

## Evidence for Pre-Columbian Animal Domestication in the New World

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The criteria traditionally used to determine animal domestication were proposed by Galton (1865:134,136) and are: (1) economic usefulness to man; (2) the ability to breed freely under confinement; and (3) the ease by which they are tended (tameness). Of these, captive breeding is crucial and will be used in this study, although usefulness is also important. Tameness is not vital to domestication and may be impossible to prove, as in the case of apiculture, where the animals cannot be safely handled.

Here we will discuss seven animals domesticated in the New World before European discovery. The dog, "llama", guinea pig, turkey, Muscovy duck, stingless bee, and the cochineal insect comprise the list of known Pre-Columbian, New World animal domesticates. We will present and evaluate the evidence, both archaeological and documentary, for domestication of these seven animals, including bone morphology; associated paraphernalia of domestication, such as stone corrals, sacrificial burials, pottery, figurines; and the writings of European conquerors, explorers, naturalists, missionaries, ethnographers, and the native peoples themselves.

### Domesticated Dogs; Canis familiaris

There is no question that the dog was found domesticated in the New World at the time of European discovery; the archaeological and documentary evidence is conclusive (Colton 1970; Landa 1566 - Tozzer trans. 1941; Lawrence 1971; Olsen 1976, 1985; MacNeish 1966). Questions arise, however, as to whether the dog was domesticated in the New World independently of the Old World, or was introduced into the New World already domesticated, or even was originally domesticated in the New World.

At the present time, the earliest dates of domesticated dogs in the world come from North America, at Jaguar Cave in Idaho, with radiocarbon dates of 9500 BC and 8400 BC (Lawrence 1971:43). Of the Jaguar Cave material, Olsen (1985:31) says:

One would not expect to find these early dogs in a locality so far south as the Jaguar Cave rock-shelter without finding remains in sites closer to the Bering Strait. Finding the remains was due to the discovery and excavation of a rock-shelter site; less inviting sites, as yet unknown, between Jaguar Cave and the Bering Strait may, of course, hold equally important early dogs.

Remains of another early domestic dog were found at Ventana Cave west of Tucson, Arizona in a layer associated with the Chiricahua-Amargosa II culture complex and a radiocarbon date of 9500 BC (Colton 1970:153). There is some question about the context of that date. Haury rejects the antiquity of this date and suggests that this dog is probably associated with the Hohokam culture a thousand years ago (1950:159).

In the period between 1932-1953, twenty-eight more or less complete short faced wolf Canis Lupis familiaris skulls were found north and west of Fairbanks, Alaska, associated with a radiocarbon date of 8,000 BC. They have the closest morphological appearance to, and appear to be the forerunners of, contemporary domesticated Eskimo dogs (Olsen 1985:22). Olsen (1977) has discussed the possibility that the dogs were domesticated from the small, short faced Chinese wolf.

Early evidence that dogs were used as food comes from the Tehuacan Valley, at 6500-4900 BC (Flannery 1967:168). At Colima, pottery figurines of dogs holding corn cobs in their mouths, ca. AD 600, may indicate that the dogs were fattened on corn before being eaten (Burleigh and Brothwell 1978:359).

Dog bone heads were found at the Awatovi site (Olsen 1976:102,104). It is virtually impossible to identify characteristics of domestication from a carved bone. It must be assumed by the association with known domestic dogs and carved bone. Dog bone was also used in sacrifice (Landa 1566 - Tozzer trans. 1941:203).

### **Camelids; the "Llamas"**

Domesticated camelids are found throughout the Andes, parts of Central America and western Patagonia (Earle 1961:46-47). The llama, alpaca and vicuna all derive from the wild guanaco (Kenworthy 1975:46). The four varieties will be collectively referred to as "llamas" in this paper wherever that term is enclosed in quotes.

