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Taphonomy and paleoecology of asphaltic Pleistocene vertebrate deposits of the western
Neotropics

By

Emily L. Lindsey

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requirements for the degree of

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in

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in the

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of the

University of California, Berkeley

Committee in charge:

Professor Anthony D. Barnosky, Chair

Professor David R. Lindberg

Professor Partick Kirch

Professor Justin Brashares

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Taphonomy and paleoecology of asphaltic Pleistocene vertebrate deposits of the western
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by Emily L. Lindsey

Abstract

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Emily Leigh Lindsey

Doctor of Philosophy in Integrative Biology

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Asphaltic deposits, or “tar pits,” present a unique opportunity to investigate the paleobiology and paleoecology of Quaternary mammals due to their tendency to accumulate and preserve remains of numerous taxa, along with associated materials that can aid in paleoenvironmental and chronological analyses. This role is especially important in areas with low preservation potential or incomplete sampling, such as the Neotropics.

Fossil deposits in the asphaltic sediments of the Santa Elena Peninsula in southwestern Ecuador contain some of the largest and best-preserved assemblages of Pleistocene megafaunal remains known from the neotropics, and thus represent an opportunity to greatly expand our knowledge of Pleistocene paleoecology and the extinction of Quaternary megafauna in this region. This dissertation reports data from excavations at Tanque Loma, a new late-Pleistocene locality on the Santa Elena Peninsula that preserves a dense assemblage of megafaunal remains in hydrocarbon-saturated sediments along with microfaunal and paleobotanical material.

Chapter 1 details the results of three years of excavations and associated sedimentological, stratigraphic, systematic, taphonomic, and chronological studies at Tanque Loma. Remains of extinct Pleistocene megafauna are encountered within and up to one meter above a laterally extensive asphalt-saturated sandstone layer along with abundant plant material. Several meters of presumed-Holocene sediments overlying the megafauna-bearing strata are rich in microvertebrate remains including birds, squamates, and rodents, most likely representing raptor assemblages. While over 1,000 megafaunal bones have been identified from the Pleistocene strata at Tanque Loma, more than 85% of these remains pertain to a single species, the giant ground sloth *Eremotherium laurellardi*. Only five other megafauna taxa have been identified from this site, including *Glossotherium tropicorum*, *Holmesina occidentalis*, *cf. Notiomastodon platensis*, *Equus (Amerhippus) santaelenae*, and a cervid tentatively assigned to *cf. Odocoileus salinae* based on body size and geography. No carnivores have yet been identified from Tanque Loma, and microvertebrate remains are

extremely rare in the megafauna-bearing deposits, although terrestrial snail shells and fragmented remains of marine invertebrates are occasionally encountered. Accelerator Mass Spectrometry radiocarbon dates on *Eremotherium* and *c.f. Notiomastom* bones from within and just above the asphaltic layer yielded dates of around 17,000 - 23,500 radiocarbon years BP.

Taken together, the taxonomic composition, taphonomy, geologic context, and sedimentology of Tanque Loma suggest that this site represents a bone bed assemblage in a heavily vegetated, low-energy riparian environment with secondary infiltration of asphalt that helped preserve the bones.

The large accumulation of one taxon, *Eremotherium laurillardi*, at Tanque Loma offers a unique opportunity to investigate the ecology and behavior of this species. Chapter 2 uses data from this and other paleontological localities as well as modern African ecosystems to investigate the formation of the *E. laurillardi* assemblage at Tanque Loma and the behavioral ecology and life history of this species. Multiple lines of evidence, including a monodominant taxonomic composition; a multigenerational age structure with prime adult individuals well-represented; sediments suggestive of a low-energy anoxic aquatic environment; and the presence of abundant plant material that appears to pertain to coprolites of *E. laurillardi*; suggest that these sloths congregated and died in a protracted mass mortality event in a marshy riparian habitat. The evidence is consistent with a mass death due to drought and/or disease in a shallow watering hole, paralleling situations observed among large wallowing herbivores in Africa today. Furthermore, several neonate and fetal individuals are present in the deposit, suggesting that this species may have had a distinct breeding season, which is also common among large herbivores in seasonally dry tropical environments.

Chapter 3 endeavors to offer context for the Tanque Loma locality by combining data from these excavations with analyses of other asphaltic vertebrate localities in the region. The most well known asphaltic paleontological locality in tropical South America is the Talara tar seeps in northwest Peru, which has yielded a great diversity of microfossils as well as extinct megafauna. In addition, two other highly productive asphaltic localities have been excavated on the Santa Elena Peninsula -- the La Carolina locality excavated by Robert Hoffstetter in the 1940's, and the Coralito locality excavated by Franz Spillmann in the 1930's and A. Gordon Edmund in the 1960's. I examined fossils from these excavations currently housed in the collections of the Museo Gustavo Orces in Quito, Ecuador, the Royal Ontario Museum in Toronto, Canada, and the Museum National d'Histoire Naturelle in Paris, France, in order to compare the depositional and environmental contexts of these different sites and to investigate the paleoecology and biogeography of the mammal taxa preserved therein. In general, the communities of megaherbivores are comparable between these geographically close sites, but Talara and La Carolina present a much more diverse assemblage of birds, micromammals, and carnivores as compared with the other two localities. Taxonomic, geomorphological, and taphonomic data indicate that these two sites were most likely "tar pit" style traps analogous to the famous Rancho La Brea locality in California, USA, while the SEP sites Coralito and Tanque Loma likely represent fossil

assemblages in marshy or estuarine settings with secondary infiltration of tar. In addition, geological and taxonomic differences between the nearby localities Coralito and Tanque Loma suggest differences in local paleoenvironments and lends further support for the hypothesis of gregarious behavior in at least two species of extinct giant ground sloths.

Finally, the radiocarbon dates so far obtained on extinct taxa at Tanque Loma and the other asphaltic localities examined here are consistent with a model positing earlier extinctions of megafauna in tropical South America than of related taxa further south on the continent, although this observed pattern may be an artifact of low sampling in the region.

For Dr. Thomas W. Stafford, Jr.
Longtime mentor, colleague, and friend.

Table of Contents

| | |
|---|-----|
| Acknowledgements..... | iii |
| Chapter 1. Tanque Loma, a new late-Pleistocene megafaunal tar seep locality from southwest Ecuador..... | 1 |
| Chapter 2. Sociality, wallowing, and drought-related mortality in Pleistocene giant ground sloths from the Tanque Loma locality, Santa Elena, Ecuador..... | 44 |
| Chapter 3. “Tar pits” of the western Neotropics: paleoecology, taphonomy, and mammalian biogeography..... | 58 |

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Chapter 1

Tanque Loma, a new late-Pleistocene megafaunal tar seep locality from southwest Ecuador

1. Introduction

Asphaltic paleontological localities (known colloquially as “tar pits”) serve as unique repositories of Quaternary paleontological resources, due to their extremely high preservation potential (Ho 1965, McMenamin *et al.* 1982, Akersten *et al.* 1983). The rich accumulations of bone, along with insect remains and plant material, preserved in asphalt seeps allow a wide range of paleontological investigations, including paleoecological comparisons (e.g., Lemon & Churcher 1961), studies of biology (e.g., Feranec 2004) and behavior (e.g., Carbone *et al.* 2009) of prehistoric animals, and analyses of changes in the ecology of species and communities as ecosystems approached the terminal Pleistocene (e.g., Van Valkenburgh & Hertel 1993, Coltrain *et al.* 2004). In addition many asphalt seeps, such as the famous Rancho La Brea locality in Los Angeles, California, USA, appear to have acted as “traps,” preserving a cross-section of local ecosystems (Stock & Harris 1992), and thus present researchers with a biodiversity baseline against which to measure the effects of later extinctions.

Asphalt seeps are also important because they can preserve biological material in geographic areas with otherwise poor preservation, such as the wet tropics, thus providing vital insight into the paleofauna and paleoecology of these little-known areas (e.g. Prevosti & Rincon 2007). In the Neotropics, fossiliferous asphalt seeps are known from northwest Peru (Lemon & Churcher 1961, Churcher 1959, 1966, Czaplewski 1990), southwest Ecuador (Hoffstetter 1952, Campbell 1976), Venezuela (Rincon 2006a, b, 2008, 2011, Czaplewski *et al.* 2005, Prevosti & Rincon 2007, Rincon *et al.* 2009, Holanda & Rincon 2012), Cuba (Iturralde-Vinent *et al.* 2000) and Trinidad (Blair 1927, Wing 1962). Unfortunately, only one of these localities – Las Breas de San Felipe in Cuba (Iturralde-Vinent *et al.* 2000) -- has ever been excavated in a systematic, stratigraphically-controlled manner, which limits investigators’ ability to draw meaningful conclusions about the formation, chronology, and faunal associations at these sites.

Here we present results of excavations at a new neotropical Pleistocene asphaltic locality, Tanque Loma, Ecuador. Tanque Loma comprises an extensive stratigraphic sequence of deposits stretching from at least the late Pleistocene through today. Megafaunal remains are concentrated in and just above asphaltic sediments in the lower part of the deposit, which also contain abundant plant material and occasional invertebrate remains. Higher, presumably Holocene strata contain abundant microvertebrate bones interspersed with layers of charcoal. While the research presented here focuses predominantly on Tanque Loma’s megafaunal deposits, the sedimentology and paleoclimatic implications of the presumed-Holocene strata will be discussed briefly as well.

This study constitutes the first stratigraphically-controlled paleontological excavation in the fossiliferous and oil-rich deposits of the Santa Elena Peninsula in southwest Ecuador. The Santa Elena Peninsula is an important paleontological region

because it contains numerous fossiliferous localities preserving a rich accumulation of late-Quaternary fauna in an area (tropical South America) where we currently have relatively little data regarding Pleistocene ecosystems and taxa. Quaternary vertebrate localities in the Neotropics are relatively rare, and only a dozen published direct radiocarbon dates exist on any Quaternary mammals from this region (Barnosky & Lindsey 2010). The Santa Elena Peninsula, with its vast fossil deposits preserved in petroleum-saturated sediments, thus represents one of the best opportunities to investigate Pleistocene fauna, ecosystems and extinction dynamics in the South American tropics.

2. Regional Context

The Tanque Loma paleontological locality is located on the northern side of the Santa Elena Peninsula in southwest Ecuador (Figure 1.1). The site lies at 2° 13' S, 80° 53' W, between the municipalities of La Libertad and Santa Elena, approximately 800 meters from the modern coastline. The current elevation of the site is 69.5 meters above sea level.

The Santa Elena Peninsula is relatively young, having emerged sometime after the beginning of the Pleistocene, and tectonic uplift has continued throughout the Holocene (Sheppard 1930, 1937, Edmund 1965, Stothert 1985, 2011, Damp *et al.* 1990, Ficarelli *et al.* 2003). The Peninsula comprises one or more Pleistocene marine terraces, known regionally as *Tablazos*. Some authors (Sheppard 1928 & 1937; Hoffstetter 1948a & 1952; Ficarelli *et al.* 2003) recognize three wave-cut terraces, while others (Sarma 1974; Pedoja *et al.* 2006) recognize four, at least in some parts of the Peninsula. Still others (Marchant 1961; Ecuadorian Instituto Geografico Militar [IGM] 1974) propose a single, faulted terrace. Three *tablazos* have also been proposed for the nearby Talara region of northwestern Peru (Lemon & Churcher 1961). Since the present study did not include a detailed regional geological analysis that would help to resolve this issue, we will refer to this feature simply as the *Tablazo formation* (*sensu* IGM 1974, Pedoja *et al.* 2006). The Tablazo formation, which reaches a thickness of up to 40 meters, is composed of calcareous sandstones, sands, sandy limestones and fine conglomerates, with abundant gastropod, barnacle and echinoid fossils (Barker 1933, IGM 1974). These deposits are cut by numerous dry riverbeds (*arroyos*), most of which only contain appreciable water during periods of high rainfall, generally associated with El Niño events (Spillmann 1940).

The Tablazo formation unconformably overlies Tertiary (Eocene - Miocene) deposits of (primarily) limestones, shales, sandstones, and conglomerates (Sheppard 1937, IGM 1974). These include the Tosagua formation (upper Oligocene - lower Miocene), the Zapotal formation (Upper Eocene-lower Oligocene), the Ancon group (mid - upper Eocene), and the Azucar group (lower Paleocene - middle Eocene). The oil that seeps to the surface in the Tablazo deposits is thought to emanate from sandstones in these latter two groups (Sheppard 1937, IGM 1974; *but see* Jaillard *et al.* 1995). Two late Mesozoic deposits, the upper Cretaceous Cayo formation and the Jurassic-Cretaceous Piñon Complex outcrop at a few points throughout the Peninsula (Figure 1.1).

Industrial oil exploration has occurred on the Santa Elena Peninsula since the late 19th Century (Peláez-Samaniego *et al.* 2007), but the surface tar seeps have been exploited since prehistoric times by indigenous cultures and, later, Spanish explorers to seal boats, a

practice that continued into the 20th Century (Bengston 1924, Colman 1970, Bogin 1982). In the early 1900's, and continuing through at least the 1970's, shallow oil wells (*pozos*) were dug to extract oil by hand (Bengston 1924, Colman 1970), and bones of Pleistocene megafauna are still visible protruding from the walls of these pits today. Megafauna bones are also visible in the many dry riverbanks that riddle the Peninsula (Barker 1933) and are commonly found in surface oil deposits (Colman 1970).

Previous paleontological work on the Peninsula by Spillmann (1931, 1935, 1940), Hoffstetter (1948, 1952), Edmund (1965 & *unpublished field notes*) and Ficarelli *et al.* (2003) has yielded numerous mammal fossils, in both asphaltic and non-asphaltic contexts (Table 1.1). The Peninsula has been inhabited since at least 10,800 BP (Stohtert *et al.* 2003) and a significant amount of archaeological research has been conducted in this region (Bushnell 1951, Sarma 1970, Stohtert 1983, 1985, 2011; Stohtert *et al.* 2003). However, with the possible exception of the Cautivo locality (Ficarelli *et al.* 2003), there is no documented evidence of associations between ancient humans and extinct Pleistocene megamammals.

2.1 Paleoenvironment

Modern climate in western Ecuador is heavily influenced by upwelling of the Humboldt Current, the Intertropical Convergence Zone (ITCZ), and the El Niño Southern Oscillation (ENSO) (Tellkamp 2005), and these factors were probably major drivers of Pleistocene climate in the region as well. Some researchers (Campbell 1976, Koutavas *et al.* 2002) have suggested that during the Pleistocene, ENSO conditions – which today result in significantly higher rainfalls on the western SEP (Sheppard 1937, Bogin 1982) – may have been a persistent phenomenon in this region. However, this does not appear to have resulted in the establishment of wet tropical forest ecosystems as are typical of the northern Ecuadorian coast today. Sea core isotopic and pollen data (Heusser & Shackleton 1994) indicate that western Ecuador experienced cool, dry conditions during the last glacial, between approximately 28,000 – 16,000 BP, resulting in the expansion of grasslands at least in the Andes. This same pattern is also noted in pollen records of neighboring Colombia (van der Hammen 1978) and Peru (Hansen *et al.* 1984). Precipitation in the region appears to have reached its lowest levels around 15,000 RCYBP (Tellkamp 2005).

The end of the Pleistocene (approximately 14,000 to 10,000 years ago) was marked by warmer temperatures and a dramatic increase in precipitation (Heusser & Shackleton 1994, Tellkamp 2005) which, combined with the resultant erosional runoff and rising sea levels, resulted in the widespread establishment of mangrove swamps along the Ecuadorian coast, including the SEP (Heusser & Shackleton 1994). Sarma (1974) notes a trend of increasing aridity throughout the Holocene, with brief returns to fluvial conditions around 7,500 and 4,000 years ago. In the last century, vegetation cover has been substantially reduced through human activities, including deforestation (Marchant 1958, Bogin 1982, Stohtert 1985, 2011).

Today, the Santa Elena Peninsula is a coastal desert with very little vegetation except where underground springs provide permanent standing-water in otherwise

usually dry arroyos (Stoother 1985). Whether this modern landscape is due primarily to early Holocene climatic changes (Sarma 1974), to mid-Holocene uplift (Damp *et al.* 1990), or to relatively recent intervention by humans (Stoother 1985, Ficarelli *et al.* 2003), is still a matter of debate.

3. Materials & Methods

The megafaunal deposit at Tanque Loma was discovered in 2003 by Ecuador's state-run oil company, PetroPenínsula, when an excavator removed the edge of a hill during maintenance on an adjacent naturally-occurring oil seep. Initial excavations were conducted in 2003 – 2006 by a team of archaeology students from the Universidad Estatal Península de Santa Elena (UPSE) under the direction of Arqueólogo Eric X. Lopez Reyes. The Museo Paleontológico Megaterio (MPM) was constructed at UPSE to house the excavated remains. Additional excavations were conducted in 2009-2011 by teams from the University of California – Berkeley, UPSE, and the George C. Page Museum led by ELL. The name of the locality derives from the hill (*loma*) whose eastern margin overlies the deposit, on which sit a number of large oil cisterns (*tanques*).

All bones excavated from Tanque Loma are repositated at the MPM in Santa Elena, Ecuador. Fossils excavated during the 2003 – 2006 excavations have been fully prepared and were included in the faunal analyses in this study. Fossils excavated between 2009 and 2011 are still in process of preparation, and were included in the taphonomic studies of the deposits, but not the quantitative faunal analyses. However, in general the material recovered during the later field seasons appears to conform to the patterns noted for the earlier excavations, comprising predominantly intact, large bones of megatherid sloth and occasionally gomphotherid. The one notable difference is the discovery, in 2010, of a few rib fragments that appear to belong to a large carnivore, possibly *Smilodon*, though these have yet to be prepared and definitively identified.

3.1 Excavation

A grid made of irregular rectangular units (measuring 2-4 meters in width by 3-5 meters in length) was established in December of 2003, and added to throughout 2005 and 2006 (Figure 1.2). The 2009 – 2011 excavations proceeded in the pre-established units, three of which (units 8, 9, and 10) had been partially excavated during 2005 and 2006, leaving material in the western portion of these grid units *in-situ* in the hopes of establishing a Paleontological Park at the site. This material was removed during the 2009 excavations, as negotiations with the local governments had unfortunately stalled, making the designation of a Paleopark unlikely. Each of the rectangular units in the grid was excavated by stratigraphic layers of 10 cm – 20 cm, and the positions of all fossil remains and large (> 15cm) clasts and wood pieces within each layer were mapped. Three-dimensional positional data was taken for all mapped objects, and in the final two years of excavation (2010-2011) 3-D orientation within the deposit was determined using a Brunton compass for all objects >10 cm that had a length equal to at least twice their width.

3.2 Stratigraphy and Sedimentology

Detailed stratigraphic studies of the Pleistocene and Holocene deposits at Tanque Loma were made by ELL in 2009 – 2011. These descriptive studies were supplemented with laboratory analyses of sediment grain size, soil pH, and organic carbon content, conducted by ELL at the University of California – Berkeley in 2011-2012.

In the sediment grain size analyses, approximately 200 g of sediment from each stratum was passed through a series of nested screens ranging from -3ϕ to 3ϕ . Continuously running water was used to ensure that clumps were fully disintegrated. Dried sediment samples were weighed before and after screening to determine the percentage of sediment grains and clasts in each size class.

The pH of sediment samples was measured using a pH meter (Oakton Acorn series pH 5). Ten grams of dry sediment were weighed and combined with 20 mL of deionized water. Samples were allowed to sit in the water for 30 minutes, after which the calibrated pH and temperature probes were immersed and stirred in the sediment mixture. Measurements were repeated three times for each sample, and then averaged.

Organic carbon content of the different sediment layers was determined by Loss-on-Ignition (LOI) analysis (*sensu* Dean 1974). Oven-dry sediment samples were weighed in crucibles of known weight, then baked in a Thermoline 30400 oven at 560° C for one hour. Some samples had papery, black, charred material clinging to the crucibles after one hour in the oven; in this case baking continued for up to six hours, until all charred material had disappeared. Baked samples were cooled in a desiccator, then re-weighed to determine the amount of carbon combusted.

To comply with U.S. Department of Agriculture standards, all sediment samples were sterilized prior to analysis by baking in a Thermo Scientific Precision 6526 oven at 155° C for 0.5 hours, but this should have had no effect on the conclusions of any of the analyses reported here.

