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OSL ages of the Clovis, Late Paleoindian, and Archaic components at Area 15 of the Gault Site, Central Texas, U.S.A.

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ABSTRACT

The Gault Site, Texas, U.S.A., affords a near-complete regional prehistoric sequence from an ~2 m-thick alluvial sedimentary interval. Age estimates on Clovis, Late Paleoindian, and Archaic components were obtained using optically stimulated luminescence (OSL) dating of silt-sized quartz grains. The luminescence characteristics of the quartz are favorable, showing normal equivalent dose distributions and no evidence of incomplete zeroing. The artifacts span Clovis to Archaic forms, and their ages are generally in excellent agreement with independent radiocarbon ages from five other Texas sites. The mean OSL age of the Clovis deposits of 12,900 ± 700 a agrees with the known Clovis ages from Central Texas and a generalized model that places the Clovis occupation of Central Texas between ~13,600 to 13,000 cal BP (Holliday, 2000). This study indicates that accurate age determinations can be made using OSL on silt-sized quartz grains at Gault.

1. Introduction

Excavations at the Gault Site (Fig. 1) have yielded a near-complete regional prehistoric sequence that includes a major Clovis settlement/workshop. The site is located in Central Texas, U.S.A., in southwestern Bell County, approximately 70 km north of Austin (N Lat 30.892246, W Lon 97.709739). It is situated on Buttermilk Creek, a first and second-order stream valley with small but reliable springs flowing 5.5 to 6.0 m below the surrounding surface of the Edwards Plateau, a Cretaceous limestone upland. There are abundant high quality chert outcrops at and near the site. The area conforms to the Balcones Canyonlands ecotype as found near the southern and eastern margins of the Edwards Plateau (Diamond et al., 1987), and therefore, was an excellent habitat for hunting and gathering groups. Every defined interval in the regional prehistoric chronology of Central Texas is represented by time-diagnostic artifacts at the Gault Site, prima facie evidence that the locality has seldom failed to meet human needs (Collins, 2007).

An extensive and dense Holocene anthropogenic deposit that is regionally categorized as a burned rock midden (Collins, 2007; Thoms, 2009) characterizes the upper deposits across most of the site area and is up to 2 m thick in places (Collins, 2002). Cultural materials in the midden are diagnostic of the Early, Middle, and Late Archaic as well as the Late Prehistoric periods in the archaeological chronology of Central Texas (Collins, 2002), spanning ages from ~9,000 to 500 BP (Collins, 2004). Across most of the site, nearly a century of looting has destroyed the integrity of the midden, but the underlying predominantly fluvial strata were left intact (Collins, 2002). These intact fluvial deposits host a stratified sequence of Paleoindian components.

Intermittent investigations between 1991 and 2013 include 15 block excavations containing stratified prehistoric cultural components. The Gault project is focused on investigating the early part of the local chronology (notably Clovis and older-than Clovis intervals). The analytical efforts of this investigation are continuing, and some of the current archaeological interpretations are subject to future refinements. Early Paleoindian lithic components were encountered in 9 of the excavation blocks (c.f. Collins, 2007: Fig. 4.2). Two of these blocks, Areas 12 and 15, have also yielded evidence of cultural components predating Clovis. Early components recognized on the basis of time-diagnostic artifacts in Areas 12 and 15 include Clovis, Folsom, and Dalton; these are overlain by strata containing several early, regionally-defined, diagnostic artifact forms. The focus of this paper is on the dating of the Clovis and post-Clovis cultural components in Area 15.

In this work we use various abbreviations for reporting radiocarbon and luminescence ages. For radiocarbon ages, we have followed Stuiver and Reimer (1998) and Anonymous (2005), where 'BP' means explicitly "conventional radiocarbon years before AD 1950", whereas 'cal BP' means "calibrated radiocarbon years." For luminescence dating we use

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'a' (annum *i.e.* years ago), which gives the estimated time interval between deposition and the time of sample measurement.