Evidence of "llama" domestication occurs in the Puna of Junin, central Peruvian highlands (Wheeler Pires-Ferreira, et al 1976:489). Remains in Level 4, relatively dated between 4200 BC and 2500 BC, show the change in bone morphology associated with the shift from wild to domesticated "llamas". Examination of camelid bone morphology from deposits in the Atacama Desert show the gradual development of the "blue rim", a thick layer of collagen on the bone surface, visible under microscopic study. This is a characteristic of domesticated "llamas" (Pollard and Drew 1975:229-304), and indicates that "llamas" were gradually domesticated during the period between 4200 BC and 2400 BC.

A stone corral with twenty centimeters of llama dung in the bottom was encountered adjacent to a ceramic workshop in the Moche' Valley (Porzorski 1976:130). One layer of dung 3 meters thick contained plant material (maize stalks, cobs and leaves, and algarrobo seeds) suggesting that crop-waste was fed to "llamas" (Shimada and Shimada 1985:15). Modelled clay figurines and vessels depicting llamas carrying packs and figurines of copulating llamas wearing harnesses suggest that llama breeding was controlled (Shimada and Shimada 1985:5. fig.1a).

Aside from their use as food, domesticated llamas were also used to transport cargo (Prescott 1843:806) and copper ore (Shimada and Shimada 1985:15), the fleece of all varieties was used for production of wool (Prescott 1843:807), in some areas "llamas" were milked (Shimada and Shimada 1985:3), and were sacrificed in religious ceremonies (Meggers 1966:149; Porzorski 1979:167; Strong and Evans 1952:31).

In 1532, members of the Pizarro expedition noted huge herds of llamas. Miguel de Estete wrote of llamas kept in herds and used for food in 1534. De Cuenca recorded Indian testimony about large herds in Northern Peru during his journey of 1566-1567. He spoke of eight corrals made of mud and stone for butchering and sacrificing the llamas (Shimada and Shimada 1985:17). Fully domesticated llamas had spread throughout the lowlands by 700-600 BC (Shimada and Shimada 1985:3).

### Guinea pig; the Cavy; Cavia porcellus

The guinea pig, or cavy, is indigenous to the Andes. Remains of the earliest known fully domesticated form were recovered from Pikimachay Cave in the highlands of Peru, ca. 5000 BC (Stahl and Norton 1987:385). The guinea pig was found in the Culebras Complex ca. 1800 BC

(Lanning 1967:63), and in association with monumental architecture at Huaca ca. 1300-600 BC (Shimada and Shimada 1985:8). Guinea pigs were also found in association with human burials in the Ayalan cemetery in Ecuador, as were Muscovy ducks, dating to ad 500 (Hesse 1980).

Meggars (1972:123) notes that guinea pigs were raised inside houses, and that they began to play an important role in the economy at an early time (Meggars 1972:46). Due to their high fertility and ease of maintenance, they ranked with sea food as the most important source of protein in the diets of the coastal Peruvians (Stahl and Norton 1987:385). Throughout the Andes, guinea pigs were most commonly kept as a food source, although they were also used as sacrificial offerings, an antidote to sorcery, and for the diagnosis and cure of illness (Bolton 1979:263-239).

#### Muscovy Ducks; Carina moschata

In the Ecuadorian lowlands, Muscovy ducks were domesticated between 700 BC and 600 BC, called the "Historic" Period, and were associated with burials in the cemetery at Ayalan at AD 500 (Hesse 1980).

The 1987 discovery of an intact Moche' warrior-priest tomb at Sipan, Peru, dated to AD 290, gives us a unique look into the culture of this Andean civilization. Included in the adornment of the warrior-priest were mirror image ear ornaments believed to depict a stylized Muscovy duck (Alva 1988:546-547).

Meggars (1966:123) mentions a large duck that was kept inside houses in Ecuador. The ducks were used for a number of purposes. Their meat was used as food--early explorer Cieza de Leon mentioned a duck raised in coastal Ecuadorian houses for food, as a sacrificial animal, and their dried meat made an aromatic powder (Stahl and Norton 1978:386).

#### Turkeys; Meleagris gallopavo

Turkeys are found throughout North and Central America. Domesticated turkey bones appear in the Tehuacan Valley sequence early in the Palo Blanco phase, ca. AD 180. This is the oldest reliably dated evidence for the domestic turkey in Mesoamerica (Flannery 1966:175).