3.3 Faunal analyses

Prepared bones housed in the MPM collections were identified and analyzed by ELL in collaboration with H.G. McDonald of the U.S. National Parks Service. Because material collected during the 2009 – 2011 field seasons has not been fully prepared, only specimens collected during the 2004 – 2006 field seasons were considered in the faunal analyses, including species composition, population demographics, NISP, MNI, and element counts. For each specimen, information regarding taxon, element, age of organism, percent present, and part preserved was recorded. In addition, notes were taken on taphonomic markings including as scratches, weathering, breakage, erosion, and punctures. Taxonomic, demographic, and taphonomic data were compared with published information from other localities of known origin to investigate the environmental and depositional context of the site.

3.4 Radiocarbon analyses

Accelerator mass spectrometry (AMS) radiocarbon dating was attempted for five bones from the Tanque Loma locality. The bones analyzed included 1) a manual phalanx from an adult *Eremotherium* (Field # HE 616) found during the 2009 field season at the interface of Strata IV and V; 2) a *Notiomastodon* caudal vertebra (MPM291) and 3) a *Notiomastodon* metapodial (MPM325) excavated during the 2004 field season from the lower part of Stratum IV; 4) an *Eremotherium* vertebral epiphysis excavated during the 2009 field season from the upper part of Stratum IV; and 5) an Aves phalanx recovered during screening in 2011 from the lower part of Stratum III (Figures 1.2 and 1.3).

All bone samples were prepared by ELL at the Center for Accelerator Mass Spectrometry (CAMS) at Lawrence Livermore National Laboratories in Livermore, California, USA. Bone samples were collected and the outermost layer of bone from each sample was removed using a Dremel Tool to avoid contamination from adhering sediments. Samples consisting of 120mg – 150mg of un-crushed bone were decalcified in 0.5N HCl at 38°C for 24 - 72 hours, until the bone had a spongy texture. Decalcified samples were placed in 0.01N HCl at 58°C for 16 hours to unwind the collagen. Collagen samples were filtered through Whatman® quartz fiber filters with vacuum suction and then ultrafiltered in Centriprep® centrifugal filters that had been pre-rinsed via centrifuge four times in Milli-Q purified water. The ultrafiltered collagen was freeze-dried, then combusted with Copper oxide (CuO) and silver, and the resultant carbon dioxide was graphitized. Graphite targets were analyzed in an accelerator mass spectrometer by Tom Guilderson at CAMS.

Because all bones were found at or above the top of Stratum V, and did not show any evidence of contamination by asphalt, no solvents were used for tar extraction on any of these five samples.

4. Results

4.1 Stratigraphy and Sedimentology

Seven distinct sedimentary strata have been identified overlying the limestone bedrock at Tanque Loma (Figure 1.3). The lower strata (IV – VII) are presumed to be latter-Pleistocene (Lujanian: 0.781 Ma – 0.012 Ma) in age, based on the presence of bones of extinct megafauna including ground sloths, horse, and gomphothere in these layers. Radiocarbon dates obtained on some of these megafauna bones (reported herein) support this conclusion. The strata above these layers (Strata I – III) are inferred to be Holocene, based on a marked change in deposition and the absence of extinct taxa. (It should be noted that extant megafauna have not been recovered from Strata I – III either, and attempts at radiocarbon dating of material from these layers have so far proved unsuccessful. However, the stark change in depositional characteristics (see below), along with other indicators of paleoenvironmental change detailed below, cause us to tentatively assign a Holocene age to these strata).

The uppermost stratum (Stratum I) is modern colluvium measuring 30 cm – 45 cm thick, washed down from the hill overlying the deposit. This stratum consists of uncompacted, poorly-sorted, friable, brown (10YR 4/3) sediment with abundant plant material (mostly modern plant roots) and angular limestone clasts up to 3 cm in diameter. The sediments are composed of roughly 26% gravels, 20% sands, and 50% muds (silts or clays). The sediments have a pH of 6.6 and contain only about 3% organic carbon (Table 1.2). Sixty liters of sediment from Stratum I were sifted through nested 2- 4- 8- and 16-mesh screens, but no vertebrate remains were encountered.

Stratum II is a 45 cm - 80 cm thick grey-brown (10YR 5/2) silty paleosol, with poorly-sorted very small (2 mm) clasts and CaCO₃ nodules throughout. Approximately 2% of Stratum II sediments are gravels, 15% are sands and > 82% are muds. This stratum appears to have been deposited in slow-moving water, probably a meandering river. Organic carbon content of this stratum is very low (about 4%) and pH of the sediments is 7.6. Twenty liters of Stratum II sediments were sifted through 2- 4- 8- and 16-mesh screens, but no vertebrate remains were encountered.

Stratum III is 95 cm – 160 cm thick and comprises 15 distinct unconsolidated sedimentary layers (Table 1.2). Some of these layers occur as graded beds likely deposited during flooding events, while others appear as laminated beds probably deposited in still water. Repeated episodes of desiccation and paleosol development are evident in this stratum. Some of the layers are very thin (< 1 cm thick) and appear to contain substantial amounts of charcoal. Such layers have a very high organic carbon content (> 40%) and contain macroscopic pieces of charcoal. The various layers of Stratum III vary widely in sediment composition, from 1% to > 50% gravels, 6% to 52% sands, and 22% to > 92% muds. The pH of the sediments generally increases from the upper to lower layers, ranging from 5.7 at the top to 7.8 in the lowermost layer. Stratum III is extremely rich in microvertebrate remains, and thousands of bones of birds, squamates, and small mammals have been recovered through dry- and wet-screening of these layers. No remains of extinct megafauna have been encountered in Stratum III.

Strata IV – V (and likely VI – VII as well) comprise the Pleistocene (Lujanian) deposits at Tanque Loma. Stratum IV unconformably underlies Stratum III. At the contact with Stratum III there is occasionally present a 1 mm – 2 mm thick layer of black powdery sediment with some plant material, apparently charcoal. Below this thin line, and extending irregularly down into the top of Stratum IV, occasionally forming rootlet casts, is a calcareous deposit interpreted as caliche. Stratum IV is a compact, silt-sand paleosol that has a maximum thickness of 110 cm, reduced to 55 cm towards the west corner of the excavated grid units where the underlying bedrock protrudes upward. Stratum IV can be divided into upper and lower segments of about equal thickness in most of the site, distinguishable by color (7.5 YR 4/4 vs. 10 YR 4/3, respectively) as well as clast size and abundance. These two sub-strata may represent separate episodes of sediment deposition and paleosol development. The upper sub-stratum is a weakly-graded, sandy matrix supporting abundant small (mostly 1 – 2cm) clasts. Small (1mm – 3mm) carbonate nodules are also present in this sub-stratum, especially the upper section. The lower sub-stratum contains numerous clasts, with 90% - 95% of the clasts being moderately-to-largely-spherical, angular clasts 1 cm - 25 cm in diameter and the remaining 5% - 10% of the clasts being moderately spherical, rounded (fluvial) rocks, 0.5 – 5 cm diameter. This

layer is moderately graded, containing ~40% 0.5 cm-diameter angular clasts in the lower 40 cm of the deposit, 20% 2-3 cm diameter subangular-angular clasts in the lower 25 cm, and 10% 4-5 cm subangular-angular clasts in the lower 10 cm. Fragments of sea urchin spines and bits of shell are found throughout this layer, and small (1 cm – 2 cm long, 2 mm – 3 mm diameter) twig fragments are abundant in the lower part near the contact with Stratum V.

The matrix sediments of Stratum IV are made up of approximately 6% gravels, 25% sands and 68% muds, and contain about 11% organic carbon. The pH of Stratum IV sediments is 7.4. Cobbles up to 20cm in length are occasionally encountered. Megafauna bones are present throughout Stratum IV, but are sparse and fragmentary towards the top of the deposit, growing more abundant and better preserved towards the bottom (Figure 1.4). Megafauna bones are highly abundant in the lower 20 cm of this stratum. Despite methodical excavation techniques and extensive screening, fewer than five microvertebrate bones have been discovered in Stratum IV. However, a substantial amount of paleobotanical material, including twigs, needle vesicles, and thorns, was recovered during screening.

Stratum V consists of sediments similar to the lowermost portion of Stratum IV, but these have become saturated with asphalt. In this layer megafaunal bones are so abundant as to constitute a clast-supported breccia of bones, cobbles and plant material. Wood pieces (up to 15 cm long) and cobbles (5 cm – 20 cm diameter) are relatively common. In many places, there is a “mat” of plant material (mostly consisting of 1 cm – 2 cm long twigs) lying immediately on top of bones. Stratum V extends in a continuous layer of approximately 50 cm thickness throughout the entirety of the locality. In some places, this layer is seen to undercut the bedrock forming the nucleus of the hill. Sediments in certain areas of the deposit contain a substantial amount of liquid tar (sometimes in amounts sufficient to impede excavations), while the sediments in other areas are drier, though still completely saturated. The sediments most saturated with oil contact fissures where oil is actively seeping. Many other active seeps are visible on the land surface in riverbeds and hillsides in the immediate vicinity of the site.

Stratum VI is a silty, grey-green, anoxic sediment that oxidizes quickly to dark brown-black when exposed to air. This stratum is interpreted as a gley.

Stratum VII is a compact, sterile green clay. The depth of this layer varies substantially depending on the location of the underlying bedrock.

The bedrock layer at Tanque Loma consists of highly friable white limestone. This rock appears to form the nucleus of the hill overlying the locality. It protrudes into the Pleistocene strata at the western edge of the excavation (Figure 1.2) and slopes steeply downward to the east.

4.2 Faunal Composition and Taphonomy

To date, approximately 200 m³ of megafauna-bearing deposit have been excavated at the Tanque Loma locality. The full extent of the deposit is still unknown, but the fossiliferous layer is observed to continue to the north, south and southwest of the excavated sections. In the 2003 – 2006 excavations, a minimum 663 megafaunal bone

elements were excavated and prepared from approximately 140 m³ of deposit. Bones deposited in the lower (tar-saturated) sediments at Tanque Loma are generally in good condition and not heavily fragmented. 68% of bones, excluding vertebrae, ribs, & cranial elements, are ≥ 75% complete. 45% of these are 100% complete.

4.2.1 Systematic Paleontology

The megafaunal specimens so far prepared from the Tanque Loma locality comprise two species of ground sloth, one species of gomphothere, one species of pampathere, one species of horse, and a cervid.

ORDER: PILOSA Flower, 1883

FAMILY: MEGATHERIIDAE Owen, 1842

GENUS: *EREMOTHERIUM* Spillmann, 1948

Eremotherium laurillardi Lund, 1842

Referred material: This taxon is represented by at least 571 individual elements comprising nearly every skeletal element (excluding some small podials, sternbrae, and sesamoids) (Figure 1.5; *See Appendix A for complete list of specimens*).

Remarks: The two Pleistocene megatheriid sloth species from South America are *Megatherium americanum* and *Eremotherium laurillardi* (Cartelle and De Iuliis 1995, 2006). These two genera are distinguishable by features of the skull, teeth, manus, and femur (De Iuliis & Cartelle 1994, Cartelle & De Iuliis 1995, Tito 2008, McDonald & Lundelius 2009). The diagnostic manual bone, the metacarpal-carpal complex, has not been identified among the megathere elements at Tanque Loma. However, the other diagnostic megathere elements at this site are consistent with *E. laurillardi*. The maxillae so far prepared from Tanque Loma that include the premaxillary contact (n = 2) exhibit a triangular suture. This is in contrast with the suture in *Megatherium* which is rectangular, and well-fused to the maxilla (Cartelle & De Iuliis 1995). The prepared mandibles (n = 11) that include the anterior portion through at least the first molariform have a mandibular symphysis that terminates at m1 (Figure 1.5-D); this is in contrast with *Megatherium*, in which the mandibular symphysis ends at the m2 (Cartelle & De Iuliis 1995). Finally, the complete prepared femora (n = 8) possess relatively rectilinear (rather than convex) femoral margins (Figure 1.5-E). Based on these morphologically distinctive specimens, and since *M. americanum* is not known to be associated with tropical lowlands (e.g. Bargo *et al.* 2006) it is reasonable to assume that the associated megathere elements at Tanque Loma belong to *E. laurillardi* as well.

The presence of a second, smaller megathere species, *Megatherium* (= *Pseudomegatherium* = *Eremotherium*) *elenese*, in the region is still debated (Pujos & Salas 2004, Tito 2008). However, because this question has never been well-resolved, we follow Cartelle & De Iuliis (1995, 2006) in assigning all megathere material in this study to *E. laurillardi*.

ORDER: PILOSA Flower, 1883
FAMILY: MYLODONTIDAE Gill, 1872
GENUS: *GLOSSOTHERIUM* Owen, 1840
Glossotherium tropicorum Hoffstetter, 1952

Referred material: The second sloth species at Tanque Loma is represented by two humeri, two ulnae, one thoracic vertebra, two (fused) sacral vertebrae, one partial mandible, and one isolated tooth, probably pertaining to a neonate or fetus. (Figure 1.6 A-C; see Appendix A for specimen numbers).

Remarks: These remains are assignable to *Glossotherium tropicorum* based on several diagnostic cranial and postcranial characters. The mandible lacks teeth and is missing the alveoli for m1 – m3, but the m4 alveolus indicates an elongate tooth consisting of two oblique lobes (Hoffstetter 1952, Roman-Carrion 2007, Pitana *et al.* 2013). The mandible is robust and deep in the back, tapering towards the front (Hoffstetter 1952, Roman-Carrion 2007) (Figure 1.6-A). The deltoid tuberosity of the humerus is very well-developed (Figure 1.6-B), and the ulna is stout, with a well-developed olecranon process (Figure 1.6-C).

Glossotherium tropicorum was first identified from the close-by La Carolina locality (Hoffstetter 1952) and remains the only *Glossotherium* species that has been identified from coastal Ecuador. Despite their close morphological resemblance, the South American *Glossotherium* is considered distinct from the closely-related North American genus *Paramylodon* based on characteristics of the cranium, which is relatively wider in *Glossotherium* and longer in *Paramylodon*, and mandible, which in *Glossotherium* is slightly shorter and exhibits a more flared premental spout (McAfee 2009).

ORDER: CINGULATA Illiger, 1811
FAMILY: PAMPATHERIIDAE Paula Couto, 1954
GENUS: *HOLMESINA* Simpson, 1930
Holmesina occidentalis Hoffstetter, 1952

Referred material: The pampathere is represented by four buckler osteoderms (Figure 1.6-D; Appendix A for specimen numbers).

Remarks: Osteoderms are diagnostic for South American Quaternary pampatheres (Scillato-Yané *et al.* 2005). The pampathere osteoderms discovered at Tanque Loma correspond to *Holmesina occidentalis*. The osteoderms are subrectangular and not very thick. They display a relatively uniform exterior with smooth bone extending almost all the way out to the lateral margin, and a narrow, well-defined, raised central figure (Edmund 1996, Scillato-Yané *et al.* 2005).

Two genera of pampatheres, *Holmesina* and *Pampatherium*, are known from the late Pleistocene of South America, and only one species – *H. occidentalis* – has been reported from the northern Pacific coast (Edmund 1996, Scillato-Yané *et al.* 2005).

ORDER: PROBOSCIDEA Illiger, 1811
FAMILY: GOMPHOTHERIIDAE Cabrera, 1929
GENUS: *NOTIOMASTODON* Cabrera, 1929
Notiomastodon platensis Ameghino, 1888

Referred material: The gomphothere species is represented by a minimum of 76 elements, comprising a partial pelvis, three femora, four tibiae, and numerous vertebrae, ribs, carpals, tarsals, metatarsals and phalanges (Figure 1.7-A; Appendix A for list of specimen numbers).

Remarks: Postcrania have not been considered taxonomically diagnostic for Gomphotheres (e.g.: Ficarelli *et al.* 1995, Prado *et al.* 2005, Ferretti 2008, Lucas & Alvarado 1991). However, the most recent analysis (Mothé *et al.* 2012) recognizes only one species of lowland gomphothere in the South American Pleistocene. We therefore assign the gomphothere species present at Tanque Loma to *cf Notiomastodon platensis*.

ORDER: PERISSODACTYLA Owen 1848
FAMILY: EQUIDAE Gray 1821
GENUS: *EQUUS* Linnaeus 1758
SUBGENUS: *EQUUS (AMERHIPPIUS)* Hoffstetter, 1950
Equus santaelenae Spillmann, 1938

Referred material: The equid is represented by two upper molars and one lower molar (Figure 1.7-B; Appendix A for specimen numbers).

Remarks: The horse teeth present at Tanque Loma coincide with descriptions of *Equus (Amerhippus) santaelenae*. Both upper and lower molars are relatively wide, and the enamel is complexly wrinkled (Prado & Alberdi 1994, Rincon *et al.* 2006). The one identifiable molar from the sample, the M3, presents an island in the isthmus of the protocone (Hoffstetter 1952).

Prado & Alberdi (1994) recognize five species of *Equus* (subgenus *Amerhippus*) from South America, with non-overlapping geographic distributions. Three of these species, *E. (A.) andinum*, *E. (A.) insulatus*, and *E. (A.) santaelenae*, have records from Ecuador, but the known ranges of the first two species are restricted to the Andes.

ORDER: ARTIODACTYLA Owen 1848
FAMILY: CERVIDAE Gray 1821
GENUS: *cf. ODOCOILEUS* Rafinesque 1832
cf. Odocoileus cf. O. salinae Frick 1937

Referred material: The cervid is represented only by two antler fragments, neither of which include the pedicle (Figure 1.7-C; Appendix A for specimen numbers).

Remarks: While the material is not sufficient to be diagnostic, we have tentatively assigned these remains to *Odocoileus salinae* as this is the only species of cervid that has been reported for the late Quaternary of coastal Ecuador (Hoffstetter 1952, Edmund 1965, Tomiati & Abbazzi 2002).

4.2.2 Bone orientation

Aside from a few *Eremotherium* vertebrae, no articulated megafaunal remains have been encountered at Tanque Loma, with one exception: the complete left hindquarters (including left ilium, femur, tibia, astragalus, calcaneum, metatarsals and some phalanges) of a juvenile *Notiomastodon* were found articulated in Stratum IV 15 cm- 30 cm above the contact with Stratum V in grid unit 9 (Figures 1.2 and 1.3).

An analysis of 91 bones and bone fragments excavated during the 2009 – 2011 field seasons from grid units 8, 9, 10, and 11 measuring greater than 30cm in length and with at least a 2:1 length:width ratio did not show any significant directional orientation (Kolmogorov-Smirnov test, $p=0.32$; Figure 1.8A).

Dip data was collected using a Brunton compass for 98 megafaunal bones in Strata IV and V of grid unit 11. Dip angles were generally shallow, with 16 bones having no dip at all, and only three bones dipping steeper than 40° (Figure 1.8B). The 80 bones with dip angles between 0° and 90° showed no pattern in directional orientation of the dipping end (Kolmogorov-Smirnov test, $p = 0.65$; Figure 1.8C). An analysis of dip orientation of only steeply-dipping (dip angle $\geq 20^\circ$) bones ($n = 19$) still revealed no pattern in orientation (Kolmogorov-Smirnov test, $p = 0.33$; Figure 1.8D). Only three of the bones in this analysis had a clear polarity (heavy end) so it was not possible to determine whether there was a consistent orientation to the heavy & light ends of the bones.

4.2.3 Bone condition and taphonomic markings

Most megafaunal bones in the lower (tar-saturated) part of Stratum IV are in good condition and do not exhibit substantial evidence of weathering (nearly all conform to weathering stages 0-1, *sensu* Behrensmeyer 1978). However, some bones present unusual taphonomic features including deep, smooth, conical holes and extensive irregular erosions or breakages on the ends (Figure 1.9). In addition, many bones are marked by abundant shallow, irregular, non-parallel scratches that are consistent with trampling abrasion (*sensu* Olsen & Shipman 1988; Figure 1.9 (B) & (F)). Bones in the upper substratum of Stratum IV, especially the upper 40 cm or so, are extremely fragmentary and do exhibit substantial weathering (Behrensmeyer weathering stages 3-5). There is no evidence of unequivocally human-caused modifications on any bones, and no tools or other evidence of human presence have been found in the megafauna-bearing strata of Tanque Loma.

4.2.4 Associated fauna

Almost no microvertebrates have been encountered in the megafauna-bearing strata of Tanque Loma. During 2010 and 2011, a few microvertebrate bone fragments 2 – 10 cm in length were collected. These correspond to several long bones of Aves and possibly one rodent, but have not yet been prepared and identified to more precise taxonomic levels. In addition, a dense microfaunal assemblage, consisting primarily of small (<= 3 cm) bird, squamate and rodent bones as typical of the Stratum III assemblages, was found precisely at the top of Stratum IV above the gomphothere skeleton in grid unit 9.

The most prevalent invertebrate fossils encountered in the Pleistocene deposits are sea urchin spine fragments and terrestrial gastropods of the genus *Porphyrobaphe*. Complete, isolated *Porphyrobaphe* shells are found throughout Strata IV and V.

