Tar Trap: No evidence of domestic dog burial with "La Brea Woman"

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We radiocarbon dated the domestic dog found associated with La Brea Woman at the Rancho La Brea tar pits (Los Angeles, California) to determine the validity of this human-dog connection. The domestic dog yielded a ^{14}C age of 3,125 ± 25 BP (calibrated date of 3,250 – 3,400 cal BP) and La Brea Woman had a re-dated age of 9,080 ± 15 BP (calibrated date of 10,220 – 10,250 cal BP). This ~7 kyr offset dispels the hypothesis this was an intentional and ceremonial human-dog burial.

Hancock Park in central Los Angeles, California, is the location of the Rancho La Brea (RLB) tar pits, a set of asphalt seeps that have yielded what is currently the richest collection of North American terrestrial plant and animal remains spanning the last ~50 kyr (Stock and Harris, 1992; Friscia et al., 2008). In 1914, excavations in Pit 10 recovered the only human remains from RLB (Merriam, 1914; Wyman, 1915), a partial female skeleton ("La Brea Woman"), with an estimated height of 144 cm, and likely age at death of 17-18 years (Bromage and Shermis, 1981; Kennedy, 1989). Early radiocarbon measurements on bone amino acids from her femur yielded a date of 9,000 ± 80 BP (UCLA-1292BB), making her remains one of the oldest known human skeletons discovered in North America (Berger et al., 1971).

Speculation over how La Brea Woman came to be entombed in the asphalt deposits includes theories of accidental entrapment (e.g. Hrdlička, 1918; Heizer, 1943), Los Angeles' first homicide (e.g. Hrdlička, 1918; Berger et al. 1971; Bromage and Shermis, 1981), and intentional ceremonial reburial (Reynolds, 1985). Remains of a small canid found near her were identified as those of an aboriginal domestic dog (*Canis familiaris*) similar to the small slender-nosed variety known as Techichi, common in the American Southwest (Reynolds, 1985). The incompleteness of the human skeleton and its proximity to scattered bone and shell artifacts, and in particular to the remains of the dog, were cited by Reynolds (1985) as evidence for a formal ceremonial reburial of La Brea Woman. Ethnographic and archaeological data indicate that several Native American groups would inter a canid with a human burial, possibly to guide the spirit of the deceased in the afterlife (e.g. Driver, 1969; Bean and Smith, 1978); and reburial or secondary interment of larger skeletal elements was a common practice in southern California (Reynolds, 1985). However, given the skeleton was dated to ~9,000 BP, the relevance of the ethnographic comparisons is questionable in light of the multiple mid- and late Holocene population movements in the region as suggested by the archaeological data. Thus, there is a strong possibility of discontinuity in the burial practices between contact period ethnographically documented groups and terminal Pleistocene/early Holocene societies inhabiting the region (Arnold et al., 2004; Arnold and Walsh, 2010).

The reburial interpretation has become widely accepted as part of the popular narrative of La Brea Woman. The disarticulated partial skeleton was recovered from depths of 2.0 – 2.7 m

(Wyman, 1915) and the fragmentary cranium and mandible of the dog was distributed between 1.2 – 1.7 m (Reynolds, 1985). However, the RLB pits are well known for their lack of well-defined stratigraphic context because movement of the viscous asphaltic matrix causes skeletons to disarticulate and relocate within the deposits over time (Woodard and Marcus, 1973; Shaw and Quinn, 1986; Friscia et al., 2008). Therefore, while the lack of any direct association between the dog and human remains raises doubts about the reburial hypothesis, it does not necessarily refute it. The age of La Brea Woman is known, and the radiocarbon dating of the canid to an age of ~9,000 BP would establish it as one of the earliest domestic dogs in North America (Morey and Wiant, 1992; Tito et al., 2011). Here we test the domestic dog – human burial connection at RLB by using accelerator mass spectrometry (AMS) to directly date bone from the mandible of the domestic dog and the ulna of the human skeleton. Stable isotope ratios of carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), and sulfur ($\delta^{34}S$) are also reported (Lee-Thorp, 2008).