MacNeish (1966:290) points to the hybridization of turkeys, as evidence by bones found at Tehuacan, as proof

that the turkey was domesticated. Bones found in the Northwest of Mexico and the Southwest United States, with earlier dates, as well as genetic similarities among present day domestic and wild turkey populations in the "Southwest United States, indicate that domesticated turkeys spread from the greater Southwest to Tehuacan" (1966: 19-5) .

Analysis of coproliths, radiocarbon dating ca. AD 180, from the Tehuacan Valley shows the presence of turkey feathers and bees in the diets of the people living there (Callen 1966:273, 265). Turkey bones found in the basin-valley sites in the Northern Sierra suggest that the bird was originally taken from its mountain habitat and penned in the lower valley villages (Di Peso 1977:7) .

Three varieties of turkeys were found at Casas Grandes, ca. AD 250. They were: 1) the Small Indian Domestic, most popular at the New Mexico Tompiro pueblos in the Rio Grande drainage; 2) the Large Indian Domestic, resembling birds from east central Arizona; and 3) the Tse Tala, which was a very large bird (Di Peso 1974:602). Evidence of egg shells and bones suggest that the Small and Large Indian Domestics were hybridized (Di Peso 1974:603) •

The earliest naturalist to give an account of the domestic turkey was Oviedo y Valdes. Slightly confused, he described turkeys that he had seen in the West Indies soon after the Conquest, "Whither they had been brought," he said, "from Spain" (Di Peso 1535:306).

Earlier records of turkeys include the lists of food served by Moctezuma to Cortes and his men in 1518 (Anderson and Dibble 1978:19; Prescott 1847:89). Prescott (1847:101) records that the yearly expenditure of the Aztec king Tezcuco included 8000 turkeys. Tepexi received tribute from his people in 1537, to give to Cortes, that included turkeys (Gorenstein 1971:341). Di Peso (1974:602) mentioned the use of turkeys for trade, plumage, blood for decoration and religious ceremonies in Casas Grandes, as well as grave goods.

### Stingless Bee; Melipona beecheii

Stingless bee apiculture occurs throughout much of the New World--Mexico, Yucatan, Central America and the Amazon Basin as far south as Sao Paulo (Nordenskiold 1929:177;£ig.12), but not in Peru. Darwin (1859:225) listed the stingless bee of Middle and South America as "Melipona domestica", due to the fact that it was so often found domesticated, although it is now termed

Melipona beecheii.

There is a great deal of documentary, but little direct archaeological, evidence of the domestication of the stingless bee. As mentioned above, an analysis of coproliths from the Tehuacan Valley, ca. AD 180, showed the presence of bees in the diet, although it cannot be proven that the bees were kept in hives (Callen 1966:265).

Sahagun (1547-69 - SeIer trans. 1829:403-405, 406-411) states that wax of the bees was used by goldworkers employing the lost-wax casting method. They made "a mold by means of charcoal and wax, applying it to designs, and in this manner fuse gold and silver." When the wax was carved into the image to be cast, "they boil the wax and mix it with white copal, by which it becomes very compact. Then they clarified it by filtration, in order that the impurities . . . may be well settled out. When the wax is prepared. . . they apply it on the charcoal." The wax-coated carving was then dipped in liquid clay and burned to remove the wax.

Easby (1966:73-75) mentioned the casting of gold using a lost-wax casting method, employing the wax of stingless bees by goldworkers of Columbia, and somewhat later in Panama and Costa Rica in the final centuries BC. Casting was never common in Peru, where the stingless bee does not occur (Plazas and de Saenz 1978:37).

The earliest documentary evidence for domestication of the stingless bee came from the Mayan Codex "Troano" (Afionymous, ca. AD 1178). The Troano is a calendrical almanac listing the times for various farming activities, including the collection of wax and honey. It is comparatively dated at roughly AD 1178 (Thompson 1950:24ipl. IIIc.) by cross-referencing with the Dresden Codex, which mentions events for which dates are known. In 1530 Alonso de Avila marched into southwestern Yucatan and seized the beehives of the region and redistributed them among his men, as a method of impoverishing the natives (Blom 1936:72). Clavigero (1780:107) mentioned the antiquity of the stingless bee in the Yucatan, and its importance to the economic system of the region.