1.1. Regional archaeology and chronology

Gault affords an unusually complete record of the local Texas prehistory, extending from the Late Pleistocene to the time of early contacts between Europeans and Native Americans. A moderately well-constrained, radiocarbon-based regional cultural chronology extending from ~9,000 to 500 cal BP is in use at Gault for the Archaic, Late Prehistoric, and Historic periods (Collins, 2004; Johnson and Goode, 1994; Prewitt, 1981; 1985). Time-diagnostic artifact types recovered in our excavations provide the basic chronological framework employed in this study (Fig. 2). The Gault chronology extends back in time into the pre-Archaic and helps define a series of Paleoindian intervals some of which are regional (identified by projectile point types Wilson, St. Mary's Hall, Golondrina-Barber, and Texas Angostura, collectively spanning the interval, ~11,200 to 9,400 cal BP) and others of which are regional expressions of cultural manifestations of much wider geographic distributions (with diagnostic types Clovis, Folsom, and Dalton, spanning the interval, ~13,500 to 11,700 cal BP). The chronological framework employed in this report for the Paleoindian intervals draws on the general regional chronology (Collins, 2004), a Paleoindian-specific synopsis for Texas (Bousman et al., 2004), published dating results from five specific sites, and selected studies from the broader expanse of North America (Supplementary Tables 2–7). Radiocarbon as well as luminescence ages are included in this pre-existing framework. The overall working chronology in use at Gault excavation Area 15 is derived and integrated from these sources for the Clovis component and is summarized in Supplementary Tables 2–5.

A generalized Clovis radiocarbon age range on the southern plains from ~13,500 to 13,000 cal BP has been derived by vetting numerous radiocarbon ages run over the past five decades from sites widely dispersed across the United States (Holliday, 2000). Subsequently, Waters and Stafford (2007: 1123-1124) have proposed a significantly constrained age range of ~13,100 to 12,900 cal BP (11,050 to 10,800 BP), but this has been criticized as it "lacks solid evidence or empirical support" (Haynes et al., 2007). Previous dating of Clovis components in Texas provides a further basis for evaluating the age of Clovis in Area 15 at the Gault Site. This regional data set (Supplementary Tables 2-5) includes radiocarbon as well as luminescence ages for Clovis from a total of five sites (Aubrey, Pavo Real, Debra L. Friedkin, and Gault Area 8); there is also relevant geochronological evidence from the Wilson-Leonard Site (see Fig. 1).

Ages of 11,590 ± 93 and 11,542 ± 111 BP (Ferring, 2001) on charcoal from the Clovis component at the Aubrey Site (Fig. 1, #2) in north Central Texas produce a calibrated range of 13,595 to 13,220 (2σ) and 13,576 to 13,143 (2σ) cal BP respectively (IntCal 13, OxCal 4.2, Bronk Ramsey, 2009). Waters and Stafford (2007) do not include this early date or those from Pavo Real (Fig. 1, #3) and Wilson-Leonard (Fig. 1, #5) sites in their analysis. The small assemblage of cultural materials from the lowest stratigraphic levels at the Wilson-Leonard Site, 30 km south of the Gault Site, has technological affinities with Clovis. An age estimate of ~ 13,500 cal BP has been extrapolated from overlying radiocarbon dates as the Clovis deposits yielded no datable material (Collins, 1998: 140–145; 280–281). This is another regional indication that Clovis may predate ~13,100 cal BP as suggested by Waters and Stafford (2007).

At the Pavo Real site (Fig. 1, #3) in south Central Texas, excavations by personnel of the Texas State Department of Highways and Public Transportation in 1979–80 recovered early cultural materials from strata 4 through 9, as follows: stratum 4, mixed Archaic and Paleoindian; stratum 5, mixed Clovis and Folsom; stratum 6, non-diagnostic; stratum 7, probably Clovis; stratum 8, probably Clovis; and stratum 9, unassigned but possibly pre-Clovis (Collins, 2003). Optically stimulated luminescence (OSL) ages were obtained for strata 5, 7, and 9 by sampling intact soil monoliths that preserved samples of this stratigraphic sequence (Supplementary Table 5). Three ages from stratum 5 range from 12,690 ± 700 a to 11,160 ± 640 a (average ~ 11,930 a), an age that is consistent with the interpretation that Clovis and Folsom artifacts resting on a deflated surface were buried in post-Folsom flood events (Collins, 2003). Two OSL ages from stratum 7 are 13,800 ± 800 a and 12,940 ± 800 a which are consistent with the interpretation that non-diagnostic artifacts in zones 7 and 8 are likely Clovis (Collins, 2003). A single age of 15,770 ± 890 a for zone 9 may indicate that the very small assemblage of cultural flakes from that stratum predate Clovis (Collins, 2003).

