The archaeological record of the large lowland neotropical Muscovy Duck Cairina moschata, one of the few native animals known to have been domesticated by pre-Columbian peoples, is poorly known. Only a few specimens have been recovered in different cultural, temporal and depositional contexts from throughout the neotropics, and differentiating between wild and domesticated forms on the basis of osteological evidence has proved to be difficult. Archaeological specimens are mainly recorded from sites in western Panama and South America, including the western lowlands of Ecuador where two new locations are described and evaluated. It is suggested that at least some of these Ecuadorian specimens belong to domesticated forms, and that the cultural contexts in which they are found at archaeological sites suggest that prehispanic trade may have influenced their geographical distribution prior to the arrival of Europeans.

The Muscovy Duck Cairina moschata is perhaps the most enigmatic of the few New World vertebrate domesticated animals, which include the Turkey Meleagris gallopavo, Guinea-Pig or Cuy Cavia porcellus, Llama Lama glama and Alpaca Vicugna pacos. A small number of bone specimens identified as Cairina have been reported from archaeological sites in widely scattered locations that belong to different cultures and time periods and represent different cultural activities (i.e. dietary refuse and burials). Generally, domesticated Cairina bones are only tentatively distinguished from those of wild forms because the skeletal criteria for their separation have until recently not been evaluated (Stahl 2005). Domestication is often assumed or inferred from the archaeological context. As a result, little beyond educated conjecture can be offered regarding the prehispanic range of the wild Muscovy Duck in pre-Columbian times, when and where this species was domesticated, whether there was one or more foci for its domestication, and whether the distribution of domesticated forms coincided with that of their wild progenitors when Europeans arrived in tropical America at the end of the 15th century.

Here we describe new evidence for pre-Columbian Muscovy Ducks in two related archaeological contexts from the western lowlands of Ecuador. After briefly reviewing the literature regarding the Muscovy's prehispanic status in the western hemisphere, we describe the specimens and their contexts, and consider the geographical distribution of domesticated Muscovy Ducks in later prehistory.

ARCHAEOLOGICAL EVIDENCE OF PRE-COLUMBIAN MUSCOVY DUCKS IN THE NEOTROPICS

 Shortly after its Spanish introduction to Europe, the domesticated Muscovy Duck was rapidly exported around the globe. Osteological evidence from archaeological sites and description in contact-period chronicles, which describe large ducks (often using the name ansar, or goose) kept in cages, suggest a possible pre-Columbian range from Mexico, southward through Central America, some nearshore Caribbean islands, and into South America as far as Chile and Argentina (e.g. Whitley 1973, Donkin 1989: 58, Cooke & Ranere 1992: 45, Angulo 1998: 21). Wild populations of Muscovy Duck are today found virtually throughout the neotropics, from Mexico’s Pacific coast around Sinaloa and Tamaulipas and its Atlantic coast around...
Nuevo León, through Central America and into forested lowland South America, as far south as Peru on the western side of the Andes, and northern Argentina and Uruguay to the east. It is also likely that wild Muscovies were present on Trinidad.

The timing, circumstance and location of early domestication remain a matter for conjecture. The relatively few archaeological contexts in which Muscovy Duck specimens have been identified provide clues about pre-Columbian range; however, in the absence of osteological criteria for distinguishing wild from domestic birds, their status remains moot. Interpretations of wild/domesticated status based exclusively on evaluations of cultural and temporal context are certainly confounded by the extensive sympatric overlap of domestic and wild birds, their ready ability to interbreed, and the ease with which viable feral populations are established.