4.2.5 Megafauna NISP, MNE, MNI, and MAU

The megafaunal bones and bone fragments excavated and prepared during the 2004-2006 field seasons comprise a minimum of 663 individual elements (NISP = 887). 571 of these elements, or roughly 86%, pertain to the extinct giant ground sloth *Eremotherium laurillardi*, representing a minimum of 16 individuals (Figure 1.10). These constitute a minimum of: nine adults, two juveniles, three neonates, and two individuals believed on the basis of size to be fetuses. An additional 76 elements, comprising roughly 11% of the identified material, pertain to the gomphothere *Notiomastodon platensis*, representing a minimum of three individuals (two juveniles and one adult). Eight elements of the Mylodont sloth *Glossotherium tropicorum* representing at least three individuals (one adult, one juvenile and one neonate or fetus); three *Equus santaelenae* teeth (MNI = 2 adults), and two fragments of antler, most likely pertaining to the cervid *Odocoileus* (*cf. O. salinae*) (MNI = 1 adult) were also recovered during the first three years of excavation. In addition, four osteoderms from the Pamphathere *Holmesina occidentalis* (MNI = 1 adult) were recovered from a test pit dug about 1m east of Grid unit 1 (Figure 1.2).

Minimum Animal Units (MAU) were calculated for *Eremotherium* by dividing the MNE for each element by the number of times that bone is represented in an individual skeleton (*sensu* Spencer *et al.* 2003). MAU is a metric used for determining completeness of skeletons and whether certain elements are over- or underrepresented, which can be useful in determining taphonomic process such as winnowing, predation, or human action (Voorhies 1969, Spencer *et al.* 2003). Percent MAU was calculated by dividing each MAU value by the MAU value for the most-represented element. For *Eremotherium*, the most common element (and thus, the one with 100% MAU) found in the deposit was the tibia, followed by the humerus (74% MAU). Astragali, femora, radii, innominates, clavicles and dentaries all had about 50% representation in the deposit. Small bones (carpals, smaller tarsals, phalanges, sternebrae and sesamoids) and more fragile elements (ribs and certain vertebrae) tended to be under-represented (1% - 22% MAU; Table 1.3). Vertebrae and costal ribs were probably somewhat underestimated because some very fragmentary specimens collected during the 2004 – 2006 field seasons were never fully prepared and

thus were not able to be included in the analyses. Additionally, several vertebrae (MNE = 17) were so incomplete that they could not be classified according to anatomical position.

MAU values were not calculated for the other five megafauna taxa found at the site, as numbers of elements represented for each taxon were too small to be informative.

In order to investigate the origin of the megafaunal deposit at Tanque Loma, percent MAU values for *Eremotherium* from this site were compared with %MAU values for large vertebrates from localities with differing depositional contexts, including a “tar pit” trap (Rancho La Brea Pit 91; Spencer *et al.* 2003) and a fluvial assemblage (the Pliocene Verdigre Quarry; Voorhies 1969) (Table 1.4). *Eremotherium* from Tanque Loma and *Merycopus* from Verdigre have a similar under-representation of small bones (carpals, tarsals) and vertebrae, although vertebrae are better represented in the Tanque Loma deposits (9% - 39% MAU for non-sacra) than at Verdigre (2% - 9% MAU). Long bones and ribs are much better represented at Tanque Loma than at Verdigre, whereas metapodials and rami are more prevalent at Verdigre. A different pattern exists for comparisons with %MAU values for the three most common herbivores in Pit 91 at Rancho La Brea: *Bison antiquus*, *Equus occidentalis*, and *Paramylodon harlani*. In general, crania, mandibles, vertebrae, and small bones such as podials and metapodials were much better represented in the La Brea deposit than at Tanque Loma, while long bones had similar %MAU values at the two sites.

Relative element representations of *Eremotherium* at Tanque Loma were also compared qualitatively with large-mammal data for archaeological and paleoanthropological butchering accumulations (Behrensmeyer 1987, Bunn 1987), for a lacustrine assemblage with hardship-induced attritional mortality (Ballybetagh bog; Barnosky 1985), and for a second Pleistocene “tar pit” (Maricopa; Muleady-Mecham 2003). Butchering localities tend to have an underrepresentation of meaty, transportable elements such as limb bones and mandibles, which are presumably carried off by human hunters. This pattern is not observed at Tanque Loma. The *Megaloceros* accumulation at Ballybetagh bog exhibits an overrepresentation of crania, mandibles, vertebrae, ribs, and podials; in contrast, the *Eremotherium* assemblage at Tanque Loma has less than 50% MAU for all of these elements, and less than 25% MAU for ribs, all but the axis vertebrae, and all podials except astragali and calcanea. Finally, skeletal element representation at the Maricopa tar seep locality is skewed in favor of appendicular elements, a fact which the authors attribute to the animals’ limbs becoming trapped and buried in the tar, while axial elements were left exposed to scavengers and environmental processes. While large limb bones (femora, humeri, radii, ulnae, and tibiae) are among the best-represented Eremothere elements at Tanque Loma, smaller limb bones, especially podials and metapodials, tend to be underrepresented at this site, which is inconsistent with an entrapment model.

4.3 Radiocarbon Analysis

Dates were obtained for the two *Notiomastodon* bones and the *Eremotherium* phalanx (Table 1.5). The *Eremotherium* vertebra and the Aves phalanx did not yield sufficient collagen for dating.

The *Notiomastodon* bones yielded overlapping dates. The caudal vertebra (MPM291) yielded a ¹⁴C date of 17,170 +/- 920 RCYBP, and the metapodial (MPM325) yielded a date of 19,110 +/- 1,260 RCYBP.

The *Eremotherium* phalanx yielded a date of 23,560 +/- 180 RCYBP. This date is consistent with the lower stratigraphic position of this bone relative to the dated *Notiomastodon* elements. However, while the *Eremotherium* phalanx did not have any asphalt evident on the surface, the interior of the bone was darker than the outside and a small amount of dark-colored liquid was observed to be extracted with the hydrochloric acid during the decalcification process. Thus, the possibility of contamination by hydrocarbons cannot be ruled out. Such contamination would most likely result in an erroneously old date, because petroleum derivatives have no remaining carbon 14 (Venkatesan *et al.* 1982).

Experiments are now underway to establish a protocol for removing all traces of tar from the Tanque Loma bones. Once developed, this procedure will be used to re-date these specimens and obtain new radiocarbon dates on other bones from this site in order to test the validity of these dates.

5. Interpretation and Discussion

5.1 Geology and Sedimentology

5.1.1. Depositional context

The overall geomorphology and sedimentological history of Tanque Loma is suggestive of a slow-moving riparian system alternately inundated and exposed throughout the later Pleistocene and Holocene. Strata IV and V, as well as many of the layers within Stratum III, consist principally of well-sorted, fine-grained sediments, containing approximately 70% – 90% muds (Table 1.2), which is suggestive of deposition in a low-flow fluvial environment (Allen 1982). In addition, in the lower 10 cm of Stratum III, several layers occur as thin, almost laminated deposits (Figure 1.3), which is consistent with deposition in still water. A standing-water environment is also suggested in the Pleistocene deposits by the presence of a green anoxic gley (Stratum VI) which tends to form in freshwater marsh contexts (Ponnamperuma 1972), underlying the bone-bearing strata.

The interpretation of these sediments as low-flow fluvial deposits is consistent with the extreme scarcity of clasts larger than 0 ϕ in most of these layers (Allen 1982). Of those clasts that are present in the Tanque Loma deposits, nearly all are quite angular and match the friable limestone material of the bedrock, suggesting that they were transported only a short distance, most likely eroding out of the adjacent hillside. This hypothesis is supported by the fact that these clasts are extremely abundant close to the bedrock nucleus of the hill, and nearly absent from sediments just a few meters to the west, and that their deposition appears to follow the slope of the hillside (Figure 1.3A). In addition, there is no evidence of rounding or smoothing of these clasts from fluvial transport. The few smooth,

rounded stones encountered in the Stratum IV and V sediments most likely provenance from re-worked marine sediments of the *Tablazo* formation that were uplifted from the ocean floor during the Pleistocene. This is also the most probable explanation for the presence of sea urchin spine fragments and occasional marine shell fragments encountered in these layers.

Finally, a low-flow regime is also suggested by the extreme abundance of microvertebrate bones throughout Stratum III and small plant fragments in Strata IV – VI, as such lightweight materials would be expected to be removed from the deposit through hydraulic sorting in a high-flow environment (Dodson 1973, Allen 1982). Additionally, there is no evidence of rounding or abrasion on either the microvertebrate or the megafaunal bones, suggesting that any transport must have been minimal (Korth 1979, Behrensmeyer 1988).

5.1.2 Paleoenvironmental evidence

The fluviially-deposited sediments at Tanque Loma appear have undergone repeated periods of desiccation and paleosol development, as evidenced by their characteristic blocky ped structures and lack of bedding features (Retallack 2008). In addition, the orange coloration observed in Stratum IV is typical of some paleosols (Retallack 1997). There appear to have been two separate episodes of paleosol development in Stratum IV, represented by the lighter and darker orange colors of the upper and lower substrata, respectively (Figure 1.3). Further evidence for paleosol development in Stratum IV is provided by the rhizoliths visible in the top few cm of the upper sub-stratum (Retallack 1988). These periods of exposure at the site may have resulted from the river meandering away from the site, or from it drying up entirely as can be observed today in the many dry arroyos throughout the area. However, the characteristic dark orange coloration of the lower substratum of Stratum IV is visible at other points within 0.5 – 1.0 km of the Tanque Loma locality (Figure 1.11), suggesting that at least this period of land exposure and establishment of a terrestrial plant community may have resulted from regional climatic change, rather than a mere redirection of the river course.

Other aspects of the sediments give evidence for climatic events at Tanque Loma. One substantially dry period appears to have occurred at the top of Stratum IV resulting in the chalky caliche layer separating this from overlying layers, as well as the calcareous rhizoliths and abundant small carbonate nodules found in the upper sub-stratum (Reeves 1976). As noted previously (*see* section 4.1), this feature is thought to divide the Pleistocene and Holocene strata at Tanque Loma. However, because Stratum III unconformably overlies Stratum IV, and because radiocarbon analyses from the upper part of Stratum IV and lower part of Stratum III have so-far been unsuccessful, it is not known whether this contact represents the Pleistocene-Holocene transition, or earlier in the Pleistocene. A plausible scenario is that this period of extreme aridity occurred at the precipitation low, around 15,000 years ago.

In addition, throughout Stratum III, thin deposits of dark sediment with very high (approximately 20% – 50%) organic carbon content, including macroscopic pieces of charcoal (Figure 1.3, Table 1.2), suggest a marked change in fire regime starting at the base

of the Stratum (inferred to be early Pleistocene). Such an increase in fire frequency and intensity is frequently observed in the South American Holocene (Markgraf & Anderson 1994, Power *et al.* 2008), and could be attributed to a variety of factors including climatic changes (Marlon *et al.* 2009), anthropogenic causes (Pausas & Keeley 2009), loss of megafauna from the ecosystem (Gill *et al.* 2009), or a combination of factors (Markgraf & Anderson 1994).

At least one brief flooding event appears to have occurred in the lower part of Stratum III, (Table 1.2: Stratum III, levels 14 – 13); these layers comprise a depositional couplet of a small (-3 ψ - -1 ψ) clast matrix overlain by fine-grained sediments, typical of a flood progression (Nichols 2009). This event would be consistent with the increased rainfall inferred for the latest Pleistocene/earliest Holocene approximately (14,000 - 10,000 years ago; Heusser & Shackleton 1994, Tellkamp 2005), or with a return to wet conditions on the Santa Elena Peninsula, which Sarma (1974) notes for 7,500 BP, 4,500 BP and 4,000 BP. However, the position of this layer within the Stratum III series of loose sedimentary deposits and regular, intense fires -- as indicated by charcoal layers -- suggests that it more likely was deposited during the Holocene rather than in the Pleistocene.

5.1.3 Asphaltic deposit

The tar-saturated layer at Tanque Loma – Stratum V – extends laterally with a more-or-less consistent depth throughout the deposit. Bones are distributed densely and relatively uniformly throughout this layer. Such geomorphology is typical of a bone-bed assemblage, and differs markedly from the geomorphology described for tar pit traps, which tend to form as numerous, isolated, often conical, asphaltic deposits (Lemon & Churcher 1961, Woodard & Marcus 1973). The implication of this morphology is that the Tanque Loma locality was not asphaltic at the time of the formation of the megafaunal assemblage, but rather that the sediments became secondarily infiltrated with tar at some point after the burial of the bones. Such a scenario has been proposed for a small number of other asphaltic paleontological localities, including the Corralito locality on the Santa Elena Peninsula (Edmund *unpublished field notes*), and Las Breas de San Felipe in Cuba (Iturralde-Vinent *et al.* 2000).

5.1.4 Context of the megafaunal deposits

Taken together, the relatively well-sorted sedimentary layers, the high proportion of muds, the scarcity of clasts except very close to their apparent source, the lack of evidence for long-distance transport of clasts and bones, the geomorphology of the primary bone bed, the evidence for the secondary infiltration of the asphalt, and the presence of at least two separate paleosols – the lower of which appears to be a regionally-extensive feature – suggest that the megafauna-bearing strata at Tanque Loma likely represent low-energy fluvial deposits separated by a period of regional desiccation. This fluvial system

apparently comprised a slow-moving river abutting against a limestone cliff – now the nucleus of the hill overlying the Pleistocene bone bed. During the first period of deposition (Strata VI and V and the lower sub-stratum of Stratum IV) at least, this slow-moving riparian system appears to have resulted in the establishment of a freshwater marshy habitat, as suggested by the abundant plant material in these strata and the underlying green anoxic gley. Other paleontological localities in the vicinity, including Cautivo (Ficcarelli *et al.* 2003) and Coralito (Edmund, *unpublished field notes*) have been interpreted as mangrove swamps; this does not appear to be the case at Tanque Loma, as the sediments are finer (i.e., less sandy) and contain significantly less marine material such as saltwater mollusks and shark teeth than noted at these other localities. Instead, Tanque Loma more resembles a marshy riparian ecosystem such as those that persist in the immediate area today. For example, about 0.5 km north of the Tanque Loma deposit, the inaptly-named Arroyo Seco contains permanent, spring-fed ponds surrounded by marshy sediments and vegetation abutting steep, loose-sediment cliffs (Figure 1.11A & B). A change in depositional context in the upper substratum of Stratum IV is suggested by the lesser amount of plant material as well as the relative scarcity and significantly greater fragmentation and weathering of the megafaunal bones recovered from this layer. Further paleontological and sedimentological studies in the vicinity of the Tanque Loma locality are required to determine if this reflects a regional environmental change.

5.1.5 Site context

The top of Stratum II appears to be coincident with a terrace level that is present throughout at least the immediate vicinity of the site (Figure 1.11C). At the time of deposition of Strata VII – II, the Tanque Loma locality would have been closer to sea-level; Holocene uplift (Stoohert 1985, Damp *et al.* 1990, Ficcarelli *et al.* 2003) would have resulted in down-cutting of the river course (the bottom of the modern arroyo is approximately two meters below the Tanque Loma megafaunal deposit), and brought the site to its present elevation. At least one major period of uplift is known to have occurred in the area between 5,500 and 3,600 BP (Damp *et al.* 1990).

5.2 Taxonomic composition

The Pleistocene strata at Tanque Loma present an extremely low taxonomic diversity of vertebrates. The 2003 – 2006 excavations recovered 993 individual specimens (excluding very fragmented ribs and vertebrae) pertaining to only six distinguishable species (Appendix A), and the material recovered during the 2009 – 2011 excavations appears to conform to this pattern. With the possible exception of a few ribs excavated in 2010, no predators have yet been identified from the megafauna-bearing layers, and microvertebrates, including birds, are extremely rare in these strata (except for the one isolated deposit found in grid unit nine at the interface between Stratum IV and Stratum III). This pattern stands in stark contrast to that observed for tar pit traps, which generally contain an overabundance of carnivores and microvertebrates, particularly waterfowl.

This pattern has been noted in the asphaltic deposits at Rancho La Brea (Stock & Harris 1992), McKittrick (Miller 1935), Talara (Campbell 1979, Seymour 2010), and Inciarte (Rincon 2011). The standard explanation for this phenomenon is that large mammals as well as small vertebrates would have been attracted by the apparent presence of a water source. In attempting to drink from (or, in the case of birds, land upon) the source, these animals would have become mired in the asphalt-saturated sediments. Additional large carnivores would have been attracted to the trapped prey, and would themselves have become entrapped (McHorse *et al.* 2012).

Large carnivores, including *Smilodon*, *Puma*, and a couple of mid-sized canids have been identified from several late-Pleistocene localities on the Santa Elena Peninsula (Table 1.1). An abundance of birds, including waterfowl, have been identified from the asphaltic SEP locality La Carolina (Campbell 1976). The absence of these animals from the asphaltic Pleistocene deposit at Tanque Loma supports the hypothesis proposed above that the formation of this site was fundamentally different from that proposed for traditional tar pit traps, and most likely that the asphalt was not present at the time the bones were deposited.

The number of individual specimens (NISP) and minimum number of individuals (MNI) counts for megafaunal taxa at Tanque Loma are both heavily skewed in favor of one species, the giant ground sloth *Eremotherium laurillardi*. This species is represented by 571 of the 663 elements excavated between 2003 and 2006, and constitutes 16 of the 25 minimum individual animals identified based on these bones. Such monodominant localities (paleontological assemblages where > 50% of the remains are represented by a single taxon) are fairly common in the fossil record (Eberth *et al.* 2010), and several explanations have been invoked to explain their formation, including selective geologic forces (Sander 1992), gregarious behavior with attritional (e.g. Barnosky 1985) or mass (e.g. Ryan *et al.* 2001, Bai *et al.* 2011) mortality, and selection by predators, including humans (e.g. Haury *et al.* 1959, Reeves 1978). For reasons noted herein, human action seems unlikely to explain the concentration of one megafaunal species at this locality. Gregarious behavior has been posited previously for *E. laurillardi* (Cartelle & Bohorquez 1982) and this may explain the preponderance of this species at Tanque Loma as well (see Chapter 2 for further discussion).

5.3 Bone taphonomy

5.3.1 Bone condition

Megafaunal bones at Tanque Loma tend to be relatively intact. The main exceptions are more fragile elements such as ribs, vertebral processes, cranial elements, scapulae, and pelvises. Breakage of fragile elements can result from several processes including exposure to the elements, transport in high flow, carnivore action, and crushing (Behrensmeyer & Hill 1980).

Most bones in Stratum V and the lower substratum of Stratum IV exhibit little to no evidence of weathering, suggesting that they generally were not exposed on the surface for a great length of time. However, there was a wide range in the degree of abrasion on these

bones -- many elements did not show any marks whatsoever, while others had a large number of shallow, non-parallel scratches that were consistent with trampling abrasion, but not fluvial transport (Olsen & Shipman 1988). These data suggest that bones were deposited in or near water and submerged fairly quickly, but were not transported a great distance after submersion. Some elements would have become buried by sediment on the bottom relatively rapidly, but others would have remained exposed underwater where they may have been trampled by large animals wading in the water source, as is commonly observed around African watering holes today (Haynes 1988).

Several interpretations were considered to explain the unusual, pit-like taphonomic features noted on some of the bones (Figure 1.9). These include: 1) human modification; 2) predation or scavenging by carnivores; and 3) bore-holes of aquatic mollusks. None of these explanations is completely satisfactory. First, there is no other evidence of human modification of these bones, including cut marks; no artifacts, debitage, or human remains have been found at the site; and the radiocarbon dates so-far obtained for the megafaunal deposit pre-date evidence for human arrival on the Santa Elena Peninsula by > 5,000 years (Stoothert 1985) and on the South American continent by > 1,000 years (Barnosky & Lindsey 2010). Second, while the location of the excavations at the ends of the tibiae is highly suggestive of predation by canids (Haynes 1983), there are no gnaw marks or pit impressions surrounding the broken and eroded areas, as would be expected if this were the source of the excavations, and there are no cracks or scratches around the smooth, conical holes on the clavicle (Figure 1.9 A-B) as should be observed were they produced from a bite (Njau & Blumenschine 2006). Finally, the smooth, conical holes are the wrong shape to have been produced by a bivalve or toredo worm, which produce holes with a narrow opening and wider interior; the excavations are too regularly-sized for barnacles; and there are no known boring freshwater mollusks (DR Lindberg *pers. comm.*). Therefore, the mechanism that produced these features is as yet unresolved.

