/5	Spielmann et al 1990
SITES OFF THE COLORADO PLATEAU						
Southern Jornada	Archaic	1500 BC	-16.5		1	Macneish & Marino 1993
Great Salt L Area	Fremont	AD 600 - 1250	-8.6 ± 0.8	10.6 ± 0.5	57	Coltrain & Stafford 1999
Steinaker Gap	BM II / Fremont	~ AD 240-250	-11.6		2	Coltrain 1996
Southern Jornada	Mesilla	AD 300-1100	-9.5		1	Macneish & Marino 1993
Southern Jornada	El Paso	AD 1200-1400	-7.8 ± 0.48		6	Macneish & Marino 1993
Antelope Creek, Texas		AD 1200-1500	-8.0 ± 1.0		25	Habicht-Mauch et al 1994
Stillwater Marsh, Nevada	Archaic	300 BC-AD 1600	-17.1 ± 1.1	11.4 ± 1.5	39	Schoeninger 1999

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