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Carbon and nitrogen stable isotope analysis of hunter–gatherers from the Coleman site, a Late Prehistoric cemetery in Central Texas

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ABSTRACT

We report on a stable isotopic analysis of 17 hunter–gatherer burials from the Coleman site (41BX568), a Late Prehistoric Toyah Interval (700–350 years BP) occupation in Texas. Prior to our analysis, isotopic research on Toyah populations in Central Texas was represented by a single burial at site 41BX677. That burial showed an isotopic pattern suggestive of a diet heavily focused on CAM/C_4 plants and C_4 fauna. Coleman burials show a different pattern. While interpretations are complicated by high variability in the isotopic signatures of children and by differences in male and female diets possibly related to mate exchange, the 11 adult and adolescent burials at Coleman show a diet focused on C_3 fauna and the use of both C_3 and CAM/C_4 plants. The moderate CAM/C_4 plant use is a radical departure from a trend of increasing C_3 plant use that characterized hunter–gatherers in this region for at least 6200 years prior to the start of the Toyah Interval. Protein sources among Coleman adults probably centered on deer, but also included high nitrogen ($\delta^{15}N$) animals, such as fish. Males seem to have differential access to these high nitrogen sources. Two different isotopic patterns, one reflecting a focus on C_3 fauna and moderate use of CAM/C_4 plants, and a second reflecting C_4 fauna and extensive use of CAM/C_4 plants, are represented during Toyah. While interpretations are complicated by small sample sizes, these two patterns could simply reflect temporal differences, different acquisition strategies based on availability, or hint at different subsistence strategies. It may also be the case that the 41BX677 individual represents an immigrant into the Central Texas region, one with a different isotopic history.

1. Introduction

Much of prehistoric Texas maintained hunter–gatherer adaptations until historic contact (see Johnson and Hard, 2008). Where we have adequate data, the ability to sustain a hunter–gatherer subsistence base appears to be related to humans intensifying on locally available plants and aquatic resources. For example, coprolites (e.g., Riley, 2012; Sobolik, 1988), floral and faunal remains (e.g., Dering, 1979; Lord, 1984), and bone isotope studies (e.g., Huebner, 1991) from dry shelters in the Lower Pecos region of Texas (Fig. 1) suggest the exploitation of seasonally available resources and provide evidence of the intensification on aquatic resources (e.g., Jurgens, 2008) and succulents (e.g., Dering, 1999). Recent isotopic work on human burials by Hard and Katzenberg (2011) suggests that intensive use of marine and freshwater resources supported large populations (e.g., Ricklis, 2004) in the Texas Coastal and Riverine Zones (Fig. 1). Detailed patterns of hunter–gatherer subsistence are not well documented in South Texas (Fig. 1) because of a dearth of investigation (Hester, 2004; Hester et al., 1989). More work has been done in Central Texas (Fig. 1), but we often lack high quality data sets (see Collins, 2004) that can be tied directly to diet (e.g., coprolites). Well-preserved floral and faunal assemblages are rare, and subsistence details are often inferred by indirect methods such as changes in feature frequency and type (e.g., Black and Creel, 1997; Thoms, 2009), and technological shifts (e.g., Tomka, 2001).

Researchers in Central Texas have not vigorously pursued the isotopic study of human remains, a source of direct subsistence data. Here we review extant isotopic data on populations in the Central Texas region. Burials dating to the prehistoric period with collagen carbon and nitrogen data, as well as carbon data isolated in carbonate from bone apatite, are limited. There are

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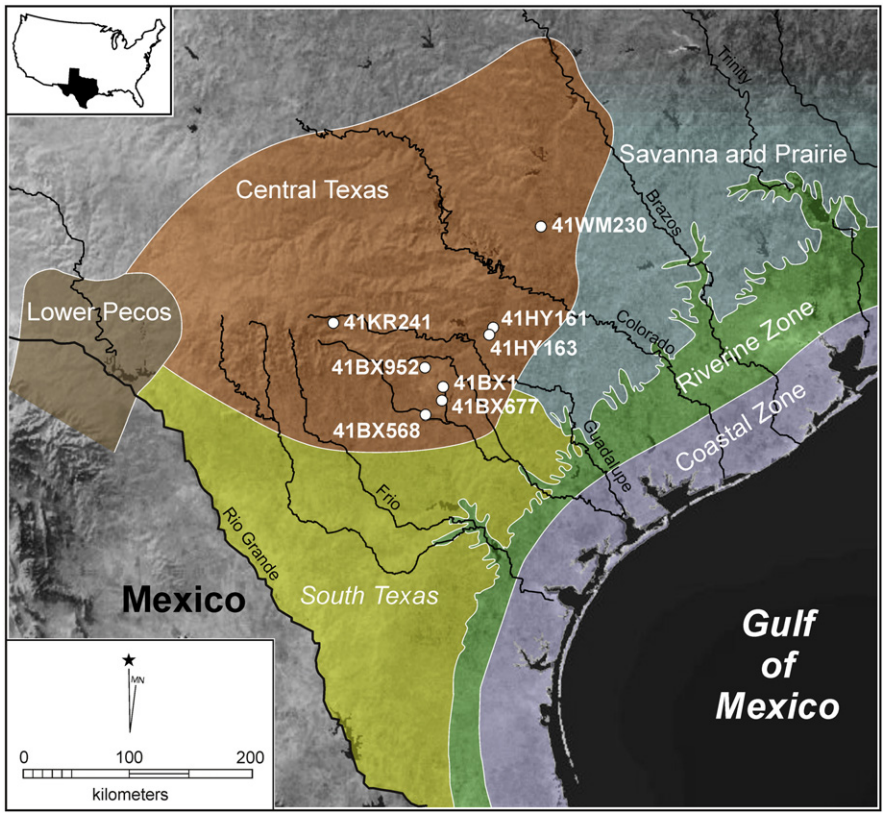