5.3.2 Bone orientation

The fact that overall bones at the site were randomly oriented suggests that there was no significant, consistent water flow transporting bones at this locality. However, the possibility of rapid, short-distance transport, as would occur during a flash flooding event, cannot be ruled out, as such events do not result in directional orientation of bones, especially if elements are still articulated during transport and/or retain adhering chunks of flesh that could dramatically alter the shape and hydrodynamic properties of the bones.

5.3.3 Element representation

There is a wide range in the relative representation (%MAU) of *Eremotherium* skeletal elements at Tanque Loma. The primary phenomena invoked to explain differential representation of skeletal elements in the fossil record are differential preservation (Conard *et al.* 2008), water transport (e.g. Voorhies 1969), predation and scavenging (Spencer *et al.* 2003, Mecham 2003), and selection by humans (e.g. Metcalfe & Jones 1988).

Comparison of relative element representation values for Tanque Loma *Eremotherium* remains with those from other assemblages of known origin (the Verdigre flood deposit, Rancho La Brea Pit 91 tar pit trap, Maricopa clay-mud traps, Ballybetagh bog lacustrine assemblage, and anthropogenic accumulations) were made in order to elucidate the origin of the Tanque Loma megafauna deposit.

A river or flood deposit, as Verdigre is presumed to be (Voorhies 1969), would be expected to retain a relatively low percentage of elements, because 1) fossils collected in the deposit are likely to be washed in from surface exposures, where bones might have accumulated and been dispersed over a long period of time; 2) water flow would also carry some accumulated elements out of the site, and 3) without a preserving agent, such as hydrocarbons, preservation after deposition would not necessarily be as high. Moreover, which elements become preserved in a fluvial assemblage depends upon the flow regime and the physical characteristics of the bones. Voorhies (1969) identifies three groups of elements based on their hydrodynamic properties. These were compared with the elements encountered at Tanque Loma to evaluate the hypothesis that this locality constitutes a fluvial assemblage. It should be noted, however, that Voorhies' experiments were performed using bones of mid-sized ungulates and carnivores (sheep and coyotes), and thus the hydrodynamic properties of the different elements observed in his experiments might not be completely applicable to the larger and differently-shaped *Eremotherium* bones. We expect these differences would most likely be observed in *Eremotherium* femora, humeri, tibiae, and metapodials, all of which have substantially different relative dimensions than those observed in more cursorial carnivores and ungulates. It is also worth considering that in the case of a short-term high water flow event, such as a flash flood, bone winnowing might occur differently or not at all, especially if some elements were still articulated and/or still had flesh adhering to them, which could radically alter their shape and hydrodynamic properties.

Voorhies Group I, or those most likely to be transported in a current (and thus least likely to be found in a bone bed assemblage deposited in rapidly-flowing water), includes ribs, vertebrae, sacra, and sterna. All of these elements are underrepresented in the Tanque Loma deposit (1% - 20% MAU). Voorhies group II, those bones with intermediate water-transport properties, include long bones (femora, humeri, radii, tibiae), metapodials and pelvises. Most of these bones tend to be relatively well-represented in the Tanque Loma deposit (\geq 45% MAU), especially tibiae, which are the most common element encountered (100% MAU). However, metapodia are quite under-represented (17% - 22% MAU). Voorhies Group III, those bones most likely to be left behind in a lag deposit, include crania and mandibles. These elements are moderately represented in the Tanque Loma deposit (26% MAU for crania; 48% MAU for mandibles). In general, fragile elements and long bones are much better represented at Tanque Loma than in the Verdigre Quarry, while Verdigre has greater proportions of metapodials and rami, and podials show equally low representation at both localities.

Of the depositional contexts considered here, tar pit traps should tend to have the most complete overall representation of elements because for any individual corpse there would be only a short interval of exposure during which bones could be transported away from the site (primarily through carnivory/scavenging), after which preservation by immersion in tar would be extremely high. Many smaller *Eremotherium* elements – podials,

metapodials, and mandibles – and more fragile bones – crania, vertebrae, ribs, scapulae and pelvises – are far less prevalent at Tanque Loma as compared with the Rancho La Brea deposits, while larger and sturdier elements show comparable representation. Tanque Loma also exhibits no clear bias towards preservation of appendicular elements such as that observed at Maricopa (Muleady-Mecham 2003) – the long bones are better-preserved than the axial elements, but podials are very poorly represented.

The Ballybetagh bog *Megaloceros* assemblage represents an attritional assemblage presumably accumulated over multiple years with relatively rapid burial and minimal transport of bones after deposition. The best-represented elements in this assemblage were found to be crania (including antlers), mandibles, ribs, vertebrae, and podials, which were interpreted as the elements that would have been most robust to dispersion and breakage by trampling (Barnosky 1985). While these particular elements are generally poorly-represented at Tanque Loma, the assemblages are similar in that the *Eremotherium* elements with the highest %MAU values at Tanque Loma – principally longbones – tend to be larger, heavier, less-breakable elements that would be less likely to be dispersed far or heavily fragmented through trampling.

Finally, anthropogenically-accumulated assemblages tend to have an overrepresentation of nutritious (meaty), easily-transportable parts, including mandibles and longbones (Behrensmeyer 1987, Bunn 1987). While these elements all have relatively high representation at Tanque Loma, the similarly high representation of other elements such as clavicles, axis vertebrae and pelvic elements, is not consistent with transportation of isolated elements to (or away from) the site by anthropic agents. These data are not surprising, as there are no artifacts or evidence of human activity at the site, and the radiocarbon dates so-far obtained for the megafauna deposit pre-date any established human arrival in the region by more than 5,000 years (Stoohert 1985).

Overall, the pattern of relative representation of *Eremotherium* elements at Tanque Loma does not closely match any of the considered contexts – the Rancho La Brea and Maricopa tar pit “traps,” the Verdigre fluvial deposit, the Ballybetagh bog lakeside assemblage or a butchering locality. However, it is most similar to the lacustrine example in that many of the more underrepresented elements – in this case ribs, vertebrae, and cranial elements – are bones that would probably be more likely to be fragmented through trampling. As noted, several vertebrae (n=17) were excluded from the analysis because they were too fragmentary to identify to anatomical position. An additional group of vertebrae (N~100) and ribs (N~98) that were collected during the 2004 – 2006 excavations are so fragmented that they have not yet been prepared, and thus we were not able to include them in this analysis. This differential fragility of different elements could also explain the under-representation of *Eremotherium* crania in the deposit; this explanation was also invoked by Voorhies {1969} to explain the dearth of crania at Verdigre.

Trampling would not, however, likely explain the extreme paucity of *Eremotherium* podial (3% - 6% MAU) or metapodial (17% - 22% MAU) bones at Tanque Loma, which should be largely protected from crushing by their compact shapes and dense structure. Neither would fluvial transport, as these elements are roughly the same size as, and thus probably no more likely to be transported away from the site than, the largest rock clasts encountered in Stratum V. One plausible explanation for their scarcity is that these

relatively small, distal elements may have been selectively exposed due to biotic forces: dense plant growth, as may be encountered in marshy settings such as that hypothesized for the Pleistocene deposit at Tanque Loma, tends to push up smaller, lighter elements above the substrate, while burying larger heavier ones (A.K. Behrensmeyer, *pers. comm.*) These exposed elements may then have been broken up by weathering processes or carried off by scavengers.

5.4 Paleoeological Implications

5.4.1 Paleoenvironmental change

The Tanque Loma locality offers important opportunities to investigate paleoenvironmental and faunistic change in the western coastal Neotropics during the late Pleistocene, across the Pleistocene-Holocene transition and throughout the Holocene. Today the western Santa Elena Peninsula is dry and sparsely vegetated, with dense vegetation present only in riverbeds supplied with year-round water from subterranean springs (Stohtert 1985). However, the region must have been more verdant during the Pleistocene in order to support the great quantity of megafauna that were evidently present on the Peninsula during this period. Various authors (Lemon & Churcher 1961, Sarma 1974, Stohtert 2011) have proposed that the Pleistocene ecosystem in this region would have comprised permanent or semi-permanent rivers supporting dense vegetation corridors between areas of open grassland savannah. This model is supported by pollen and climatic data (Heusser & Shackleton 1994) indicating dry conditions and significant extent of grassland in the western Andes, as well as by bird fossils recovered from the late-Pleistocene La Carolina locality on the Santa Elena Peninsula that indicate the presence of substantial wetlands in this area (Campbell 1976, Tellkamp 2005). Sea core data suggests that cool, arid, glacial conditions persisted until about 15,000 years ago, after which temperatures and precipitation increased until the earliest Holocene, around 10,000 years ago. This may have resulted in an expansion of dense forested habitat across the landscape, negatively impacting savannah-adapted megafauna populations (Ficcarelli *et al.* 2003). Such a phenomenon has been proposed as a factor in the extinction of the large mammal fauna of South America at the end of the Pleistocene (Cione *et al.* 2009).

Sedimentological features at the Tanque Loma locality may correspond to some of these paleoecological data. At the time of deposition of most of the Pleistocene sediments at Tanque Loma, the site was moist and heavily vegetated. We interpret this as representing a lush habitat in a river bottom. However, the upper Stratum IV sediments indicate the desiccation of this marshy habitat and establishment of a regionally-extensive plant community – represented by the dark orange paleosol in the lower substratum of this layer – followed by a change in depositional regime constituting similar fluvially-deposited silty sands, but with fewer, smaller clasts and the near-cessation of the accumulation of fossil remains. A second, much more pronounced change occurs at the top of Stratum IV, with the development of a layer of caliche – a sign of extreme aridity – followed by a marked change in depositional pattern, with occasional flooding and much more frequent desiccation episodes. Also very notable in the Stratum III (presumed-Holocene) deposits

are the repeated appearance of charcoal-intensive layers, indicative of increased fires that may be related to a drier climate, the loss of large ecosystem engineers such as proboscideans, anthropogenic burning, or a combination of these forces.

Unfortunately microvertebrates, which can serve as excellent paleoecological indicators (e.g. Blois *et al.* 2010, McGuire 2010), are nearly absent in all but the highest Pleistocene sediments at Tanque Loma. However, other taxa may provide some paleoenvironmental insight. For instance, the presence of the terrestrial snail *Porphyrobaphe*, common in Strata IV & V of Tanque Loma, has been noted in Pleistocene & Pliocene deposits throughout the Peninsula (Barker 1933, Pilsbry & Olsson 1941), but today it appears to be restricted to wetter coastal regions further to the north (Barker 1933, *but see* Breure & Borrero 2008). Detailed analyses of the paleobotanical material recovered from Strata IV and V, and of the rich microvertebrate assemblages present at the Stratum IV-III interface and throughout Stratum III – which, based on size-selectivity, we preliminarily interpret as raptor assemblages – will provide a much better picture of the late-Quaternary paleoenvironmental history of the western Santa Elena Peninsula.

5.4.3 Implications for late-Quaternary extinctions

Although the available chronological evidence places the primary megafaunal deposit at Tanque Loma several thousand years before the end of the Pleistocene, this locality may have implications for continental-scale investigations of the late-Quaternary extinction event. The radiocarbon dates of 17,000 – 19,000 RCYBP on *cf. Notiomastodon platensis* and of 23,500 RCYBP on *Eremotherium laurillardi* from Tanque Loma represent a significant contribution to the fewer than one dozen direct ¹⁴C dates on neotropical megafauna. The *E. laurillardi* date is one of fewer than five direct dates on South American *Eremotherium* (Rossetti *et al.* 2004, Hubbe *et al.* 2013) and the only one outside of Brazil. The *cf. N. platensis* dates double the number of direct dates on this taxon, and overlap completely with the other two, which include one from northern Ecuador and one from Brazil (Coltorti *et al.* 1998, Rossetti *et al.* 2004). The antiquity of these dates is consistent with the pattern, noted by Barnosky & Lindsey (2010), of Last Appearance Dates on Pleistocene taxa occurring earlier in northern South America than in the southern, temperate part of the continent, and also with models predicting a greater reduction in preferred habitat for *Eremotherium* than for its temperate sister taxon *Megatherium* during late-Quaternary climatic shifts (Lima-Ribeiro *et al.* 2013). However, the presence of tar at Tanque Loma warrants additional dating of material from this site to ensure that none of the bones analyzed were contaminated with hydrocarbons, which can produce erroneously old dates (Venkatesan *et al.* 1982).

6. Conclusions

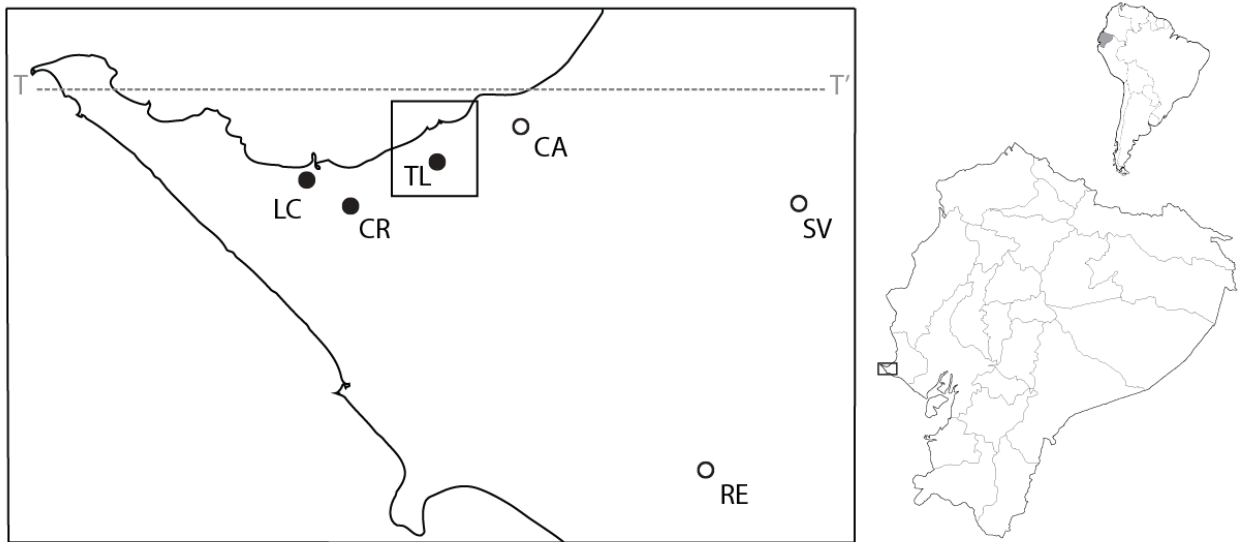
The sedimentological, taphonomic, and taxonomic information for the primary Pleistocene megafauna assemblage at Tanque Loma suggest that, unlike most well-known asphaltic deposits such as Rancho La Brea in Los Angeles, USA, the Inciarte locality in Zulia

province, Venezuela, and the Talara asphalt seeps in Talara, Peru, this site was not a “tar pit” style trap, capturing and preserving organisms through entrapment in asphalt. Rather, this site most likely represents a bone bed assemblage, formed in a shallow, anoxic marshy setting, with secondary infiltration of tar. Several lines of evidence support this conclusion, including 1) the consistent lateral extent of the primary bone bed and asphaltic sediments; 2) the near-absence of carnivores, small mammals and birds from the Pleistocene layers; and 3) the abundance of plant material in the Pleistocene sediments and the presence of an anoxic gley underlying these strata. There is no evidence that Tanque Loma was a mangrove swamp estuary as has been proposed for other sites on the Santa Elena Peninsula. The relative representation of megafaunal elements and lack of evidence of high-energy fluvial activity suggests that probably most of the remains present in these layers pertain to animals that died in or around the marshy habitat, although small, isolated elements such as teeth and osteoderms may have washed in from further away. The overabundance of *Eremotherium laurillardi* remains in this deposit relative to other taxa may lend support to the hypothesis that this species was gregarious.

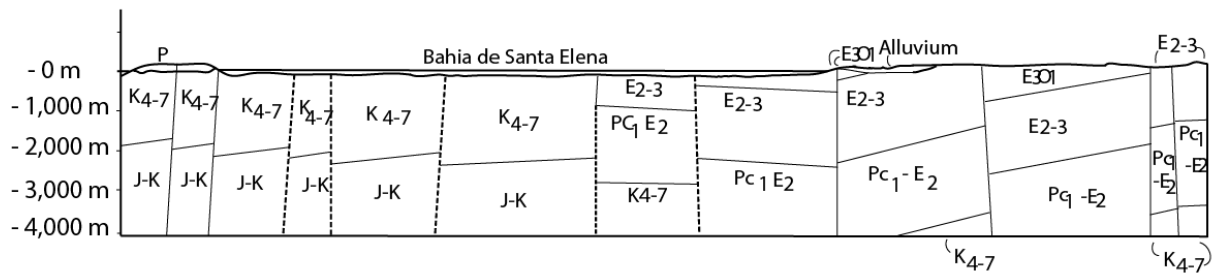
The megafauna remains associated with this inferred riparian environment appear in dense accumulations apparently spanning several thousands of years (at least roughly 23,400 – 18,000 BP); they then become much more scarce after a period of apparently regional desiccation, and disappear entirely after an extremely arid event. Efforts to bracket this event with radiocarbon dates have so far proved unsuccessful, however it may pertain to an inferred precipitation low around 15,000 years ago.

The three radiocarbon dates so far obtained on megafaunal bones from Tanque Loma are consistent with the pattern of older Last Appearance Dates on Neotropical megafauna relative to their temperate South American counterparts. This pattern is intriguing and may have important implications for our understanding of climatic and biogeographic drivers of these extinctions, but additional radioisotopic dating is required to verify that this observed pattern is not simply an artifact of low sampling in the region.

A



B



E3 O1: Zapotal Formation. Eocene-Oligocene sandstones

E2-3: Ancon Group. Eocene sandstones, siltstones, shales, limestones, and conglomerates

PC1 E2: Azucar Group. Paleocene-Eocene sandstones, shales, and conglomerates

K4-7: Cayo Formation. Cretaceous sandstones, greywackes, chert, and volcanoclastics in claystone matrix

J-K: Piñon Complex. Jurassic-Cretaceous basalt and diabase

Figure 1.1: (A) Map showing location of Tanque Loma locality and other published paleontological localities from the Santa Elena Peninsula, Ecuador. TL = Tanque Loma; LC = La Carolina (Hoffstetter 1952); CR = Corralito (Spillman 1935); RE = Rio Engabao (Edmund, 1965); CA = Cautivo (Ficarelli *et al.* 2003); SV = San Vicente (Lindsey, *unpublished data*). Black dots denote asphaltic localities; open dots denote non-asphaltic localities. (B) Generalized stratigraphic profile of the Santa Elena Peninsula along transect line T-T'. Modified from IGM (1974).

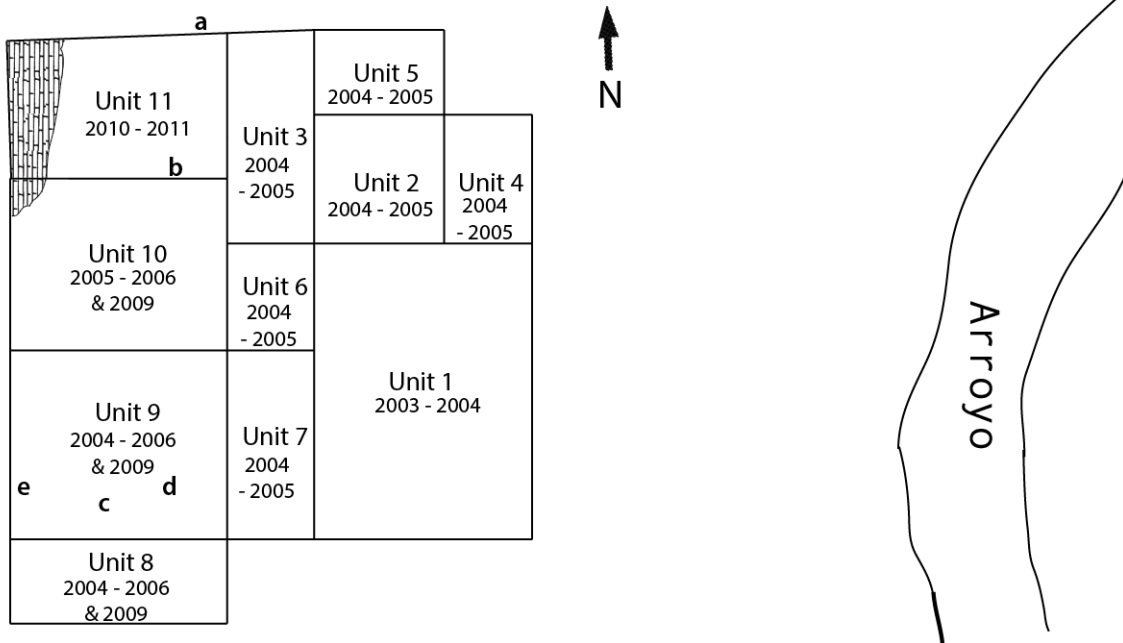


Figure 1.2: Detail of the box in Figure 1.1A showing area of the Tanque Loma locality, and map of Tanque Loma field site showing excavated grid units, years of excavation, and locations of radiocarbon-dated bones. **a**, **b**, **c**, **d**, & **e** indicate locations of the following samples collected for radiocarbon-dating: Aves phalanx, *Eremotherium* vertebral epiphysis, MPM291 (cf. *Notiomastodon platensis* caudal vertebra), MPM325 (cf. *Notiomastodon platensis* metapodial), and HE616 (*Eremotherium laurillardi* phalanx), respectively.