The stingless bee was domesticated simply by cutting a 2-3 foot section of hollow log, drilling a flight hole, then stopping the ends with plugs made of clay, or stones mixed with clay, that could be removed to collect the wax and honey or propagate the hives (Schwarz 1948:144). New hives were created by the simple expedient of separating a part of the brood comb, and placing it and few old bees in a new hive (Huber 1839:22).

The hives were often made of earthenware and ornamented with the heads of men or monsters, with the flight hole represented by the mouth (Schwarz 1948:145). Explanations for this ornamentation ranged from the erotic--to bring good luck, to the pragmatic--to show which side is up when the hives are moved (Redfield 1934:48) ..

The stingless bee was used for a variety of purposes: wax; honey; wealth; status; (Schwarz 1948); as indemnity for crimes (Landa 1566 - Tozzer trans. 1941:98); and as medicine to treat vomiting and cramps (Nordenskiöld 1929:170) .

### Cochineal Insect; Oactylopius coccus

Swartz (Meighan, et al. 1958:Table 7; p. 145) provides a compilation of animals throughout the world that have been domesticated and includes the cochineal. It was bred and produced a dye.

Examples of fine weaving of llama wool, colored with yellows, blues and reds date back as early as the Late Formative Period, ca. 700-500 BC (Murra 1962:710-728). It is possible that the red dye was cochineal dye, although it would be difficult, if not impossible to ascertain provenance of dyes in archaeological settings.

The red cochineal dye was extracted as a tribute item as early as 1511-1512 among the Toltecs (Oonkin 1977:21) .

The cochineal was raised on a variety of cactus, called the opuntia, described by Oviedo y Valdes (1526), as well as other, later, Spanish historians. Nopals, or opuntias, were cultivated, then seeded with pregnant cochineals, which laid eggs that matured into adult insects, which were then harvested (Donkin 1977:16). Because the cochineal, whether domestic or wild, is a parasite on the nopal, the cactus must be "rested" every third to fourth year (Alzate 1777-1794:85).

The harvested cochineal was treated in a variety of ways, all culminating in a silvery powder, that would, when properly processed, produce a deep red dye. So valuable was this dye, that as early as 1548, the cabidlo of Tlaxcala., Mexico, instructed officials to supervise the trade, as it was too easy to adulterate the product by the addition of such things as ash, sand, or inferior quality dye (Lee 1948:457).

Called niin by the Maya, the cochineal made a

medicine used in the treatment of swollen testicles and sores on the tongue caused by smallpox (Roys 1931:125,164), and for the treatment of burns and broken *limbs* (Oviedo y Valdes 1526:99).

## Summary

There were seven domesticated animals kept in the New World before European discovery. All but the cochineal may be demonstrated both archaeologically and with documents. The dog dates to 9500 BC at Jaguar Cave, Idaho (Lawrence 1971). The llama dates to 4200-2500 BC in the Central Peruvian Highlands (Wheeler Pires-Ferreira, et. al 1976). The guinea pig dates to 5000 BC in the highlands of Peru (Stahl and Norton 1987).

The Muscovy duck dates to 700-600 BC in the Ecuadorian lowlands (Hesse 1980). The turkey dates to AD 180 and probably came from the greater Southwest (MacNeish 1966). The stingless bee dates back to at least AD 180, at least, and is spread throughout Central and South America (Callen 1966). The cochineal is known historically, but there is no conclusive archaeological evidence for it (Donkin 1977).