Fig. 1. Map of the study area showing archaeological/ecological regions. Also shown are the seven Central Texas sites with dated human collagen and apatite isotopic data discussed in Section 1.2 (see also Table 1), as well as the location of the Coleman site (41BX568). The Coastal and Riverine Zones are from Hard and Katzenberg (2011). Other distinctions are based primarily on regional summaries in Perttula (2004).

reports on five burials with isotopic data for the Early Archaic (8900–6000 years BP), four from the Middle Archaic (6000–4000 years BP), and 17 interments for the Late Archaic (4000–1200 years BP) period. The Late Prehistoric period, divided into the Austin (1200–700 years BP) and Toyah (700–350 years BP) Intervals (Collins, 2004; Turner et al., 2011), consists of 15 burials with isotopic data, but 13 of these are from the earlier Austin Interval.

Following our review, we present an isotopic analysis of 17 interments using carbon and nitrogen from bone collagen and carbon from bone apatite. The samples were recovered at the Coleman site (41BX568; Potter et al., 2005) in Central Texas (Fig. 1). Radiocarbon dates on collagen from seven of these burials show a restricted time range (656–506 years BP) in the Toyah Interval. Excluding six pre-adolescent interments that had different diets, the 11 adult and adolescent Coleman individuals (6 males, 4 females, 1 undetermined) suggest an increasing dependence on C_4 and/or CAM plant resources, which is consistent with substantial use of plants such as succulents. These results reflect a radical divergence from a trend of increasing C_3 dependence that characterized the Central Texas region for at least 6200 years (ca. 6900–700 years BP). Collagen carbon and nitrogen values suggest the possibility that white-tailed deer may have been a significant protein source for the Coleman population, though there are hints of the consumption of other animals with high $\delta^{15}N$ values, such as fish, present in selected burials. While sample sizes are small, males dominate these cases of elevated $\delta^{15}N$. There is no evidence in the Coleman isotopic patterns for a dependence on bison. Most researchers suggest these animals returned to the region in large numbers around 700 years BP after an absence of several centuries (Collins, 2004; Dillehay, 1974) and that these animals were an important food (e.g., Johnson, 1994; Shafer, 1977). The Coleman samples also diverge from the pattern shown by the previously reported Central Texas Toyah Interval isotopic sample that hints at a focus on bison (Cargill, 1996). The isotopic data suggest that intensification in this case is complex, with the possibility that at least two different subsistence systems, focused on different resources, may have been in place during the Toyah Interval. Alternatively, this may reflect previously unrecognized temporal patterns within the Toyah Interval, or may reflect isotopic signatures from outside the Central Texas region, with individuals migrating into the area and retaining some component of their isotopic signature of origin.

1.1. Stable carbon and nitrogen isotope analysis and paleodiet

Stable isotope research relies on established relationships in chemistry and biology (see Ehleringer, 1991; Sharp, 1997). Applications to prehistoric human populations rely on the observations that while bone turnover rate varies with age, sex, and type of bone (see Hedges et al., 2007; Parfitt, 2002), isotopic ratios of carbon and nitrogen in human bone reflect the average isotopic values of these elements in an individual's diet over the last decades of life (Mays, 1998; Tykot, 2004). Stable isotopic ratios have been widely used for paleodietary reconstructions, and overviews of the methods, applications, and potential pitfalls can be found in a variety of sources (e.g., Ambrose, 1993; Katzenberg, 2008; Kellner and Schoeninger, 2007; Krueger and Sullivan, 1984; Lee-Thorp, 2008; Schwarcz, 2000; van der Merwe, 1992).