We have archaeological evidence which establishes a pre-Columbian distribution of Muscovy Duck from at least Panama, Venezuela and Trinidad in the north, south through the Pacific versant of Ecuador and Peru, into eastern lowland Bolivia and as far as extreme north-western Argentina (Fig. 1). Some of our best evidence is found in the central Pacific watershed of Panama. Wetmore (1956) briefly mentions the recovery of a distal ulna fragment in association with Ground Sloth Eremotherium sp. specimens from an upper Pleistocene fossil bed at El Hatillo, in Herrera Province. Cooke (1984: 253), Cooke and Ranere (1992: 41) and Cooke et al. (in press) report Muscovy Duck from the Sitio Sierra site in Panama in a bone sample from refuse dumps which includes a fairly diverse lowland bird fauna with savanna, swamp, coastal and scrubby forest taxa. Nineteen bones identified as Cairina, which were found in a refuse dump dated between 100 and 500 AD, include at least 15 elements from a single individual. The size of a complete first phalanx suggests it to be that of a domesticated male according to the measurements provided for this element by Stahl (2005). Some of the remaining elements are considerably smaller and appear to be either domesticated females or wild males. A sample of 46 Muscovy bones was identified from the Cerro Juan Diaz site, located 30 km south of Sitio Sierra and contemporary with it (Cooke et al. 2000). Although the sample includes individuals of markedly different sizes, these have not been formally evaluated in light of Stahl’s (2005) research (Cooke et al. in press). Sitio Conte is a site whose cemetery was used mostly between 750 and 950 AD but whose refuse lenses include both earlier and later deposits. An unnamed specialist who identified some bones from Lothrop’s 1931–1934 excavations at Sitio Conte identified Muscovy Duck (Lothrop 1937: 16). Only passing mention is made of pre-Columbian specimens from northern South America and the Caribbean. Cairina moschata is included in a list of birds identified in pre-Columbian midden deposits excavated at the Hacienda Tocorón near northern Venezuela’s Lake Valencia (Wetmore 1935). Wing (1977: 59) also lists Muscovy Duck in her analysis of animal bones from three Trinidadian sites whose pre-Columbian occupations date to after 0 AD.

Muscovy Duck specimens have been reported previously from Ecuador, with recently excavated and identified material detailed separately below. A relatively large assemblage of 73 duck specimens was identified in association with human burials at the south coastal Ayalán cemetery (Hesse 1980). All but one specimen were associated with secondary human burials in large urns that were probably associated with the late Milagro Phase culture, which occupied the area from roughly 900 AD until the arrival of Spaniards in the early 1500s (Ubelaker 1981). Hesse (1981: 138) notes a predominance of wing (humerus, radius, ulna, carpometacarpus) and leg (femur, tibiotarsus, tarsometatarsus) bones along with exotic domesticated Guinea-pig Cavia porcellus and Llama Lama sp. He suggests that because these specimens are predominantly associated with burials, they do not represent human food remains, but reflect some ritual activity. Further north along the Ecuadorian coast, Muscovy Duck appears again with Guinea-pig at Salango (Stahl & Norton 1987). As many as two individuals are represented by lower wing bones (radius, ulna) in association with cultural deposits of the Guangala Phase, which proliferated throughout the south coastal area between 100 BC and 800 AD. Salango, in particular, is identified as the major centre of an extensive prehispanic trade network involved in the movement of local Spondylus marine bivalves (Norton 1987). Much further to the south, Muscovy Duck is mentioned as probably present in Moche occupations after 500 AD in the upper Piura river in northern Peru (Kaulicke 1991: 414). It is interesting, and perhaps important, to note its association with domesticated Llama, and Spondylus, in human burials. That Muscovy Ducks were present in pre-Columbian times in the northern coastal lowlands of Peru is indicated by realistic depictions of this species on clay vessels and by identified Cairina feathers associated with the later Moche and Chimú cultures, which occupied that area after 0 AD (e.g. Donnan 1978, O’Neill 1984).
The largest sample of pre-Columbian Muscovy Duck bones obtained thus far comes from the eastern Bolivian lowlands at Pailón, which was occupied by humans for some 800 years (Prümers 2002). Faunal assemblages from the sites of Pa-6 and Pa-5, which date between 600 and 1000 AD, include 125 specimens representing all portions of the skeleton. Relatively larger elements were considered to represent males (n = 5), with smaller elements representing females (n = 5). Hutterer (1997) interpreted this balanced sex profile as evidence for either the hunting of breeding pairs or domestication. He also interpreted patterned damage observed on some specimens as evidence for human butchering of ducks for food. Some long bones were carved and drilled (Hutterer 1997: 329), or fashioned into punches and tubular...
beads, probably at the site (Prümers 2002: 141). Our southernmost archaeological context comes from the late pre-Columbian Incan administrative centre of Potrero-Chaquía in Catamarca province of northwestern Argentina. Excavations in two barrios or quarters at the site recovered 15 Muscovy Duck specimens in a sample, which like some of the Ecuadorian samples, included domesticated camelids and Guinea-Pig. It is suggested that ducks may have been raised in the interiors of barrios La Solana and Retambay for meat consumption (Rodriguez-Loredo 1997–1998).