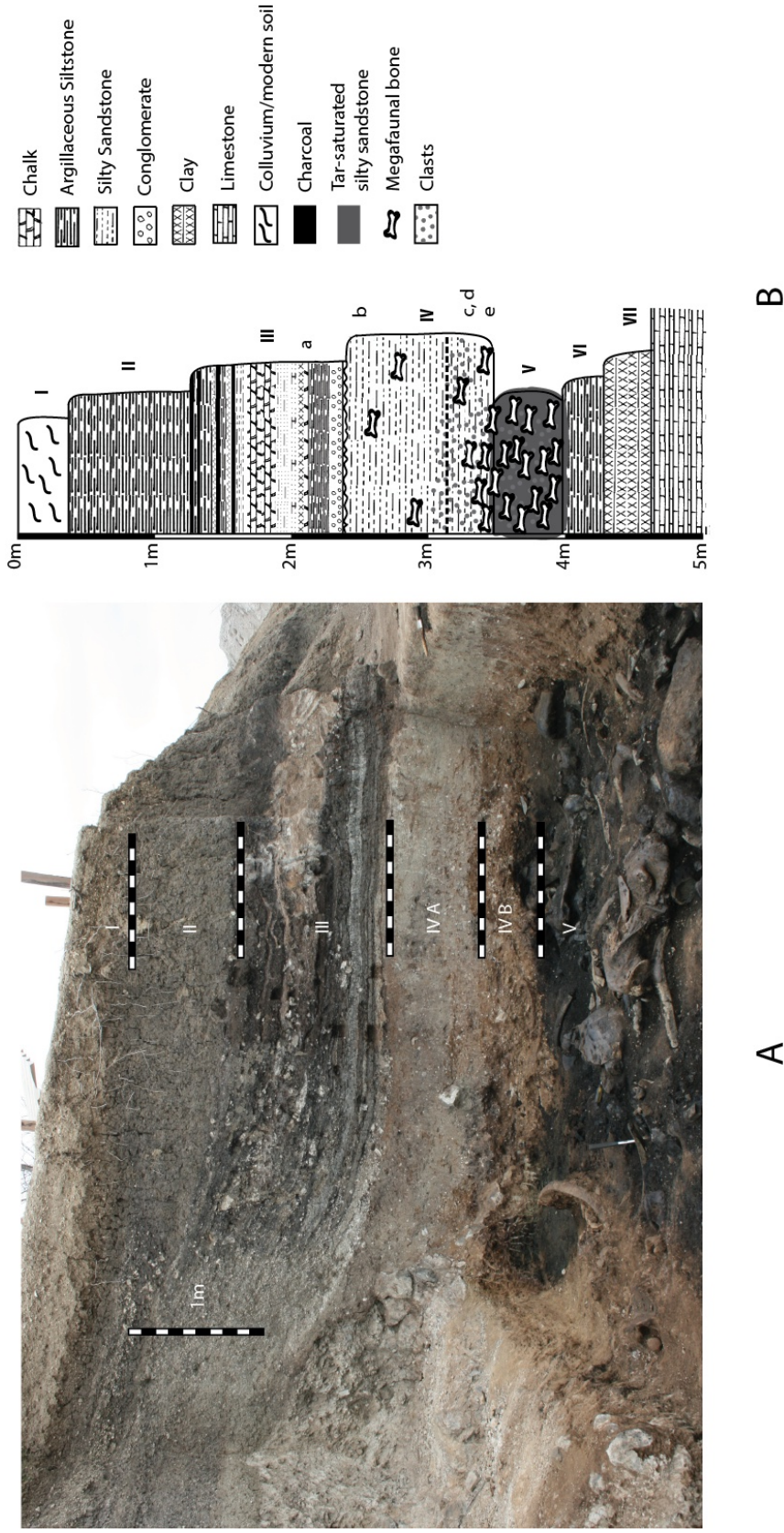


Figure 1.3: (A) Photo of north wall of Tanque Loma grid unit 11. (B) Generalized stratigraphic profile for Tanque Loma locality. **a, b, c, d, & e** indicate stratigraphic positions of the radiocarbon dated Aves phalanx, *Eremotherium* vertebral epiphysis, MPM291 (cf. *Notiomastodon platensis* caudal vertebra), MPM325 (cf. *Notiomastodon platensis* metapodial), and HE616 (*Eremotherium laurillardi* phalanx), respectively.

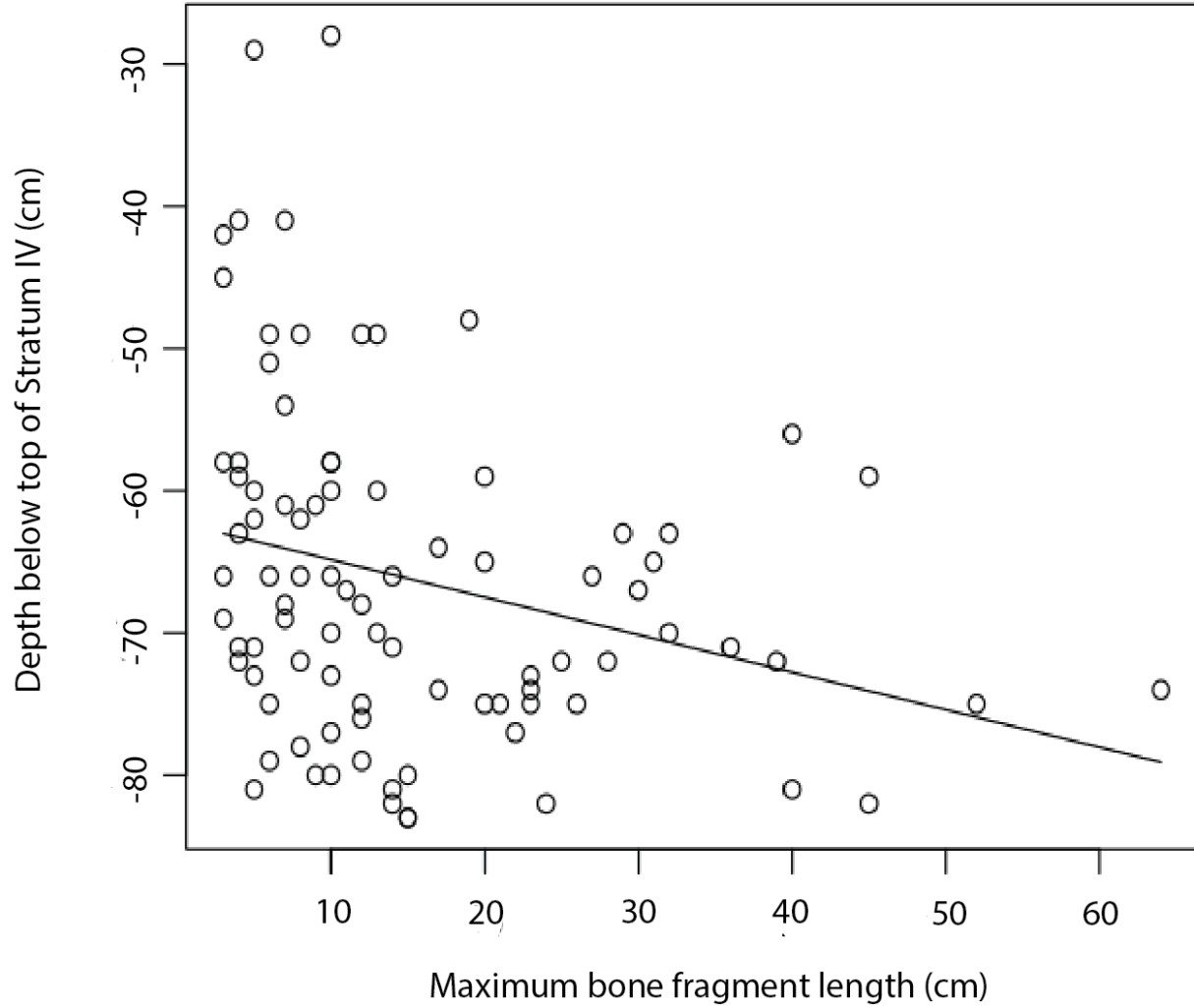


Figure 1.4: Distribution and size of megafaunal bones within Stratum IV of grid unit 11 at the Tanque Loma locality. Bones toward the bottom of the stratum are more abundant and larger, whereas those toward the top are more fragmentary and scarce. Pearson's product-moment correlation, $cor = -0.28$, $p=0.009$.

A



10 cm

B



10 cm

C



10 cm

D



10 cm

E



Figure 1.5: *Eremotherium laurillardii* bones from Tanque Loma. (A) Cranium, right lateral view. (B) Cranium, ventral view. (C) Right mandible, lateral view. (D) Mandible, occlusal view. (E) Femur, anterior view.

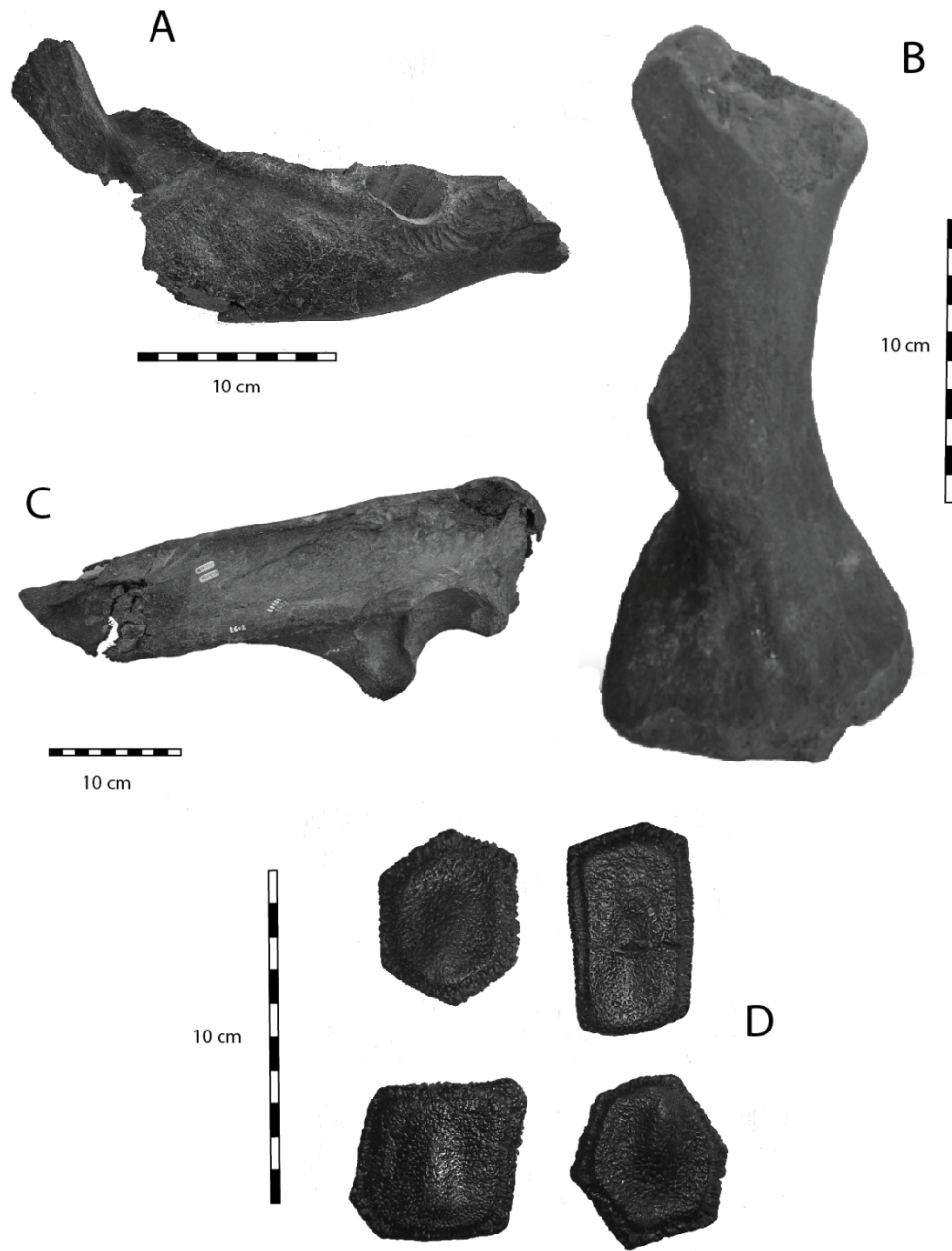


Figure 1.6: (A) Specimen L113, *Glossotherium tropicorum* left mandible, lingual view. (B) Specimen L518, juvenile *Glossotherium tropicorum* left humerus, anterior view. (C) proximal cf. *Glossotherium* ulna. (D) *Holmesina occidentalis* buckler osteoderms.

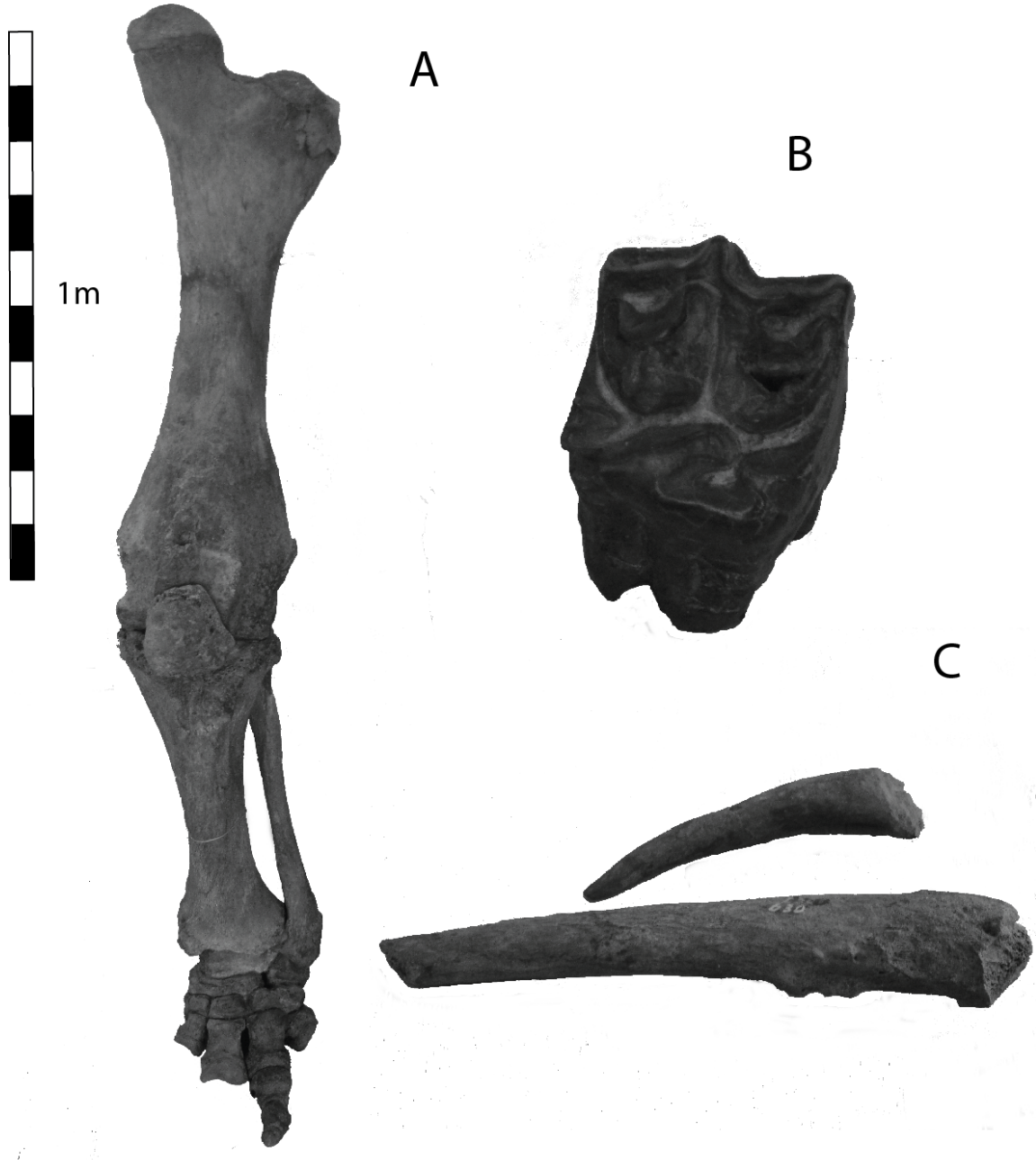


Figure 1.7: (A) Articulated *cf. Notiomastodon platensis* hind leg, anterior view. (B) *Equus santaelenae* upper left molar, occlusal view. (C) *cf. Odocoileus salinae* antler.

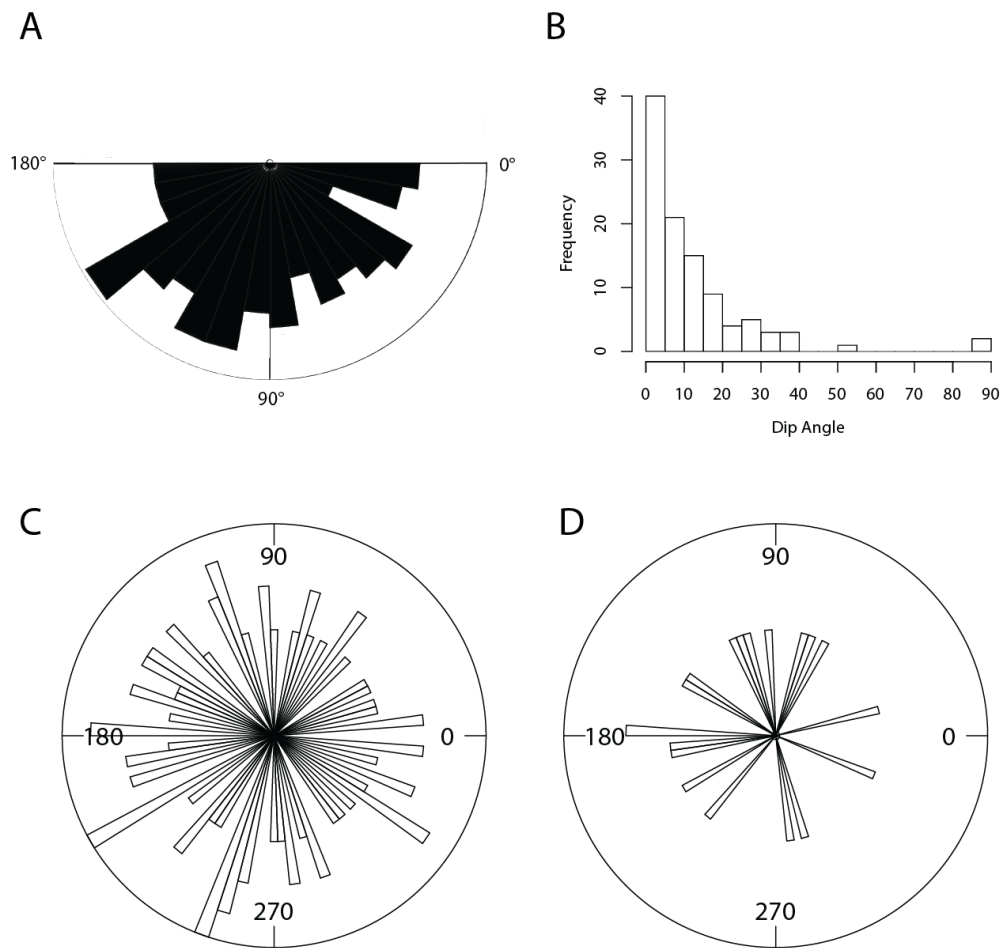
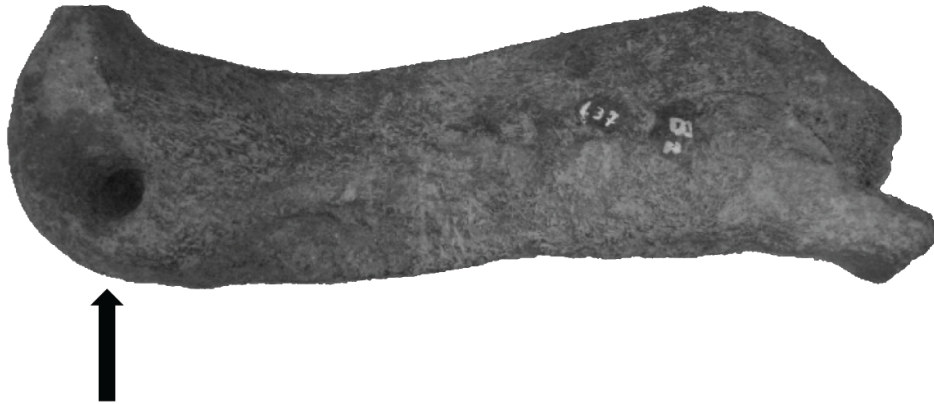
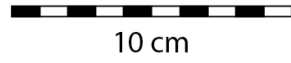
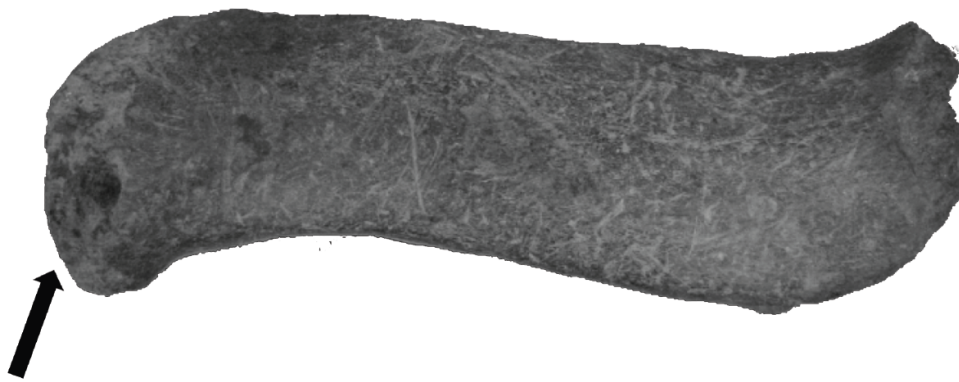
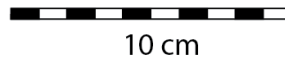


