

# On the Validity of *Equus laurentius* Hay, 1913

Eric Scott, Division of Geological Sciences, San Bernardino County Museum, Redlands, California

Thomas W. Stafford, Jr., Stafford Research Laboratories, Boulder, Colorado

Russell W. Graham, Department of Earth and Space Sciences, Denver Museum of Nature and Sciences, Denver, Colorado

Larry D. Martin, Division of Vertebrate Paleontology, Natural History Museum and Biodiversity Research Center, University of Kansas, Lawrence, Kansas

## ABSTRACT

The species *Equus laurentius* Hay, 1913 has been controversial since its inception. Authorities have differed over the interpretation of this taxon; some have considered it a legitimate Pleistocene horse species, while others have proposed that the name is invalid on the basis that the holotype specimen is a mineralized skull of a recent horse. As the taxon is still frequently employed in studies of Pleistocene equids, it is important to correctly assess its validity.

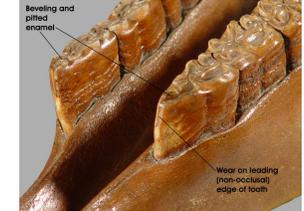
Our study presents the results of accelerator mass spectrometry <sup>14</sup>C dates obtained from the holotype skull and mandible. The radiocarbon measurements confirm that both the skull and the mandible are younger than 400 years in age. Protein chemistry and stable isotope analyses also support a recent age for the specimens. The size and morphology of the specimens fall within the range of like elements of modern *Equus caballus* Linnaeus, 1758. The species *Equus laurentius* Hay is a junior synonym of *Equus caballus* Linnaeus. Neither the taxon nor its holotype is taxonomically or phylogenetically pertinent to studies of North American Pleistocene *Equus*.

## BACKGROUND

The species *Equus laurentius* was named from an associated skull and mandible recovered from a sandbar on the north side of the Kansas River near Lawrence in Douglas County, Kansas (Hay, 1913). The specimen (KUPV 347) was presumed to be of Pleistocene age, as it was found in apparent association with a femur assigned to *Smilodon* from the same sandbar and appeared mineralized. *E. laurentius* was considered by Hay (1913) to be a horse similar in size to smaller domestic breeds, with rather small cheek teeth that exhibited relatively simple enamel infoldings or plications. Measurements provided by Hay (1913) for KUPV 347 did not distinguish the specimen from extant *E. caballus* (Hay, 1927).

Several subsequent authors (Matthew, 1926; Savage, 1951; Winans, 1985, 1989) considered the holotype of *Equus laurentius* to be a skull of a modern horse, *Equus caballus* Linnaeus, 1758. Others (e.g. Quinn, 1957; Mooser, 1959; Azzaroli, 1995, 1998) interpreted the skull and mandible to be virtually identical to *E. caballus*, but to be of Pleistocene age; these authors reduced the taxon to subspecific status [= *E. caballus laurentius* for *E. ferus laurentius* in Azzaroli (1998)]. Winans (1989) assigned the name to one of her metrically-defined "species groups"<sup>1</sup>, and later studies (e.g., MacFadden, 1992; Duckler and Van Valkenburgh, 1998; Pinosof, 1998) interpreted this to be an actual synonymy.

An ongoing investigation to obtain radiometric dates from late Pleistocene fossils in North America, initiated and directed by one of us (RWG) in order to better interpret the sequence of extinctions at the end of the Pleistocene Epoch, included KUPV 347. The results of accelerator mass spectrometry (AMS) dating performed by another of us (TWS) suggested a recent age for the specimen, indicating that the holotype of *Equus laurentius* was not a Pleistocene horse. As the holotype of *E. laurentius* consists of portions of two individual animals (Winans, 1985, 1989), and as the initial analysis did not incorporate data on the protein chemistry and stable isotope composition of the specimens, the present study was initiated to confirm and, as necessary, augment the original AMS date. This investigation also presents data on the morphology of the holotype that have not been previously presented.



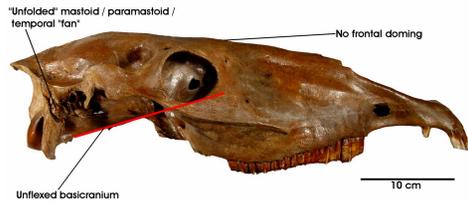
**Figure 4.** Oblique view of the mandible of KUPV 347, showing the leading (non-articular) edges and the occlusal surfaces of the left and right p2. The enamel has been completely worn away from the leading non-articular edge of each tooth; this unusual wear can likely be attributed to bit wear, suggesting that this mandible is from a domestic, bitted horse. The anterior 1/3 of the occlusal surface is beveled and pitted, also suggesting bit wear (after Brown and Anthony, 1998).