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## References Cited

- Alva, Walter  
1988. Discovering the New World's richest unlooted tomb. National Geographic 174:510-548.
- Alzate y Ramirez, Jose Antonio de  
1777. Memoria en que trata del insecto grana o cochinilla. Boletin de la Sociedad Mexicana de Geographia y Estadística 3:82-86.
- Anderson, Arthur J.O., and Charles E. Dibble  
1978. The War of Conquest: How it Was Waged Here; or The Aztec's Own Story As Given to Fr. Bernardino de Sahagun, Rendered into Modern English. Salt Lake City: The University of Utah Press.
- Anonymous Mayan Author  
ca. 1178. The Troano Codex.
- Blom, Frans Ferdinand  
1936. The Conquest of Yucatan. Boston: Cooper Square Publishers.
- Bolton, Ralph  
1979. Guinea pigs, protein and ritual. Ethnology 18:229-252.
- Burleigh, R., and D. Brothwell  
1978. Carbon isotopes in relation to maize in the diet of domestic dogs from early Peru and Ecuador. Journal of Archaeological Science 5:355-362.
- Callen, Eric O.  
1966. Analysis of the Tehuacan coprolites. In "Environment and subsistence: Tehuacan Archaeological-Botanical Project," ed. by Douglas S. Byers. Vol. 1, pp. 261-289. The Pre-History of the Tehuacan Valley, ed. by Richard S. MacNeish. Austin.
- Clavigero, Francesco Saverio  
1780. Storia antica del Messico; cavata da± migliori storici spagnuoli, e da± manoscritti, e dalle pitture antiche degl± indiani. Cessna 1:107-108.
- Colton, Harold S.  
1970. The aboriginal southwestern Indian dog. American Antiquity 35:153-159.
- Darwin, Charles  
1859. On the Origin of Species (a facsimile of the First Edition, 1964.) Cambridge: Harvard University Press.

- Di Peso, Charles C.  
 1966. Archaeology and ethnohistory on the Northern Sierra. In "Archaeological frontiers and external connections," ed. by Gordon F. Ekholm and Gordon R. Willey. Vol. 4, pp. 3-25. Handbook of Middle American Indians, ed. by Robert Wauchope. Austin
- 1974. Casas Grandes: a fallen trading center on the Gran Chichimeca, (3 Vols.). Amerind Foundation Series No.9., ed. by Gloria J. Fenner. Dragoon.
- Donkin, R. A.  
 1977. Spanish red. An ethnogeographical study of cochineal and the Opuntia cactus. Transactions of the American Philosophical Society, Vol. 67, part 5. Philadelphia: American Philosophical Society.
- Earle, Olive L.  
 1961. Camels and Llamas. New York: William Morrow.
- Easby, Dudy T., Jr.  
 1966. Early metallurgy in the New World. Scientific American 214:72-78.
- Flannery, Kent V.  
 1966. The vertebrate fauna and hunting patterns.. In "Environment and subsistence: Tehuacan Archaeological-Botanical Project," ed. by Douglas S. Byers. Vol. 1, pp. 132-177. The Pre-History of the Tehuacan Valley, ed. by Richard S. MacNeish. Austin
- Galton, Francis  
 1865. The domestication of animals. Transactions of the Ethnological Society of London, n.s. 3:122-138.
- Gilmore, Raymond M.  
 1963. Fauna and ethnozoology of South America. In "Handbook of South American Indians," ed. by Julian H. Steward. Vol. 6, pp. 345-464. Bureau of American Ethnology, Bulletin 143. Washington.
- Gorenstein, Shirley  
 1971. Archaeology, history and anthropology in the Mixteca-Puebla region of Mexico. American Antiquity 36:335-343.
- Huary, E.W.  
 1950. The Stratigraphy and Archaeology of the Ventana Cave, Arizona. Tucson: University of Arizona Press.