Figure 1.8: (A) Rose diagram depicting orientation of all bones and bone fragments >10 cm in length, with a length:width ratio of at least 2:1, excavated in grid units 8, 9, 10, and 11 during the 2009 – 2011 field seasons. N = 91. Kolmogorov-Smirnov test, $p=0.32$. Because bone orientation was taken without regard to bone polarity, orientation is plotted on a 180° axis. (B) Histogram depicting dip angles of bones and bone fragments >10 cm in length, with a length:width ratio of at least 2:1, collected in grid unit 11. N = 98. (C) Rose diagram depicting directional orientation of dipping end of bones included in (B), excluding horizontally- and vertically-oriented bones. N = 80. Kolmogorov-Smirnov test, $p = 0.65$. (D) Rose diagram depicting directional orientation of dipping end of only steeply-dipping (dip angle $\geq 20^\circ$) bones included in (B). N = 19. Kolmogorov-Smirnov test, $p = 0.33$.

A



B



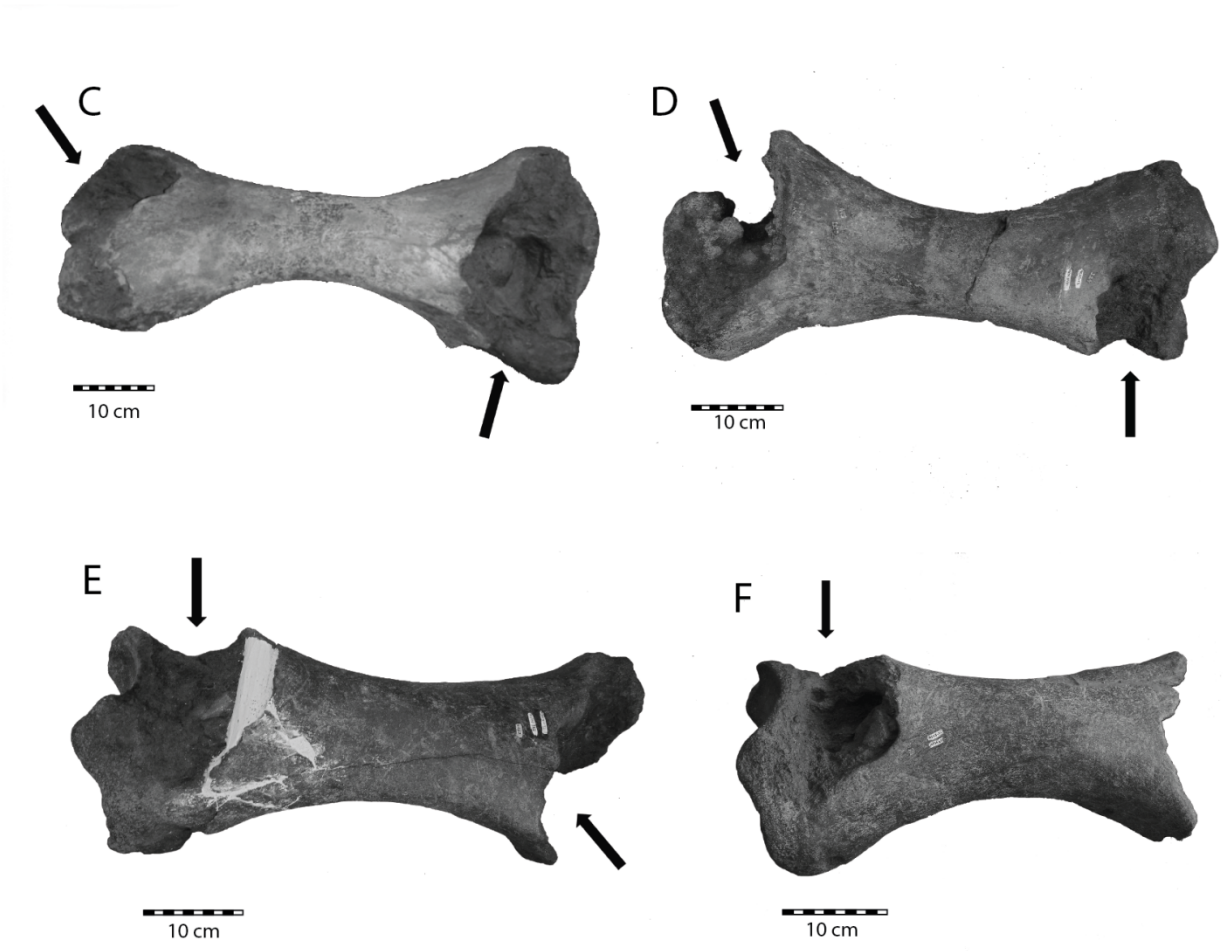


Figure 1.9: Some unique taphonomic marks on bones from Tanque Loma locality. (A) Specimen MPM212, *Eremotherium laurillardi* clavicle, with smooth, conical hole on lateral end. (B) Reverse side of MPM212 with smaller hole. (C) Specimen MPM674, *E. laurillardi* tibia, showing deep erosions on both ends. (D) Specimen MPM340, *E. laurillardi* tibia, showing deep erosions on both ends. (E) Specimen MPM342 *E. laurillardi* tibia, showing significant erosion/breakage on both ends. (F) Specimen MPM675, *E. laurillardi* tibia, showing irregular excavations on proximal end (distal end broken off). Arrows indicate location of noted taphonomic features. (B) and (F) are covered in shallow scratch marks interpreted as trampling abrasion.

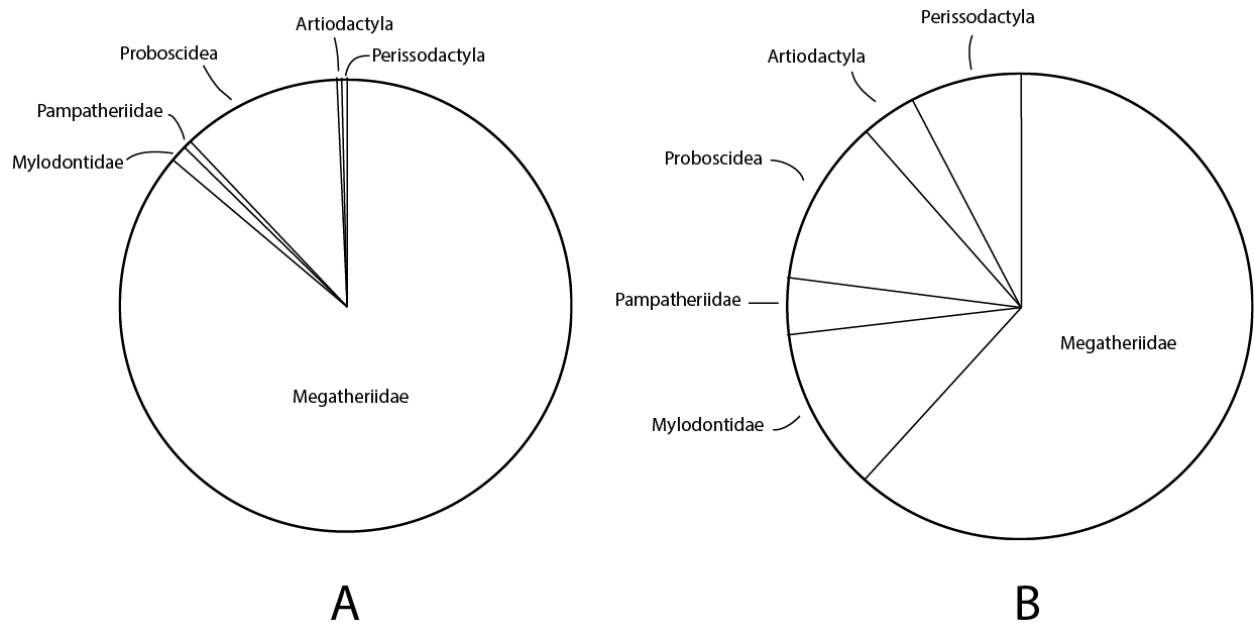


Figure 1.10: Graphs showing proportions of (A) Minimum Number of Elements (MNE), and (B) Minimum Number of Individuals (MNI) for the different megafaunal genera recovered at the Tanque Loma locality.

A



B



C



Figure 1.11: Present-day marshy riparian areas in river arroyos sustained by underground springs, in the vicinity of the Tanque Loma locality. (A) Shows orange paleosol believed to correspond to the lower part of Stratum IV at Tanque Loma. (B) A similar marshy context is proposed for the formation of some of the Pleistocene deposits at Tanque Loma. (C) Shows regionally-extensive terrace (dotted line) believed to correspond to the top of Stratum II at Tanque Loma. (A) and (C) photos courtesy of AD Barnosky.

| | La Carolina | Coralito | Tanque Loma | Rio Engabao | Cautivo | San Vicente |
|------------------------|-------------|----------|-------------|-------------|---------|-------------|
| MARSUPIALIA | | | | | | |
| Didelphidae | | | | | | |
| <i>Didelphis</i> | | X | | | | |
| XENARTHRA | | | | | | |
| CINGULATA | | | | | | |
| Pampatheridae | | | | | | |
| <i>Holmesina</i> | X | X | X | X | | |
| PILOSA | | | | | | |
| Mylodontidae | | | | | | |
| <i>Glossotherium</i> | X | X | X | | X | |
| <i>Scelidodon</i> | X | X | | | | |
| Megaheriidae | | | | | | |
| <i>Eremotherium</i> | X | X | X | X | | X |
| RODENTIA | | | | | | |
| Caviidae | | | | | | |
| <i>Nechoerus</i> | X | | | | | |
| CARNIVORA | | | | | | |
| Canidae | | | | | | |
| <i>Dusicyon</i> | X | X | | | | |
| <i>Procyon</i> | X | | | | | |
| Felidae | | | | | | |
| <i>Puma</i> | X | | | | | |
| <i>Smilodon</i> | X | X | | X | | |
| Mustelidae | | | | | | |
| <i>Lutra</i> | | | | X | | |
| PROBOSCIDEA | | | | | | |
| Gomphotheriidae | | | | | | |
| <i>Notiomastodon</i> | X | X | X | | X | |
| PERISSODACTYLA | | | | | | |
| Equidae | | | | | | |
| <i>Equus</i> | X | X | X | X | X | |
| ARTIODACTYLA | | | | | | |
| Camelidae | | | | | | |
| <i>Palaeolama</i> | X | X | | | | |
| Cervidae | | | | | | |
| <i>Odocoileus</i> | X | X | X | X | | |
| Tayassuidae | | | | | | |
| <i>Tayassu</i> | | X | | | | |

Table 1.1: Mammal taxa reported from Pleistocene localities on the Santa Elena Peninsula, Ecuador. Data are from Hoffstetter (1952, La Carolina), Edmund (1965, Rio Engabao), Ficcarelli et al. (2003, Cautivo), Lindsey & Lopez (this publication, Tanque Loma) and Lindsey (*in prep.*, Corralito and San Vincente).

| Sample # | Provenance | avg pH | % organic carbon | %-4 phi | %-3 phi | %-2 phi | %-1 | %0 phi | %1 phi | %2 phi | %3 phi | % >3 phi |
|-----------|-----------------------|--------|------------------|---------|---------|---------|-----|--------|--------|--------|--------|----------|
| SS-11-304 | Stratum I | 6.58 | 3% | 0% | 6% | 11% | 9% | 6% | 5% | 4% | 6% | 52% |
| SS-11-305 | Stratum II | 7.56 | 4% | 0% | 2% | 0% | 0% | 1% | 1% | 3% | 11% | 82% |
| SS-11-290 | Stratum III, level 4 | 5.65 | 11% | 0% | 0% | 0% | 1% | 1% | 1% | 1% | 3% | 92% |
| SS-11-291 | Stratum III, level 5 | 6.03 | 11% | 0% | 0% | 4% | 9% | 10% | 7% | 7% | 15% | 49% |
| SS-11-292 | Stratum III, level 6 | 6.32 | 39% | 0% | 4% | 2% | 4% | 7% | 9% | 13% | 20% | 41% |
| SS-11-293 | Stratum III, level 7 | 6.88 | 41% | 0% | 1% | 3% | 5% | 6% | 6% | 7% | 6% | 66% |
| SS-11-294 | Stratum III, level 8 | 6.87 | n/a | 0% | 0% | 0% | 4% | 8% | 6% | 13% | 17% | 52% |
| SS-11-295 | Stratum III, level 9 | 7.55 | 8% | 0% | 1% | 6% | 8% | 13% | 13% | 15% | 9% | 35% |
| SS-11-296 | Stratum III, level 10 | 7.31 | 51% | 0% | 0% | 6% | 8% | 10% | 13% | 10% | 8% | 45% |
| SS-11-297 | Stratum III, level 11 | 7.74 | 21% | 0% | 0% | 2% | 1% | 3% | 4% | 11% | 5% | 74% |
| SS-11-298 | Stratum III, level 12 | 7.39 | 19% | 0% | 0% | 1% | 1% | 2% | 4% | 4% | 4% | 84% |
| SS-11-299 | Stratum III, level 13 | 7.41 | 18% | 0% | 1% | 1% | 1% | 3% | 4% | 5% | 6% | 79% |
| SS-11-300 | Stratum III, level 14 | 7.84 | 8% | 0% | 29% | 11% | 11% | 11% | 7% | 5% | 4% | 23% |
| SS-11-301 | Stratum IV | 7.43 | 11% | 0% | 3% | 2% | 2% | 2% | 2% | 6% | 16% | 68% |

Table 1.2: Results of sediment analyses (grain size analysis, pH, and Loss on Ignition) for Strata 1 – 4 at Tanque Loma locality.

| Element | NISP | MNE | MNI | # in skeleton | MAU | %MAU |
|-------------------------|-------------|------------|------------|----------------------|------------|-------------|
| Cranium | 21 | 4 | 4 | 1 | 4.00 | 26% |
| Mandible | 21 | 15 | 8 | 2 | 7.50 | 48% |
| Molariform | 38 | 38 | 5 | 18 | 2.11 | 14% |
| Atlas | 4 | 3 | 3 | 1 | 3.00 | 19% |
| Axis | 6 | 6 | 6 | 1 | 6.00 | 39% |
| Other Cervical Vertebra | 18 | 17 | 4 | 5 | 3.40 | 22% |
| Thoracic Vertebra | 93 | 65 | 5 | 16 | 1.33 | 9% |
| Lumbar Vertebra | 4 | 4 | 1 | 3 | 1.33 | 9% |
| Sacral Vertebra | 2 | 1 | 1 | 5 | 0.20 | 1% |
| Caudal Vertebra | 64 | 57 | 7 | 18 | 3.17 | 20% |
| Scapula | 15 | 11 | 6 | 2 | 5.50 | 35% |
| Clavicle | 13 | 13 | 7 | 2 | 6.50 | 42% |
| Costal Rib | 154 | 90 | 3 | 32 | 2.81 | 18% |
| Seternal Rib | 21 | 15 | 1 | 16 | 0.94 | 6% |
| Sternebra | 5 | 5 | 1 | 8 | 0.63 | 4% |
| Pelvis | 10 | 7 | 7 | 1 | 7.00 | 45% |
| Humerus | 34 | 23 | 11 | 2 | 11.50 | 74% |
| Radius | 25 | 18 | 10 | 2 | 9.00 | 58% |
| Ulna | 20 | 12 | 6 | 2 | 6.00 | 39% |
| Metacarpal | 20 | 20 | 7 | 6 | 3.33 | 22% |
| Carpal | 8 | 8 | 4 | 16 | 0.50 | 3% |
| Femur | 30 | 14 | 7 | 2 | 7.00 | 45% |
| Tibia | 38 | 31 | 16 | 2 | 15.50 | 100% |
| Fibula | 7 | 6 | 4 | 2 | 3.00 | 19% |
| Patella | 2 | 2 | 2 | 2 | 1.00 | 6% |
| Metatarsal | 16 | 16 | 6 | 6 | 2.67 | 17% |
| Astragalus | 17 | 14 | 8 | 2 | 7.00 | 45% |
| Calcaneum | 11 | 10 | 6 | 2 | 5.00 | 32% |
| Other tarsal | 11 | 11 | 3 | 12 | 0.92 | 6% |
| Phalanx | 30 | 30 | 3 | 24 | 1.25 | 8% |

Table 1.3: Number of Individual Specimens (NISP), Minimum Number of Elements (MNE), and Minimum Animal Units (MAU and %MAU) calculations for *Eremotherium laurillardi* elements excavated at Tanque Loma locality, 2004 – 2006

| Element | Tanque Loma Eremotherium | Verdigre Quarry Merycodus | La Brea Bison | La Brea Equus | La Brea Paramylodon |
|-------------------------|-------------------------------------|--------------------------------------|--------------------------|--------------------------|--------------------------------|
| Cranium | 26 | 4 | 100 | 88 | 71 |
| Mandible | 48 | 100 | 91 | 81 | 100 |
| Molariform | 14 | N/A | N/A | N/A | N/A |
| Atlas | 19 | 4 | 11 | 25 | 29 |
| Axis | 39 | 9 | 11 | 100 | 0 |
| Other Cervical Vertebra | 22 | 4 | 15 | 40 | 17 |
| Thoracic Vertebra | 9 | 2 | 27 | 76 | 41 |
| Lumbar Vertebra | 9 | 7 | 24 | 46 | 0 |
| Sacral Vertebra | 1 | 1 | 13 | 21 | 6 |
| Caudal Vertebra | 20 | N/A | 3 | 12 | 29 |
| Scapula | 35 | 16 | 51 | 50 | 100 |
| Clavicle | 42 | N/A | N/A | N/A | N/A |
| Costal Rib | 18 | 1 | 25 | 38 | 26 |
| Seternal Rib | 6 | N/A | N/A | N/A | N/A |
| Sternebra | 4 | N/A | 0 | 9 | 41 |
| Pelvis | 45 | 23 | 51 | 88 | 100 |
| Humerus | 74 | 49 | 43 | 94 | 71 |
| Radius | 58 | 29 | 31 | 75 | 57 |
| Ulna | 39 | 10 | 43 | 31 | 29 |
| Metacarpal | 22 | 50 | 43 | 75 | 29 |
| Carpal | 3 | 1 | 17 | 19 | 29 |
| Femur | 45 | 13 | 37 | 63 | 71 |
| Tibia | 100 | 55 | 34 | 50 | 86 |
| Fibula | 19 | N/A | 20 | 6 | 71 |
| Patella | 6 | N/A | 14 | 31 | 0 |
| Metatarsal | 17 | 67 | 26 | 88 | 14 |
| Astragalus | 45 | 41 | 23 | 38 | 71 |
| Calcaneum | 32 | 42 | 34 | 25 | 43 |
| Other tarsal | 6 | ~4 | 18 | 19 | 18 |
| Phalanx | 8 | 11 | 15 | 27 | N/A |

Table 1.4: Comparison of %MAU values for *Eremotherium* at Tanque Loma, *Merycopus* at Verdigre Quarry (Voorhies 1969) and the three most common herbivores in Pit 91 at Rancho La Brea (Spencer *et al.* 2003).

| CAMS # | Sample Name | Element | d¹³C | Fraction Modern | ± | D¹⁴C | ± | ¹⁴C age | ± |
|---------------|--------------------|--------------------------------------|------------------------|------------------------|----------|------------------------|----------|---------------------------|----------|
| 147211 | UPSE 2009 HE616 | <i>Eremotherium</i> phalanx | -20 | 0.0532 | 0.0011 | -946.8 | 1.1 | 23560 | 180 |
| 160800 | MPM291 | <i>Notiomastodon</i> caudal vertebra | -20 | 0.1180 | 0.0134 | -882.0 | 13.4 | 17170 | 920 |
| 160801 | MPM325 | <i>Notiomastodon</i> metapodial | -20 | 0.0927 | 0.0144 | -907.3 | 14.4 | 19110 | 1260 |

Table 1.5: Results of radiocarbon dating analyses of extinct Pleistocene megafauna bones recovered from Tanque Loma locality, Santa Elena, Ecuador. All analyses were conducted by ELL in collaboration with Dr. T. Guilderson at the Center for Accelerator Mass Spectrometry, Livermore, CA, USA.