**NEW EVIDENCE FOR PRE-COLUMBIAN MUSCOVY DUCK IN ECUADOR**

Recently, we identified Muscovy Duck bones from two more archaeological sites in the Pacific lowlands of western Ecuador. Both sites are found in the lower Guayas Basin and are roughly contemporaneous in age. This area of western Ecuador supports a humid tropical savanna that is characterized by marked seasonality with extended dry periods between May and October during normal non-El Niño years. Areas of the lower basin are particularly prone to inundation, both on a seasonal and a daily basis, as the large river systems that empty into the Pacific Ocean are affected by tidal impulses from the Gulf of Guayaquil. It is within this environmental context that pre-Columbian cultures constructed agricultural fields that raised planting surfaces above the levels of regular flooding. Not only did these fields artificially increase the amount of available arable land, but their accompanying ditches also provided aquatic protein, fertilizer and avenues for transportation. Impressive mounded habitation complexes and intensive raised field agriculture reached their maximum extension in the area with the appearance of the Milagro-Quevedo culture, which is identified with the historic Chono nation, around 900 AD, and terminated shortly after the arrival of Spanish invaders who first ventured south of the equator on the Pacific coast during 1526 AD (Buys & Muse 1987, Muse 1991, Delgado 2002).

Puñón del Río, strategically located along the left bank of the lower Babahoyo river, came to function as a trade distribution centre for the Milagro polity. Surviving surface features at the site include a 5-m-high mound adjacent to an open plaza, in association with eight lower platform mounds. Surrounded by large expanses of seasonally inundated savanna, some 1600 ha of which were reclaimed for planting by raised field construction, Puñón del Río was situated just due east of the Cerrito Calentura, a primary surveillance point for river traffic. The site is ideally situated for bulking and transporting products within a larger complex of at least 48 400 ha of raised fields that were constructed throughout the Guayas Basin (Muse 1991: 278).

Archaeological excavations on Puñón del Río Mound VI recovered a rich faunal assemblage dating to 1350 AD. Previous analysis of these Milagro phase faunas identified marine, freshwater and terrestrial gastropods, crustaceans, marine fish, reptiles, birds and mammals, including possibly domesticated Llama (Stahl 1988). Continued analysis has expanded this list to include Guinea-Pig and the distal left tibiotarsus (Fig. 2) and complete left first phalanx (Fig. 3) of *Cairina moschata*.

Another part of this large system of raised fields in the lower Guayas Basin included the Taura complex, which lies immediately to the east, and possibly includes part of the Puñón del Río complex. This complex of over 186 km² of raised fields was controlled by a Milagro-Quevedo phase polity possibly associated with a three-tiered site hierarchy that included primary and secondary centres surrounded by rural villages and isolated households. A primary centre in the hierarchy was Jerusalén, a mound complex that had access to distant fields via an estero. The Jerusalén mound complex includes 137 mounds, with a core of large, probably residential mounds surrounding open plazas.

Excavations undertaken on Mound J9 in the site core recovered a rich faunal assemblage that was dominated by aquatic and terrestrial vertebrates. Again, domesticated Guinea-Pig and Llama were
associated with Muscovy Duck. The Muscovy Duck was identified on the basis of one charred and almost complete right tibiotarsus (Fig. 4) recovered toward the bottom of the slope of Mound J9 (Delgado 2002).

The sex and domesticated status of each specimen were evaluated using an exploratory methodology outlined in Stahl (2005). The procedure is based on detailed osteometric measurements taken from museum specimens, which can be applied to archaeologically recovered, often fragmented skeletal specimens. The Muscovy Duck shows considerable sexual size dimorphism, with non-overlapping ranges between large males and much smaller females. A statistically significant separation of male and female specimens is provided for 54 skeletal measurements. The same measurements can be used provisionally for osteometrically discriminating wild from domesticated animals. When applied to the Ecuadorian material, the Peñón del Río specimens clearly belong to a large, domesticated male. However, the Jerusalén specimen remains ambiguous; its size suggests that it could be a wild male or female, or even a small domesticated male, but in all likelihood not a domesticated female (Stahl 2005).