## CONCLUSIONS

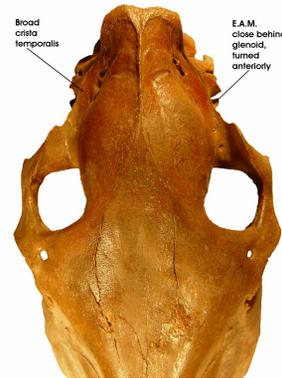
The holotype skull and mandible of the species *Equus laurentius* Hay, 1913 are from separate individuals of the modern domestic horse species *Equus caballus*. AMS dating demonstrates that the bones are less than 400 years old, suggesting that these remains are from Spanish-era horses. Protein chemistry and stable isotope composition analyses corroborate the morphological analysis, confirming that two individuals are represented. It is considered likely that the skull and the mandible differ in geologic age by only a few years to a few decades at most. The apparent presence of bit wear on the left and right p2 suggest that the mandible at least was from a domestic horse, rather than a "feral pony" as suggested by Savage (1951). The name *Equus laurentius* should no longer be applied in any manner to any North American Pleistocene horses.

## REFERENCES

Azzaroli, A. 1995. A synopsis of the Quaternary species of *Equus* in North America. *Bollettino della Società Paleontologica Italiana* 38(2): 205-221.  
 Azzaroli, A. 1998. The genus *Equus* in North America: the Pleistocene species. *Palaeogeographia Italica* 85: 1-60.  
 Bennett, D.K. 1980. Stripes do not a zebra make. Part 1 - a cladistic analysis of *Equus*. *Systematic Zoology* 29: 272-287.  
 Brown, D. and D. Anthony. 1998. Bit wear, horseback riding and the Bova site in Kazakhstan. *Journal of Archaeological Science* 25: 331-347.  
 Duckler, T. and G.J. Miller. 1994. Late Cenozoic equids from the Anza-Borrego Desert of California. *Natural History Museum of Los Angeles County Contributions in Science* No. 440: 1-90.  
 Duckler, G.L. and B. Van Valkenburgh. 1998. Exploring the health of the late Pleistocene mammals: the use of Harris lines. *Journal of Vertebrate Paleontology* 18(1): 180-188.  
 Hay, O.P. 1913. Notes on some fossil horses, with descriptions of four new species. *Proceedings of the United States National Museum* 44(1969): 569-594.  
 Hay, O.P. 1927. On the type skull of *Equus laurentius* Hay. *Journal of the Washington Academy of Sciences* 17(1): 5-7.  
 Hubbert, R. C. Jr. 1989. Phylogenetic interrelationships and evolution of North American Late Neogene Equidae. In *The evolution of Perissodactyls*, D. R. and Schoch, R. M., eds. New York: Oxford University Press, p. 176-193.  
 MacFadden, B.J. 1992. *Fossil horses: systematics, paleobiology, and evolution of the family Equidae*. Cambridge: Cambridge University Press. 369p.  
 Matthew, W.D. 1926. The evolution of the horse: a record and its interpretation. *Quarterly Review of Biology* 1: 139-185.  
 Mooser, O. 1959. La fauna "Cesdan" del Pleistocene in Agnascalcen. *Anales del Instituto de Biología, Mexico* 29: 409-452.  
 Pinosof, J.D. 1998. The American feral local fauna: late Pleistocene (Sangamonian) vertebrates from southern Idaho. In *Andean Studies - Papers for the twentieth paleontological Idaho biennial*, ed. J. White, volume 1, W.A. Alexander, II, G. McDonald, D.J. Melnick and M.E.T. Flatt, eds. Idaho Museum of Natural History Occasional Paper 36: 121-141.  
 Quinn, J.H. 1957. Pleistocene Equidae of Texas. University of Texas Bureau of Economic Geology Report Investigation 35: 1-51.  
 Savage, D.E. 1951. Late Cenozoic vertebrates of the San Francisco Bay region. *University of California Bulletin of the Department of Geological Sciences* 28: 215-314.  
 Winans, M.C. 1985. Revision of North American fossil species of the genus *Equus* (Mammalia: Perissodactyla: Equidae). Unpublished PhD dissertation, Austin University of Texas, Austin, Texas. 264 pp.  
 Winans, M.C. 1989. A quantitative study of North American fossil species of the genus *Equus*. In *The evolution of perissodactyls*, D.R. Prothero and R.M. Schoch, eds. Oxford: Oxford University Press, p. 262-297.



**Figure 1** (above and below left). KUPV 347, the holotype skull of *Equus laurentius* Hay, 1913, lateral (above) and posterior dorsal (below left) views of the skull, showing features indicating affinity with the domestic horse, *Equus caballus* including the unflexed basicranium, the "unfolding" mastoid / paramastoid / temporal "fan", and the lack of frontal doming.