Chapter 2

Sociality, wallowing, and drought-related mortality in Pleistocene giant ground sloths from the Tanque Loma locality, Santa Elena, Ecuador

1. Introduction

Sloths (Xenarthra: Pilosa, Folivora) evolved in Gondawana during the Eocene and are among the most common large vertebrates in the Pliocene – Pleistocene fossil record in South America (Patterson & Pascual 1968, Pujos & De Iuliis 2007, Tito 2008). Studies in the past two decades have contributed to our understanding of the evolutionary relationships (Gaudin 2004), diet (Hofreiter *et al.* 2000, Bargo 2001, Czerwonogora *et al.* 2011), and habitat preferences (Bargo *et al.* 2006, Lima-Ribeiro *et al.* 2013) of extinct sloths, but relatively little is known about the behavior and ecology of these animals (McDonald 2005). In the late Pleistocene of South America the largest sloths were the Megatheriidae, represented by the species *Megatherium americanum* in temperate latitudes and *Eremotherium laurillardi* in the tropics (Cartelle & De Iuliis 1995). Several paleontological sites have been reported that preserve multiple individuals of *E. laurillardi* (Cartelle & de Iuliis 1995) (Figure 2.1). Gregarious behavior has been previously suggested for this species by Rossetti *et al.* (2004) and Cartelle & Bohorquez (1982), who cite possible sexual dimorphism as well as the occurrence of inter-generational fossil assemblages. However, neither of the localities on which these interpretations were based were excavated with the stratigraphic control necessary to establish that the fossils came from animals that lived contemporaneously and died together within a short span of time (Hubbe *et al.* 2013).

The Tanque Loma locality on the Santa Elena Peninsula in southwestern Ecuador (Figure 2.1) is a new late-Pleistocene (Lujanian) vertebrate deposit that preserves thousands of megamammal bones, the vast majority of which pertain to *Eremotherium laurillardi*. Evidence from several other Lujanian megafaunal localities on the Santa Elena Peninsula indicates that *Eremotherium* was abundant, but not predominant, in this region during the late-Pleistocene. The asphaltic La Carolina locality (Hoffstetter 1952, Edmund *unpublished field notes*) yielded predominantly carnivore and ungulate remains, while the mylodont sloth *Scelidotherium* is the most abundant large mammal excavated from the asphaltic Coralito locality (Chapter 3). The less abundant, non-asphaltic localities Rio Engabao (Edmund 1965) and Cautivo (Ficcarelli *et al.* 2003) have yielded isolated bones pertaining to *Smilodon*, otter, horse, deer, pampathere, *Eremotherium*, and gomphothere. Of all these sites, only El Cautivo was excavated with stratigraphic control.

The purpose of this study is to investigate the origin of the sloth-dominated megafauna deposit at Tanque Loma, and use data from this locality to understand more about the behavior of these extinct megamammals.

2. Materials & Methods

Stratigraphically-controlled excavations were conducted at Tanque Loma in 2003 – 2006 and 2009 – 2011. Throughout these excavations, three-dimensional position and two-dimensional orientation of all bones was mapped. In addition, during the 2009 – 2011 excavations, data were taken on directional orientation, dip angle and dip orientation of long elements.

Bones recovered during the 2003 – 2006 excavations have been fully prepared and are repositated at the Museo Paleontologico Megaterio in La Libertad, Santa Elena, Ecuador. These prepared bones were identified and analyzed for taphonomic features (abrasion, breakage, weathering, and evidence of carnivory) by ELL and H.G. McDonald in 2009. These data were used to calculate paleontological indices including Number of Individual Specimens (NISP), Minimum Number of Individuals (MNI), Minimum Number of Elements (MNE), Number of Animal Units (MAU), and %MAU. Because little is currently known about ontogenetic growth in *Eremotherium*, age of individuals was estimated based on size, degree of epiphyseal fusion, and tooth wear.

Geomorphological and stratigraphic analyses were conducted at the Tanque Loma site in 2009 - 2011. Laboratory sedimentological studies, including sediment grain size, loss on ignition, and pH analyses were conducted at the University of California – Berkeley in 2011 - 2012. Radiocarbon dating analyses were performed on *Eremotherium laurillardi* and *cf. Notiomastodon platensis* bones from Tanque Loma at the Lawrence Livermore National Laboratory in Livermore, California, USA in 2010 – 2012. (See Chapter 1 for detailed methods).

3. Results & Discussion

a. Context of the megafaunal assemblage

Although the majority of the megafauna bones at Tanque Loma are preserved in asphalt-saturated sediments, several factors indicate that this deposit represents a bonebed assemblage with secondary infiltration of asphalt, rather than a “tar-pit” trap as has been the model proposed for most well-known Pleistocene asphaltic localities including Rancho La Brea in California, USA (Stock & Harris 1992), Pampa La Brea in Talara, Peru (Lemon & Churcher 1961), and Mene de Inciarte in Zulia, Venezuela (Rincon *et al.* 2008). First, the main fossiliferous deposit at Tanque Loma occurs as a single extensive, vertically-restricted layer typical of a bonebed, whereas “tar pit” formations tend to occur as isolated conical lenses (Lemon & Churcher 1961, Woodard & Marcus 1973). Second, the asphaltic sediments at Tanque Loma do not penetrate all the way to the top of this fossiliferous layer, which is inconsistent with a model positing accumulation by entrapment in tar. And third, carnivores and birds are almost completely absent from the megafaunal deposit at Tanque Loma, in contrast to tar-pit traps where these tend to be the best-represented taxa (Stock & Harris 1992, Lemon & Churcher 1961).

The strata comprising the Tanque Loma megafauna deposit consist of well-sorted fine-grained sediments, with occasional angular limestone clasts of varying sizes that

appear to have eroded out of the adjacent hillside. This sedimentary layer extends for approximately one meter above the main bonebed layer; megafauna bones are occasionally encountered in these upper sediments, but they tend to be very fragmented and weathered (weathering stages 3-5, *sensu* Behrensmeyer 1978). This is in contrast with the bones encountered within the bonebed that are generally relatively complete (68% of bones excluding vertebrae, ribs, & cranial elements, are $\geq 75\%$ complete, and 45% of these are 100% complete) and display little evidence of weathering (Behrensmeyer weathering stages 0-1). At least two separate episodes of paleosol development are evident in the megafauna-bearing strata, and a caliche deposit, including abundant CaCO_3 nodules and calcareous root casts, is present at the top of this feature, where it unconformably contacts a series of fine (0.5 cm – 10 cm thick), loose, fluvial or lacustrine deposited layers rich in microfauna bones that are presumed to be Holocene in age (Chapter 1).

The main bonebed contains abundant plant material, including a large amount of small (1 cm – 2 cm long) twigs, leaves, and thorns, as well as occasional larger (up to 30 cm long) branch and root fragments. Some of the smaller material occurs as an approximately 0.5 cm thick mat overlying some of the bones in the asphaltic sediments, but it is abundant throughout the asphaltic deposit and in the overlying non-asphaltic sediments as well. Underlying the megafauna-bearing strata is a 0.5 m thick anoxic clay-rich layer interpreted as a gley (Figure 1.3). Taken together, these data indicate that the majority of the megafauna skeletons at Tanque Loma accumulated in a low-energy fluvial or lacustrine environment with abundant marshy vegetation that underwent periodic desiccation resulting in the occasional establishment of terrestrial plant communities at this site. The fact that this marshy habitat was probably ephemeral and usually isolated from other water sources is indicated by the lack of remains of fish, turtles, or other aquatic taxa in the megafauna-bearing sediments. Several marshy habitats in arroyo bottoms near the present-day site are fed by subterranean springs (Stoehert 1985), and the ancient Tanque Loma locality may have been analogous to these habitats.

Radiocarbon dates so far obtained from Tanque Loma indicate that the main fossiliferous concentration dates to, during, or just after the last glacial (Chapter 1). An *Eremotherium laurillardi* manual phalanx collected from the uppermost part of the asphalt-saturated sediments yielded a radiocarbon date of 23,560 \pm 180 RCYBP. Two *cf. Notiomastodon platensis* elements – a metapodial and a caudal vertebra – collected from above the asphaltic layer yielded overlapping dates of 19,110 \pm 1,260 and 17,170 \pm 920. The epiphysis of an *E. laurillardi* vertebra collected from near the top of the megafauna-bearing strata did not yield sufficient collagen to date.

The fossil material examined in this study comprises at least 663 individual identifiable megafauna elements, of which 571 pertain to *Eremotherium laurillardi*. A minimum of sixteen individual *E. laurillardi* have been identified based on these specimens, including 9 adults, 2 juveniles, 3 neonates and 2 probable fetuses. Of the adults, only two or three are inferred to represent very old individuals based on extensive tooth wear. Five other large mammal taxa have been identified at Tanque Loma; these include the mylodont sloth *Glossotherium tropicorum* (NISP = 8/ MNI = 3); a gomphothere *cf. Notiomastodon platensis* (NISP = 76/ MNI = 3); the pampathere *Holmesina occidentalis* (NISP = 4/ MNI = 1); the horse *Equus santaelenae* (NISP = 3/ MNI = 2); and a deer *cf. Odocoileus salinae* (NISP = 1/ MNI = 1). (Figure 1.10). Fewer than five microvertebrate bones have been recovered

from the megafauna-bearing strata. Overall, the vast majority of both specimens (86%) and individuals (64%) represented in the megafauna-bearing Strata at Tanque Loma pertain to *E. laurillardi*.

Such monodominant assemblages can arise through attritional or catastrophic mortality. Both cases are common in the fossil record; attritional mortality is often seen in areas that particular taxa tend to frequent over long periods of time, such as watering holes (Agenbroad 1984, Barnosky 1985, Alberdi *et al.* 2001), while catastrophic death assemblages may arise in similar contexts or in deposits typified by the agents of the mortality, such as flood sediments, volcanoclastics, or archaeological sites. Attritional and catastrophic assemblages can be distinguished primarily through age profiles: an attritional assemblage should comprise an overabundance of very young and very old individuals, as these are the most likely members of a population to succumb to “natural” forces such as disease and predation, whereas a catastrophic assemblage should preserve a cross-section of the population, with a preponderance of healthy, mid-aged adults (Olsen & Shipman 1988, Hunt 1990). However, the actual situation may be more complicated, as these profiles are dependant on factors such as life span, newborn life expectancy, length of infancy, and whether the population itself is growing, stable, or in decline (*see* Lyman 1987 for further discussion).

In the case of the Tanque Loma megafauna deposit, the demographics of *E. laurillardi* most closely resemble a “typical” catastrophic assemblage, as the majority of individuals (9/14, excluding fetuses) are large juveniles or mid-aged adults, with neonates and very old adults represented in lower quantities (Figure 2.2). Contemporaneous death is also suggested by the fact that nearly all of the *E. laurillardi* bones occur in a single fossiliferous layer with relatively little sediment separating the bones, suggesting that the bonebed accumulated over a relatively short span of time (Gates 2005).

b. Causes of catastrophic assemblages

Several phenomena can produce catastrophic assemblages including 1) natural disaster such as flash flood or volcanic eruption (e.g. Voorhies 1985, Turnbull & Martill 1988); 2) miring or entrapment (e.g. Sander 1992, Varicchio *et al.* 2008); 3) selection by predators, including humans (e.g. Alberdi *et al.* 2001, Haury *et al.* 1959, Reeves 1978); and 4) death by drought or disease (e.g. Dalquest & Mamay 1963, Hunt 1990, Rogers 1990, Schwartz & Gillette 1994). The Tanque Loma *Eremotherium* assemblage can be evaluated with regard to these four factors:

1) *Natural disaster*: There is no evidence of natural disaster at Tanque Loma. As discussed above, the sediments in the megafauna deposit suggest low-energy deposition, which is not consistent with a flood or tsunami deposit. There is also no ash, charcoal, or other evidence of fire or volcanic activity in the megafauna-bearing strata. While not all natural disasters can be ruled out (e.g., noxious gas release [Xing & Norell 2006]), there is no empirical data to suggest their role in the formation of this deposit.

2) *Selection by miring or entrapment*: The Tanque Loma megafauna assemblage is not consistent with accumulation through entrapment. Although the locality is asphaltic, it did not function as a “tar pit” style trap like Rancho La Brea in California, USA (Stock & Harris 1992) and the Talara tar seeps in Talara, Peru (Lemon & Churcher 1961). All sedimentological, geomorphological, and paleontological evidence from this locality -- as discussed above -- indicates that the asphalt at Tanque Loma infiltrated the deposit after the deposition of the bone bed, and thus could not have played a role in entrapment.

Furthermore, in the case of miring distal elements (limbs) would be expected to be overrepresented in the deposit, frequently articulated and vertically-oriented (Sander 1992, Solveig *et al.* 1997, Gates 2005). At Tanque Loma, podials are among the poorest-represented elements (Figure 2.3). Very few elements (and no podial bones of *Eremotherium*) have been found articulated at Tanque Loma, and there is no directional orientation to the dip of elements, most of which have a dip angle of $< 20^\circ$ (Figure 2.4. See Chapter 1 for detailed taphonomic data).

3) *Selection by carnivoran or human predators or scavengers*: Large and mid-sized carnivores reported from Pleistocene deposits on the Santa Elena Peninsula include *Dusicyon*, *Protocyon*, *Puma*, and *Smilodon* (Hoffstetter 1952, Edmund 1965). Adult *E. laurillardi*, which comprise the majority of the remains at Tanque Loma, should have been somewhat buffered from predation by these taxa due to their extremely large size (approximately 3,500 kg, Smith *et al.* 2003). Even if certain of these predators hunted in packs, as some authors have suggested (e.g. Carbone *et al.* 2009), they would likely only attack a single megaherbivore at a time and consume it in place, as occurs among modern pack-hunting taxa such as lions and canids (Estes & Goddard 1967, Schaller 1972). On the other hand, a skeletal accumulation produced by scavenging should comprise only smaller *E. laurillardi* elements such as metapodials and phalanges, as these would be the most easily transported to a den, whereas the best represented elements at Tanque Loma are large bones such as tibiae, humeri, and radii, and even the enormous femora have nearly 50% MAU representation (Figure 2.3). Most notably, there is no evidence of carnivore tooth marks or gnawing on any of the Tanque Loma bones examined, whereas in carnivore-produced assemblages a relatively high proportion of bones present tooth marks (Haynes 1983, Arribas & Palmqvist 1998).

There is also no evidence of human activity in the Tanque Loma megafaunal deposit: none of the bones have evidence of anthropogenic cutting, and there are no artifacts or charcoal associated with the megafauna deposit. Furthermore, the presence of several young juvenile *E. laurillardi* in the deposit is inconsistent with a hunting mode specializing in prime adult individuals, which is typical of archaeological accumulations (Stiner 1990). Finally, the radiocarbon date obtained on the *E. laurillardi* phalanx from the deposit predates accepted human presence in South America by more than 8,000 RCY, and on the Santa Elena Peninsula by more than 12,000 RCY (Chapter 1). Thus, human activity can almost certainly be ruled out in the formation of this assemblage.

4) *Drought or Disease*: Several lines of evidence are consistent with the hypothesis that the megafaunal assemblage at Tanque Loma comprises a protracted mass death of a gregarious population of *E. laurillardi* in a shallow body of still water, which would be

consistent with mortality from drought or disease among large, semiaquatic herbivores (Haynes 1988, Behrensmeyer *et al.* 2012). First, the animals preserved in the bone bed appear to have mostly died *in situ*, as there is no evidence for long-distance transport of bones and the sediments and orientation of elements within the deposit do not suggest rapid or sustained flow. Second, the very low incidence of weathering on most of the bones indicates that they were either buried or submerged in water shortly after deposition. Because the generally well-sorted, fine-grained sediments and vegetational mats immediately overlying the bonebed are inconsistent with rapid burial, submersion in water is more likely. Third, the dense distribution of bones and thickness of the bonebed is consistent with deposition within, rather than peripheral to, a body of water (Hunt 1990). Fourth, despite the lack of apparent transport and weathering, very few elements are articulated, there is substantial trampling abrasion on many of the bones, and most fragile elements including ribs, vertebral processes, and cranial elements are heavily fragmented. This is consistent with a scenario in which carcasses were disarticulated and trampled on a lake bottom by large animals over a period of months (though probably not longer, given the small amount of sediment included in the bonebed). Finally, the presence of an anoxic gley immediately underlying the bonebed along with the lack of aquatic taxa suggests the presence of an isolated, probably ephemeral marshy habitat at the time the bones were deposited.

Taken together, and given that other agents such as natural disaster, entrapment, predation, and human activity appear highly improbable, these data suggest that the megafauna deposit at Tanque Loma most likely represents a population of *E. laurillardi* that, along with a few individuals of other taxa (*Notiomastodon* & *Glossotherium*) perished in a short span of time in an ephemeral watering hole, likely as the result of drought, disease, or a combination of these factors.

c. Modern analogues

The *in situ* drought- or disease-related death of a multigenerational *Eremotherium laurillardi* population within a shallow lacustrine habitat suggests that these animals may have been both gregarious and semi-aquatic. Drought-related assemblages of semi-aquatic and amphibious taxa are relatively common in the paleontological record (e.g. Dalquest & Mamay 1963, Hunt 1990), and are likely analogous to situations observed in Africa today, wherein large wallowing herbivores restricted to continuously-shrinking watering holes are known to die *en masse* within a span of days to months (Haynes 1988, Behrensmeyer *et al.* 2012). Based on the data from Tanque Loma, the nearest modern analogue to *E. laurillardi* may be hippopotami, which congregate in large numbers in water sources where they spend most of their time submerged to protect themselves against heat, sun and insects. In times of drought, as these water sources begin to dry up, surrounding vegetation disappears and the wallows become increasingly polluted with hippopotamus fecal material (Smuts & Whyte 1981). Eventually, most animals succumb to drought-related starvation and/or disease long before the watering hole has completely evaporated (Behrensmeyer *et al.* 2012, G. Matzke *pers. comm.*) (Figure 2.5).

This analogy is supported by the fact that a significant portion of the plant material encountered in the strata containing the *Eremotherium* bones appears to have been chewed by giant sloths, and likely was deposited in the then-existing marsh as fecal material. The majority of the twigs and stems recovered are relatively uniform in length, about 1 cm – 2 cm (Figure 2.6), which corresponds to the interloph distance of adult *Eremotherium* dentition. Similar material has been interpreted as the fodder of *Eremotherium* at the nearby La Carolina locality (Churcher 1966), and the northern Peruvian Talara locality (Lemon & Churcher 1961).