- Hesse, Brian  
1980. Archaeological evidence for the Muscovy duck in Ecuador. Current Archaeology 21:139-140.
- Huber, Jean Pierre  
1939. Notice sur la melipone domestique, abeille domestique mexicaine. Mem. Soc. Phys. Hist. Nat. 8:1-26.
- Kenworthy, Leonard S.  
1975. Camel and Their Cousins. New York: Harvey House.
- Landa, Diego de  
1566. Relacion' de las cosas de Yucatan. (translated and edited with notes by Alfred M. Tozzer, 1941). Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University, Vol. 18 Cambridge.
- Lanning, Edward P.  
1967. Peru Before the Incas. Englewood Cliffs: Prentice Hall.
- Lawrence, Barbara  
1971. Antiquity of large dogs in America. Tebiwa 11:43-49.
- Lee, R.  
1948. Cochineal production and trade in New Spain to 1600. The Americans 4:449-473.
- McMillan, R.B.  
1970. Early canid burial from Western Ozark highland. -Science 167:1246-1247.
- MacNeish, Richard S.  
1966. An interdisciplinary approach to an archaeological problem. In "Environment and subsistence: Tehuacan Archaeological-Botanical Project," ed. by Douglas S. Byers. Vol. 1, pp. 14-24. The Pre-history of the Tehuacan Valley, ed. by Richard S. MacNeish. Austin
- Meggars, Betty J.  
1966. Ecuador. Ancient peoples and places series, ed. by Glyn Daniel. London: Hazell Watson and Viney.
- Meighan, C.W., D.M. Pendergrast, B.K. Swartz, Jr., and M.D. Wissler  
1958. Ecological interpretation in archaeology: part II. American Antiquity 24:131-150.
- Murra, J. V.  
1962. Cloth and its functions in the Inca State.

- American Anthropologist 64:710-728.
- Nordenskiöld, Nils Erland Herbert  
1962. L'apiculture Indienne. Journal de la Societe des americanisates 21:169-182.
- Olsen, Stanley J.  
1976. The dogs of Awatovi. American Antiquity 41:102-106.
- 1977. The Chinese wolf, ancestor of New World dogs. Science 197:533-535.
- 1985. Origins of the Domestic Dog: the Fossil Record. Tucson: University of Arizona Press.
- Oviedo y Valdes, Gonzalo Fernandez de  
1526. De la natural historia de las Indias. Toledo.
- 1535. Historia general y natural de las Indiasj' islas y tierra-firme del Mar Oceano. Madrid
- Plazaz, Clemencia and Ana Maria Falchetti de Saenz  
1978. Technology of ancient Columbian gold. Natural History 88:37-46.
- Pollard, G.C., and I.M. Drew  
1975. Llama herding and settlement in pre-historic northern Chile: an application of analysis for determining domestication. American Antiquity 40:296-305.
- Pozorski, Sheila G.  
1979. Prehistoric diet and subsistence of the Moche Valley, northern Peru. World Archaeology 2:163-184.
- Prescott, William H.  
1843. History of the Conquest of Mexico and History of the Conquest of Peru. New York:Modern Library.
- Redfield, Robert, and Alfonso R. Villa  
1934. "Chan Kom, a Maya Village." Carnegie Institute of Washington. Washington.
- Roys, Ralph L.  
1931. The ethnobotany of the Maya. In The Middle American Research Series Publication, No.2. Tulane University, Department of Middle American Research, New Orleans.

- Sahagun, Bernardino de  
 1547-69. The goldsmith's art in ancient Mexico  
 (translated by Eduard SeIer). Compo - Rendu de la  
 VIII Session tenne a Paris, 1890. Congres  
International des Americanistes, pp. 401-418.
- Schwarz, Herbert F.  
 1948. Stingless Bees (Meliponidae) of the Western  
 Hemsisphere. Bulletin of the American Museum of  
Natural History, Vol. 90. New York.
- Shimada, M., and I. Shimada  
 1985. Prehistoric llama herding on the north coast of  
 Peru. American Antiquity 50:3-26.
- Stahl, Peter W., and Presley Norton  
 1987. precolumbian animal domesticates from Salango,  
 Ecuador. American Antiquity 52:382-391.
- Thompson, J.E.S.  
 1950. Maya Hieroglyphic Writing. Carnegie Institute of  
Washington, Publication 589. Washington.
- Tozzer, Alfred M.  
 1941. Translation and annotations of "Relacion' de las  
 cosas de Yucatan." Papers of the Peabody Museum  
of Archaeology and Ethnology, Harvard  
University, Vol. 18. Cambridge.
- Wheeler Pires-Ferreira, Jane, Edgardo Pires-Ferreira, and  
 Peter Kaulicke  
 1976. Preceramic animal utilization in the central  
 Peruvian Andes. Science 194:483-490.