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SHORT COMMUNICATION

WHAT SPECIES OF HORSE WAS COEVAL WITH NORTH AMERICA'S EARLIEST HUMANS IN THE PAISLEY CAVES?

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SUPPLEMENTAL DATA—Supplemental materials are available for this article for free at www.tandfonline.com/UJVP

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Well-supported coexistence of humans and megafauna is rare in the North American fossil record. Where such evidence exists, detailed information about faunal composition can provide critical insights into human-megafaunal interactions—a potential driver of the Pleistocene megafaunal extinctions at the end of the most recent ice age (Alroy, 2001; Barnosky et al., 2004). Postcranial bones such as phalanges are often among the best-preserved elements because they are small and dense, but they are also generally less diagnostic than cranial or dental specimens (Davis and McHorse, 2013). Solutions to this postcranial problem hold the potential to dramatically influence our understanding of the megafaunal ecology surrounding the earliest Americans.

The earliest directly dated human remain in North America is ancient DNA (aDNA) from the Paisley Caves of Oregon (Jenkins et al., 2012). Camelid and equid remains are preserved in the same stratigraphic layer as evidence of humans (Gilbert et al., 2008; Jenkins et al., 2012). Coprolites dated to 14.5 ± 0.3 ka (all dates in calibrated [Cal] yr BP ± 1σ) have been conclusively identified as human from aDNA analyses, replicated at multiple independent laboratories with a variety of biomolecular techniques (Rasmussen et al., 2009; Jenkins et al., 2012). The chronology of these caves was reconstructed using 203 radiocarbon dates, including 10 from horse bones, dated 14,636 ± 327 to 13,255 ± 114 Cal yr BP (Jenkins et al., 2013). The combination of aDNA and XAD-2 radiocarbon data give high confidence to the presence and potential overlap of humans and horses in the Paisley Caves ecosystem 14 kya, more than 1000 years before the appearance of Clovis culture (Jenkins et al., 2012, 2013).

What horse species coexisted at Paisley Caves with the first Americans? The equid fossils are mostly phalanges, useful for DNA or dating studies because of their density but generally considered nondiagnostic. We used discriminant analysis, a quantitative approach that has previously led to species-level identification of equid phalanges (Sertich et al., 2014), to identify the Paisley Caves phalanges. We also investigated whether we can distinguish between the two major molecularly supported clades of Pleistocene horses, the stilt- and stout-legged equids.

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Institutional Abbreviation—UOMNCH—University of Oregon Museum of Natural and Cultural History, Eugene, Oregon, U.S.A.

MATERIALS AND METHODS

We focused on the two most complete horse fossils from Paisley Caves, both of which are second phalanges. These specimens, 1830-PC-5/12A-21-25 and 1896-PC-5/16A-CU-2a, were excavated from Cave 5 in 2009 and 2010, respectively, and are reposited in the collections of the UOMNCH. One phalanx, 1896-PC-5/16A-CU-2a, has been directly radiocarbon dated, producing an age of 14,513 ± 328 Cal yr BP. The other was collected ex situ. Dated horse fossils from the caves (n = 14) span 13,033 ± 123 to 14,636 ± 327 Cal yr BP (Table 1).

We sampled representatives of all valid North American equid species contemporaneous with the Paisley Caves fauna (n = 262; see discussion in Appendix, Supplemental Data). The reference set of identified horses includes *Equus occidentalis* Leidy, 1865 (sensu Merriam, 1913), from Rancho La Brea, California, U.S.A. ; *E. conversidens* Owen, 1869, from San Josecito Cave, Nuevo Leon, Mexico; *E. scotti* Gidley, 1900, from Fossil Lake and Silver Lake, Oregon, U.S.A. (elsewhere referred to *E. pacificus* [Leidy, 1868], but we follow previous authors [Savage, 1951; Winans, 1985] in considering *E. pacificus* technically invalid); *E. lambei* Hay, 1917 from the Yukon Territory, Canada; and *Equus* sp. New World Stilt-Legged (NWSL) from Channing, Texas, U.S.A.

Eight measurements were taken on each phalanx (Fig. 1) after von den Driesch (1976), Eisenmann (1988), and Scott (2004). Bones were identified to species using discriminant analysis, a quantitative tool that uses continuous variables to estimate a series of discriminant functions, which in turn can be used to determine membership in a priori categories. Discriminant analysis on linear dimensions of bones has been successfully used for ecomorphological analysis and taxonomic identification (e.g., Plummer et al., 2008; Hopkins and Davis, 2009; Davis and McHorse, 2013; Sertich et al., 2014). In this procedure, a set of discriminant functions are estimated with reference to a training set of measured specimens of known species (or ecomorphological) identity, then used to predict the identity of unknown specimens given their measurements. Probability is assigned based on the Mahalanobis distance of an unknown from the centroid of each group; the group with the smallest Mahalanobis distance gives the highest probability, and this probability is modeled