**Figure 2** (above and right). Occlusal views of the lower right cheek teeth (above) and the incisors (right) of the mandible of KUPV 347. The "U"-shaped lingual inflexions and the ectoflexions that do only slightly penetrate the molar isthmus on m1 and m2 are identical to the condition observed in *E. caballus*. The presence of enamel cups, or infundibula, in the lower incisors is likewise identical to *E. caballus*.



**Figure 3.** KUPV 347, skull and mandible (left), compared with LACMHC 1011, a skull and mandible of *Equus occidentalis* from Rancho La Brea. Note the lack of frontal doming and the straight ventral border of the mandible in KUPV 347, traits shared with modern *E. caballus* but distinct from late Pleistocene North American large horses such as *E. occidentalis*.<sup>1</sup> It is evident that the large horse from Rancho La Brea is morphologically distinct from KUPV 347; although Winans (1989) combined these forms in a single metrically-defined "species group", the present study emphasizes that these are very different equids. Note also that the upper cheek tooth row of KUPV 347 is distinctly smaller than the lower cheek tooth row, the temporomandibular articulation is not firm, and the incisors do not occlude. These features suggest that the skull and mandible of KUPV 347 are from different individuals.

## METHODS

KUPV 347 was examined in the collections of the Division of Vertebrate Paleontology, Natural History Museum, University of Kansas, Lawrence, Kansas. Characters proposed to delineate among Pleistocene equids (Bennett, 1980; Downs and Miller, 1994) were employed. Samples of bone for AMS <sup>14</sup>C dating were acquired separately from the skull and mandible, to better assess the interpretation that two individuals were represented (Winans, 1985, 1989). Digital photos were acquired with a Sony DSC F717 Cyber-shot camera.

## RESULTS

Examination of the skull and mandible confirmed that, in both size (Hay, 1913, 1927) and morphology, KUPV 347 closely resembled *Equus caballus* (see Figures 1, 2 and 3). The skull is stained, but not mineralized (*contra* Hay, 1913, 1927). The presence of wear resembling bit wear (Figure 4) suggests that at least the mandible of KUPV 347 was from a domesticated animal.

The results of the AMS dating are as follows:

### *Equus laurentius* medial right ramus:

Sample NSRL-2112  
(May, 1995) Bone Collagen (XAD-Gelatin KOH Collagen), Fm = 0.9857±0.0066  
**120 ± 60 RC yr. BP** (CAMS-20005), δ<sup>13</sup>C = -11.5 ‰

Sample SR-6365  
(April, 2003) Bone Collagen (XAD-Gelatin KOH Collagen), Fm = 0.9634±0.0038  
**300 ± 35 RC yr. BP** (CAMS-95522), δ<sup>13</sup>C = -11.55 ‰

### *Equus laurentius* nasal:

Sample SR-6366  
(April, 2003) Bone Collagen (XAD-Gelatin KOH Collagen), Fm = 0.9707±0.0039  
**240 ± 35 RC yr. BP** (CAMS-95523), δ<sup>13</sup>C = -10.63 ‰

<sup>1</sup> Because the holotype skull and mandible of *Equus laurentius* are actually specimens of modern *Equus caballus*, the continued use of Winans's (1989) "*Equus laurentius* species group" for North American Pleistocene horses is no longer tenable. Determining a new designation for this group is problematic. Winans' own earlier (1985) dissertation preferred the species name *Equus mexicanus* Hubbard, 1955, for this group, and so some consideration should be given to this name. However, Hubbert's (1989) cladistic analysis of the Equidae suggested that the genus *Dinohippus* Quinn, 1955 cannot be separated from the genus *Equus* without paraphyly. Hubbert (1989) chose to sink *Dinohippus* into *Equus* under this interpretation, "*Dinohippus*" mexicanus Quinn, 1955 would become *Equus mexicanus*, and the species defined as "*Equus mexicanus*" by Hubbert (1955) -- having been named later -- would be supplanted.

The present study prefers not to apply the species name *Equus mexicanus* to Winans' (1989) "*Equus laurentius* species group" pending resolution of the relationship between *Equus* and *Dinohippus*. Nor are any other names for this species group advanced at present, largely due to concerns regarding the utility of any metrically-defined "species groups" that fail to distinguish domestic *E. caballus* from extant North American Pleistocene horses.

## ACKNOWLEDGEMENTS

Funding for the AMS dates was provided by a grant from the National Science Foundation; Steve Jones (Brigham Young University, Provo, Utah); the Denver Museum of Nature and Science; Stafford Research Laboratories; and Mary Scott of Carmel, California. The authors thank Kathleen Springer and J. Christopher Saeed of the San Bernardino County Museum as well as Ken Scott of the Department of Biology, California State University, San Bernardino, for reviewing portions of this study. David Anthony of the Institute of Ancient Equid Studies, Department of Anthropology, Hartwick College, New York is thanked for his comments and observations regarding bit wear in ancient horses.