An intensive program of luminescence dating (infrared stimulated luminescence [IRSL] on fine-grained feldspar) was employed at the Debra L. Friedkin Site (Fig. 1, #4) some 250 m downstream of the Gault Site by Waters and colleagues during excavations in 2006–2009. Results appear in a brief note (Waters et al., 2011a) and are clarified by Jennings (2012). Five luminescence ages for the Folsom interval, 2.5 cm thick, and two ages for the Clovis interval, 2.5 cm thick are reported (Supplementary Table 4). Ages associated with Folsom range from 11,870 ± 760 to 12,925 ± 845 a, (average ~ 12,300 a), and are reasonably close to the generally accepted range of ~12,850 to ~11,900 cal BP for this culture (c.f. Meltzer, 2006: 1). Clovis ages, ranging from 13,090 ± 830 to 13,780 ± 885 a (averaging *ca.* 13,400 a), indicate an age in agreement with the commonly expected range of ~13,450 to ~12,780 BP (c.f. Meltzer, 2009: 254).

Stafford (1998) employed 96 radiocarbon determinations on charcoal, charred hyacinth bulbs, bone, shell, sediment, and soil in developing a chronostratigraphy for the Wilson-Leonard Site, located 40 km south of the Gault Site in a similar, Balcones-Canyonlands setting (Collins and Mear, 1998). Cultural materials at Wilson-Leonard reside in a sequence of fluvial, pond, and colluvial deposits approaching 7 m in total thickness with an overall time range of >14,000 years ago to the present. The two earliest cultural components at Wilson-Leonard were inferred by Collins (1998: 123-159) on the basis of lithic production technology to be of Clovis and Folsom affinities. Neither of these constitutes a robust archaeological assemblage because sample sizes are small and no completely unambiguous diagnostic artifacts were found (Collins, 1998: 123-159). Furthermore, the geologic contexts are relatively complex and include indications of turbation. For these reasons, along with the varying results from the array of materials dated, Stafford (1998: 1039-1063) presents an inferred chronostratigraphy for the site based on multiple lines of evidence. He

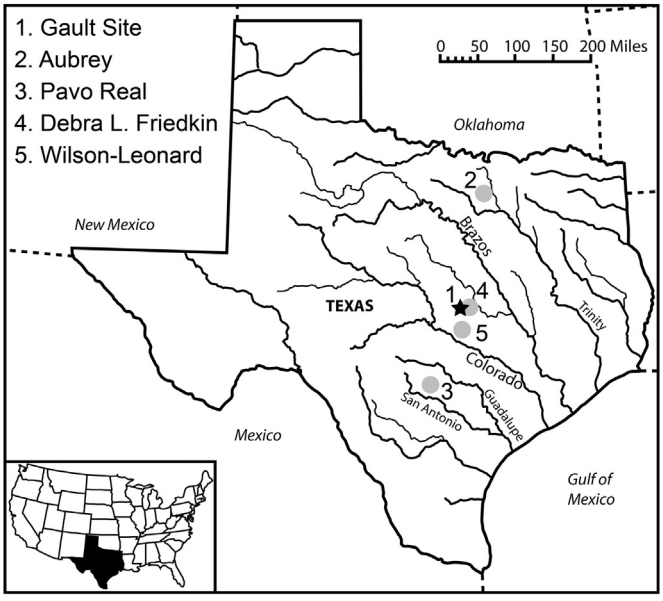

Fig. 1. Location of the Gault Site (1) and the major Clovis sites discussed in the text.