Domestic dog and La Brea Woman bone pieces (≈150 mg) were obtained using a handheld Dremel rotary tool at the La Brea Tar Pits and Museum and collagen was isolated at the UC Irvine, Keck Carbon Cycle AMS Laboratory using the procedure developed by Fuller et al. (2014) for asphalt impregnated bones at RLB. Since there was some possibility that a preservative (possibly glyptal – an alkyd resin) was used to conserve the La Brea Woman skeleton, two aliquots were dated, with one receiving an initial sonication treatment with acetone (2 x 1 hr), then water (1 hr), all at ~ 45°C. This sample is labeled "acetone" in Table 1 and was then processed using the standard protocol. Extracted collagen was very well preserved: fluffy and white, with yields >1% and with atomic C:N of 3.3, indications it was free of petroleum contamination and suitable for isotopic analysis and AMS radiocarbon dating. All radiocarbon dates were calibrated using the IntCal13 data (Reimer et al. 2013) and the Calib 7.0 program (http://calib.qub.ac.uk/calib/) operated by the Queen's University, Belfast.

Stable isotope ratio and ^{14}C measurements are reported in Table 1. La Brea Woman had an exclusive C_3 terrestrial diet with no evidence of marine protein consumption ($\delta^{13}C$ = –20.0‰). This is significant given the site's proximity to the coast (Figure 1) and the documented maritime capabilities of the Paleoindians in the area (e.g. Erlandson et al., 2011), who would have had ready access to the rich marine resources along the southern California coast. The $\delta^{15}N$ (7.4‰)

and $\delta^{34}S$ (2.7‰) results are low, but it is impossible to determine a more specific diet without additional isotopic measurements from other species that date to the early Holocene at RLB, and this is an area of active research. However, contemporary Early Mesolithic humans from Europe had high animal protein diets and display similar low $\delta^{15}N$ values, suggesting these could be characteristic of the climate and environment of the Northern Hemisphere during this period (e.g. Schulting, 2005; Schulting, 2008). The domestic dog had a similar diet that was predominately C_3 terrestrial ($\delta^{13}C$ = –18.9‰) with a low $\delta^{15}N$ value (6.8‰) and as for the human remains, additional studies are needed to determine the paleodiet with more specificity.

La Brea Woman was re-dated twice, and the mean age (9,080 ± 15 BP) agrees with the original result of 9,000 ± 80 BP (UCLA-1292BB; Berger et al., 1971). The new calibrated date corresponds to an age range of 10,220 – 10,250 cal BP (CALIB 7.1 using IntCal13 data, 2 sigma range), and confirms the presumed early Holocene antiquity of this skeleton. Currently, there are nine New World human remains with published ^{14}C ages (measured directly on the human skeletal materials) that are older than La Brea Woman although concerns have been expressed regarding the accuracy of the ^{14}C measurements on the two oldest skeletal samples (Taylor and Bar-Yosef 2014: Section 7.3.6, Table 7.1). In contrast, the domestic dog produced an age of 3,125 ± 25 BP or a calibrated date of 3,250 – 3,400 cal BP (CALIB 7.1 using IntCal13 data, 2 sigma range). This ~7 kyr offset underscores the need to directly ^{14}C date objects from RLB rather than relying on a single date or a few dates to determine ages of multiple specimens from a deposit. It also shows conclusively that whatever the circumstances were that led to the presence of La Brea Woman in Pit 10 at RLB, they did not include the intentional associated burial of a domestic dog.

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Table 1 – Stable isotope ratio measurements and ^{14}C ages for the La Brea Woman and associated domestic dog.

UC Irvine Accelerator Mass Spectrometry #	La Brea Tar Pits and Museum Catalog #	Species	Pit	Collagen Fraction Analyzed†	Collagen Yield (%)†	$\delta^{13}C$ (‰)†	$\delta^{15}N$ (‰)†	$\delta^{34}S$ (‰)‡	%C†	%N†	%S‡	Atomic C:N†	Atomic C:S†	Atomic N:S‡	Uncalibrated ^{14}C Age BP†	+/-	Calibrated ^{14}C Age Range BP (2 sigma)*
127072	LACMHC§ 1323	*Homo sapiens*	10	3-30 kDa	4.3	-20.0	7.4	2.7	42.6	15	0.26	3.3	437	156	9075	30	10200 - 10250
127086	LACMHC§ 1323	*Homo sapiens*	10	3-30 kDa (Acetone)	3.1	-20.0	7.4	-	43.5	15.2	-	3.3	-	-	9085	35	10190 - 10280
Mean Results for La Brea Woman						**-20.0**	**7.4**	**2.7**	**43.1**	**15.1**	**0.26**	**3.3**	**437**	**156**	**9080**	**15**	**10220 – 10250**
133537	LACMHC§ 6260	*Canis familiaris*	10	3-30 kDa	3.3	-18.9	6.8	-	43.8	15.6	-	3.3	-	-	3125	25	3250 – 3400

§Los Angeles County Museum Rancho La Project

†Additional details regarding ^{14}C methods and isotopic analysis can be found in Fuller et al. (2014).