**DISCUSSION**

We do not know when, where or under what circumstances Muscovy Ducks were first domesticated by the pre-Columbian inhabitants of tropical America. A number of possible single or multiple centres for early domestication have been proposed, including the Central Andes, the southern Caribbean shore, Paraguay and the Argentinian Chaco, and/or the middle and lower Amazon (Donkin 1989, Angulo 1998: 70, Gilmore 1950: 462). It has been speculated that the relative ease with which the Muscovy Duck could
have adapted to life with humans was important in its domestication. Donkin (1989: 16–18) stresses the omnivorous Muscovy’s predilection for agricultural crops, its territorial habits, social gregariousness, promiscuity, fertility and overall fitness for cohabitation with humans. Angulo (1998) mentions its role in controlling insect infestation in sedentary communities as a major reason for early domestication.

In Ecuador today, Muscovy Ducks are found in wetland areas below 300 m asl on either side of the Andes, particularly in western Guayas province where they have been reported from the Yaguachi marshes close to both Jerusalén and Peñón del Río (Ridgley & Greenfield 2001: 122). Their earliest reference is provided in Pedro de Cieza de León’s 1535 description of Puerto Viejo, in which he mentions the xuta, a duck-sized bird that was domesticated, kept in native houses and considered good to eat (Cieza de León 1924: 156). Although Donkin (1989: 48) warns that another bird is known variably as yuta, yutu or yuthu, he is clearly referring here to some form of tinamou, local species of which tend to be relatively small, not easily confused with a duck, and unlikely to have been domesticated or kept in dwellings. Nonetheless, later 16th century documents describe domesticated ducks, possibly Muscovy, in Amazonian, northern Andean and western lowland areas of Ecuador (Donkin 1989: 69).

We have archaeological evidence of Muscovy Duck in various contexts from the southwestern lowlands of Ecuador after the time of Christ, and osteological evidence suggests that domesticated varieties were probably known to pre-Columbian inhabitants of the lower Guayas Basin, where they are associated with large mound sites and intensive raised field agriculture. Moreover, these later Milagro-Quevedo centres are believed to have engaged in exchange networks whose ultimate geographical reach was vast (Muse 1991). Elsewhere, Stahl (2003) has argued that non-native domesticated Guinea-Pigs and camelids may have appeared first in the northern Andes via terrestrial and/or marine trade. Beginning some time before Christ, a few domesticated animal specimens appear in specific, often non-utilitarian contexts at archaeological sites to or from which spondylid oysters were circulated. We can possibly add the domesticated Muscovy to the list of domesticated animals that was circulated, either intact or in portions, around the Andean area via pre-Columbian trade.

The discovery of some original point from which Muscovy Ducks were transported by humans will probably remain elusive. However, it is interesting to note their appearance with domesticated mammals and Spondylus molluscs during the first millennium BC, at a time and in an area where interregional interaction along longitudinal and latitudinal axes was critical (Shimada 1999: 481). Concerned with agriculture and human fertility, pre-Columbian cultures throughout the northern Andean area valued tropical warm water marine shells, particularly Spondylus, which was revered as a food for water-giving deities. This was very probably an ancient pattern that expanded into the direct and indirect trade of metal, gems, shells, beeswax, cotton, tobacco, cocoa, wood and various commodities throughout extensive areas as far as western Mexico. The likely focus of these societies was the shaman who represented the nexus of ideological and social interaction (Shimada 1999). Within this broader cultural context, Stahl (2003) has suggested that foreign exotics, including animals and animal products, may have been introduced through networks organized and controlled by elites in search of items from cosmographically and cosmologically distant sources.

The appearance of Muscovy Duck in prehistoric contexts along the Pacific watershed of Panama, certainly by the early centuries of the Christian era, may be associated with this movement of goods and exotics throughout the wider pre-Columbian world. Archaeologists have long suggested the important role of prehistoric linkages between Panama and distant areas, particularly Colombia and Ecuador. However, from available evidence, specialists working in Panama suggest that it may be premature at this point to link these areas unequivocally. Although long-distance interaction cannot be ruled out, many of the supporting artefacts used to demonstrate linkages lack good archaeological context, and the raw materials used in their production were potentially available on a local level (Cooke & Sánchez 2001; Cooke et al. 2003). Nonetheless, the active roles of prehispanic social and economic networks remain as potentially important mechanisms for the geographical distribution of animals both within and beyond their established ranges.

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