‡Additional details about $\delta^{34}S$ measurements can be found in Nehlich (2015).

*Calibrated using the IntCal13 data (Reimer et al. 2013) and the Calib 7.0 program (http://calib.qub.ac.uk/calib/)

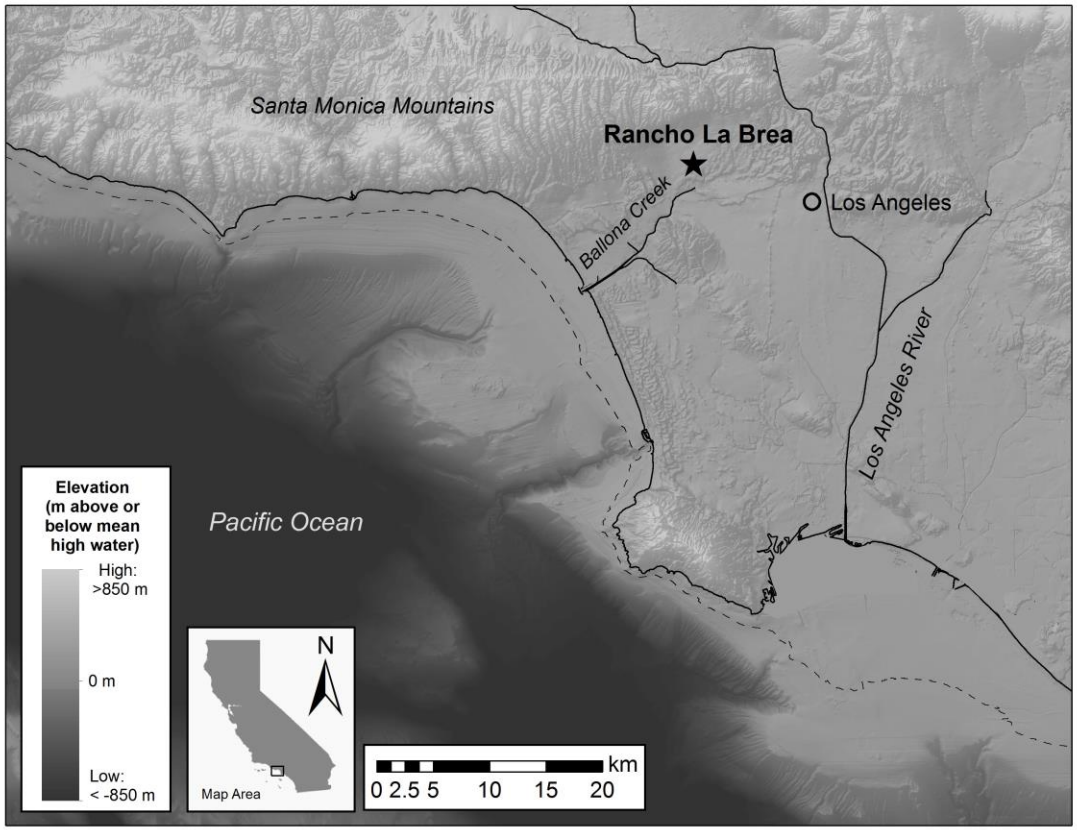

Figure 1 – Schematic map showing location of Rancho La Brea relative to past and present coastlines of the Santa Monica Basin. Dashed line represents approximate location of coast at 10kyr (i.e., 30 meters below current sea level; Lambeck et al. 2014). Tectonic uplift along the Santa Monica basin coastline over the past 10kyr is negligible (<4m) in comparison to eustatic sea level change (Ward and Valensise, 1994). Map drawn with Arc GIS 10.3 using bathymetric and topographical digital elevation model data produced by NOAA's Tsunami Inundation Project and National Geographic Data Center (Caldwell et al. 2011).