Unfortunately, no close relatives of *Eremotherium* survive today, and it is difficult to ascertain what might be the closest ecological analogue to these animals. The phylogenetically closest living relatives of *Eremotherium*, modern tree sloths, are ecologically dissimilar in many respects (small, arboreal) but probably retain some shared characteristics such as relatively long gestation period (gestation in *Choloepus* is about 12 months) and low metabolism. The extant terrestrial mammals most similar in size to *E. laurillardi* are elephants (which are also known to engage in wallowing behavior), but these differ from modern and almost certainly extinct sloths in having much higher metabolic rates and larger home ranges.

Hippopotami might be considered a reasonable analogue to Eremothere ground sloths. Like modern sloths, hippos have complex, multi-chambered stomachs that employ microbial fermentation to digest their browse, and they tend to spend most of their time within a few hundred meters of their watering holes, venturing out mainly to forage. The data from Tanque Loma suggests that wallowing behavior may be another similarity between the species.

Wallowing behavior in *E. laurillardi* would not be unreasonable to expect. Wallowing is a common cooling mechanism not only in hippopotami but among other extant megaherbivores that inhabit arid, tropical ecosystems, including elephants, wildebeest, and rhinos. Some taxa of giant sloths are known to have been at least partially aquatic (De Muizon & McDonald 1995) and individuals of the Pleistocene mylodont sloth *Lestodon* have yielded isotopic nitrogen ratios similar to those for hippopotami (R.A. Fariña, *pers. comm.*) It has even been postulated that, like extant wallowing mammals, megathere sloths were hairless (Fariña 2002), in which case wallowing behavior would have been particularly advantageous as protection against sun and insects.

d. Life history traits of *Eremotherium laurillardi*

If, as interpreted here, the Tanque Loma bonebed represents a catastrophic death assemblage of a population of *Eremotherium laurillardi*, it may have the power to provide information about the life history of this species. Specifically, the presence of two fetuses and three neonates among the 16 individual sloths might suggest that *E. laurillardi* had a distinct breeding season. This is typical of large mammals that inhabit seasonally dry tropical environments, including hippopotami and elephants. Seasonal births are also observed in modern tree sloths of the genus *Bradypus* and may occur in the two-toed sloth *Choloepus hoffmanni* as well (Taube *et al.* 2001, Bezerra *et al.* 2008).

An alternative interpretation is that the two *E. laurillardii* fetuses may represent a set of twins. However, twinning is extremely rare both in extant megamammals and in modern sloths (Millar & Zammuto 1983, Taube *et al.* 2001). Thus, the relatively high incidence (5/16, or 31%) of *E. laurillardii* individuals of nearly identical gestational age is more likely due to seasonal births.

In modern tropical savannah megaherbivores, births are timed to coincide with the wet season, in order to ensure adequate resources for the growing offspring (Laws & Clough 1966, Hanks 1972, Smuts & Whyte 1981). Presuming that *E. laurillardii* behaved similarly, the presence of several late-gestation fetuses or newborn individuals at Tanque Loma are consistent with the hypothesis that the assemblage arose through drought-related mortality, as this age crop would be expected to coincide with the end of an unusually long dry season.

4. Conclusions

Taken together, the evidence from the Tanque Loma locality suggests several aspects of the behavior of *E. laurillardii*: 1) the presence of a monodominant, probably catastrophic assemblage comprising individuals from all age categories implies that these animals may have been gregarious, and may have gathered in intergenerational groups; 2) the occurrence of this catastrophic assemblage in a low-energy, marshy aquatic setting containing a large amount of what appear to be *E. laurillardii* feces indicates that these organisms may have engaged in wallowing behavior, as is practiced by certain modern large African mammals – notably hippopotami -- as an escape from heat and insects; and 3) the presence of three newborn and two fetal sloths in the assemblage suggests that these animals may have had a distinct breeding season, as is common among modern megaherbivores inhabiting seasonally dry tropical environments.

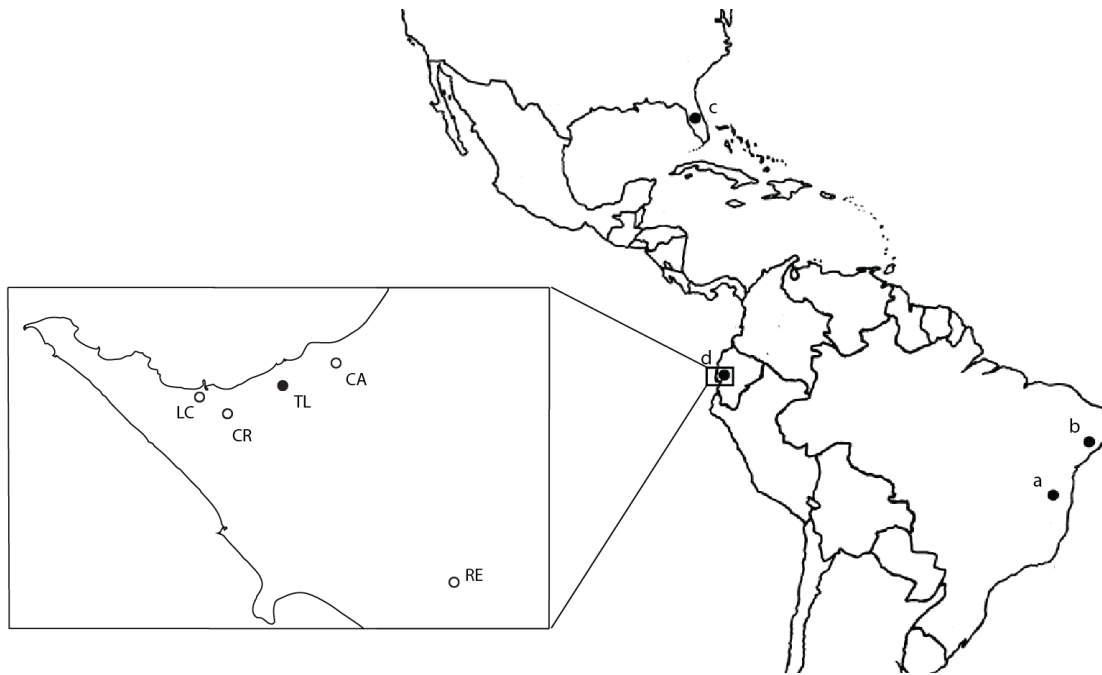


Figure 2.1: Map showing monodominant *Eremotherium laurillardi* localities reported in the literature. (a) Toca das Onças in Bahia, Brazil (MNI = 36), (b) Pernambuco Brazil (MNI = 14), (c) Daytona Beach Bonebed in Florida, USA (MNI = 11), (d) Tanque Loma in Santa Elena, Ecuador (MNI = 16). (Map modified from Cartelle & de Iuliis 1995; data from Cartelle & de Iuliis 1995, Araújo - Júnior *et al.* 2013, and this study). Inset shows detail of boxed area in (A): Santa Elena Peninsula, Ecuador, showing location of Tanque Loma (TL) in relation to other megafauna localities in the region: CA = Cautivo; CR = Coralito; LC = La Carolina; RE = Rio Engabao.

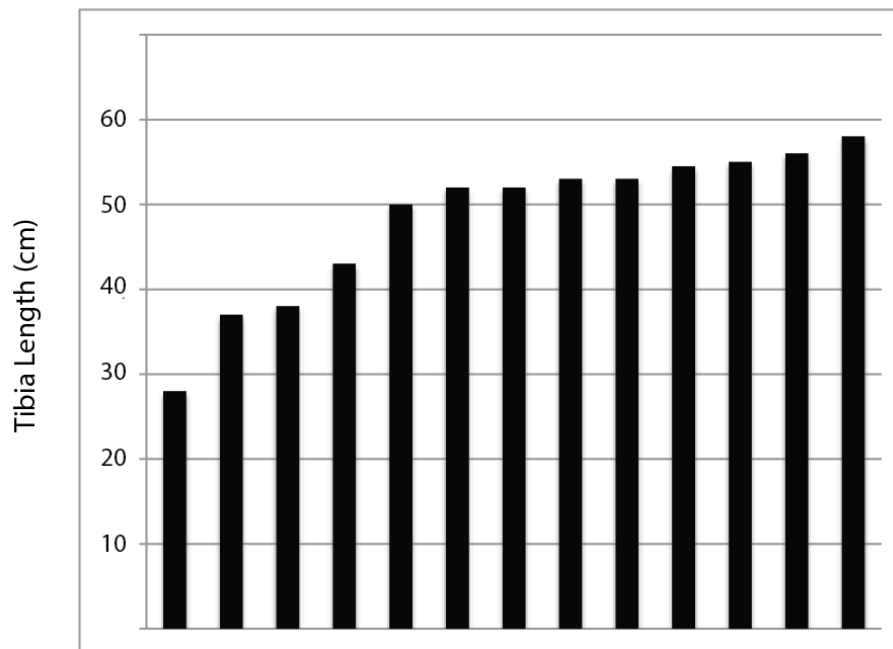
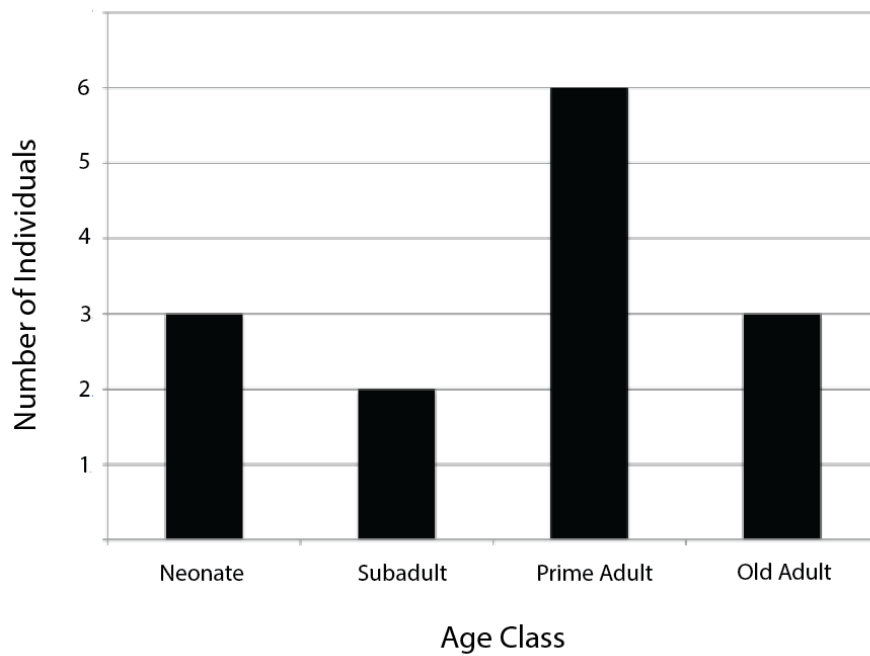


Figure 2.2: Age and size profiles of *Eremotherium laurillardi* individuals at Tanque Loma locality (fetuses excluded). (A) Mortality profile by age class. (B) Lengths of 13 complete left tibias of *E. laurillardi* collected from the bonebed.

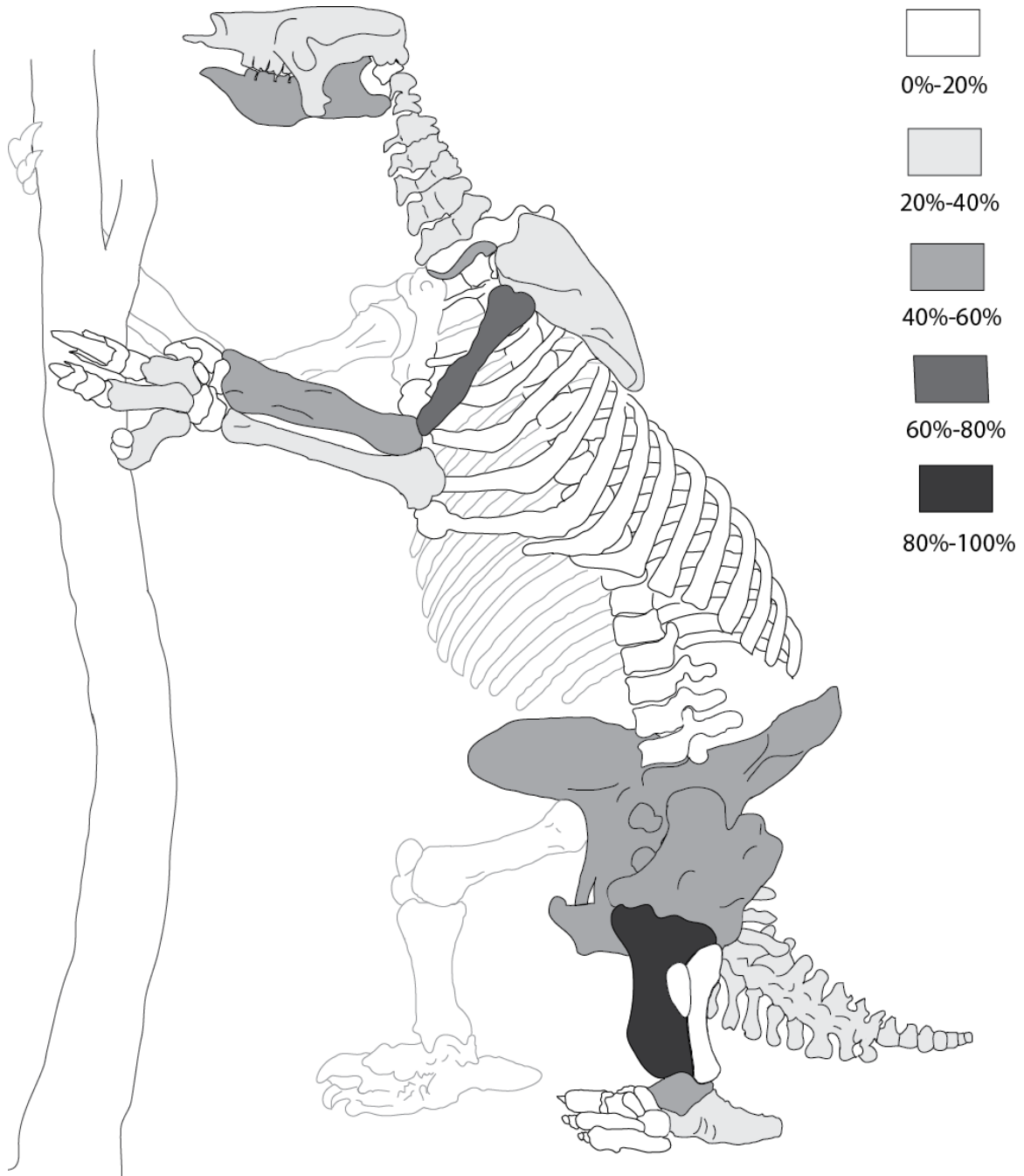


Figure 2.3: Relative representation (% MAU) of skeletal elements of *Eremotherium laurillardi* recovered at Tanque Loma locality, Santa Elena, Ecuador.



Figure 2.4: Rose diagram showing dip angle of long elements encountered in the Tanque Loma bonebed. Analysis includes all bones and bone fragments > 10 cm in length in excavation unit 11 that had a length-to-width ratio of at least 2:1. N = 103. Most elements (78%) have dip angles shallower than 20°.



Figure 2.5: Photos taken by Dr. G.E. Matzke during monitoring of hippopotamus populations in the Selous Game Reserve, Tanzania, over an 18-month period in 1973-74. (A): Matandu River hippo population comprising ~140 individuals at the beginning of the dry season, in relatively clean conditions. (B): Same waterhole later on in the dry season, with some hippopotamus fecal debris visible floating on the surface in the foreground. (C): Hippos in a nearby waterhole on the Kingupira floodplain during the dry season. Entire surface of the water is covered by abundant fecal debris. (D): Matandu River waterhole late in the dry season, showing a small group of live hippos in the water and many hippo corpses on the shore. Within the span of one week the herd was reduced from its original size to ~40 live hippos.



Figure 2.6: Plant material collected from the lower 10cm of Stratum IV at Tanque Loma. The uniform length of many of the plant fragments encountered in the deposit, at approximately half the interloph distance of *Eremotherium* molariforms, indicate that these likely represent coprolite material of *Eremotherium* sloths.

Chapter 3

“Tar pits” of the western Neotropics: paleoecology, taphonomy, and mammalian biogeography

Introduction

Asphaltic paleontological localities, colloquially known as “tar pits,” are important paleontological resources because of their tendency to collect and preserve organic remains regardless of exterior environmental conditions (Jull *et al.* 2004). These localities can serve as important repositories of information about extinct fauna and ecosystems, because they preserve both remains of organisms and materials such as isotopes and pollen that can be used in paleoenvironmental analyses (Akerston *et al.* 1983, Stock & Harris 1992, Coltrain *et al.* 2004). In addition, because most of these localities are Quaternary, the faunistic information they preserve can be used in establishing “biodiversity baselines” for understanding ecosystems before and after the late-Quaternary extinction event.

Asphaltic localities are particularly important resources in the lowland Neotropics, because they preserve remains with otherwise scarce Quaternary paleontological data (Churcher 1959, Rincon *et al.* 2006). This scarcity is due to both physical and social factors. First, bone and collagen can be degraded by the elevated heat, ultraviolet radiation and acidic soils that are typical of these regions (Lebon *et al.* 2011), and second, because countries in these regions are often poorer and/or less stable than their temperate counterparts, even when fossils are preserved there may be logistical, economic, and political challenges to their recovery (Laurin 2012). Currently the Neotropics has the least Pleistocene data for the South American continent, with fewer than a dozen direct radiocarbon dates on megafauna from this region (Barnosky & Lindsey 2010).

Increasing Quaternary paleoecological data in the Neotropics is particularly important. First, this region constitutes 80% of the South American continent, and thus understanding paleoecological dynamics such as biogeographical patterns of South American taxa, post-Great American Biological Interchange (GABI) dynamics, or causes of late-Quaternary extinctions in South America is dependant upon good geographical and taxonomic coverage of the tropical zone. Second, this region is an area of exceptionally high extant biodiversity (Olson & Dinerstein 1998) that is expected to be disproportionately impacted by modern environmental changes related to climate change and anthropogenic impacts (Brooks *et al.* 2002, Williams *et al.* 2007). Thus, having a better understanding of ecological dynamics and extinction drivers in past neotropical ecosystems could prove important in informing modern conservation efforts in this region today.

Fortunately, several known asphaltic localities preserve rich accumulations of late-Pleistocene fauna in the neotropical region. The most well known of these localities is Pampa La Brea in Talara, Peru (e.g. Lemon & Churcher 1961, Churcher 1966, Campbell 1979, Czaplewski 1990, Martinez & Cadenillas 2004). Several fossiliferous asphaltic sites are also known from the nearby Santa Elena Peninsula in southwest Ecuador. These include the La Carolina (Hoffstetter 1952, Campbell 1976) and Coralito (Spillmann 1935,

Edmund, *unpublished field notes*) localities, excavated in the early - middle part of the 20th Century, as well as a new locality, Tanque Loma (Chapter 1) (Figure 3.1). Two additional highly fossiliferous asphaltic localities have been reported recently from Venezuela: Mene de Inciarte in Zulia State (Czaplewski *et al.* 2005, Rincon 2006a, 2006b, & 2011, Prevosti & Rincon 2007, Rincon *et al.* 2006, 2008, & 2011); and El Breal de Orocuai in Monagas State (Rincon *et al.* 2009, 2011, Holanda & Rincon 2012). In addition, asphaltic vertebrate localities are known from a couple of Caribbean islands including Trinidad (Blair 1927) and Cuba (Iturralde-Vinent *et al.* 2000).

The purpose of this study is to compare the taphonomy, paleoecology and biogeographic faunal patterns of the late-Quaternary (Lujanian South American Land Mammal Age) asphaltic vertebrate localities from the western coastal Neotropics – the three reported localities from the Santa Elena Peninsula in Ecuador (La Carolina, Coralito, and Tanque Loma) and the better-studied Talara locality on the north coast of Peru (Figure 3.1). These sites all fall in a shared biogeographic zone (Udvardy 1975) and probably have a similar recent geological history. Multiple authors (Sheppard 1928 & 1937; Hoffstetter 1948 & 1952; Lemon & Churcher 1961, Ficarelli *et al.* 2003) have noted the presence of three marine terraces uplifted during the early/middle- and later- Pleistocene in both regions. Although the individual terraces (known in both regions as *Tablazos*) may not be homologous, they are similar in age and composition, both comprising a series of calcareous sandstones, sands, sandy limestones and fine conglomerates, with abundant mollusk fossils (Barker 1933, Lemon & Churcher 1961, IGM 1974). And, in both regions, the *Tablazo* deposits overlie older rocks, some of which seep oil that emerges onto the surface in numerous locations.

Both on the Santa Elena Peninsula and in northern Peru, the modern ecosystem is a coastal desert and the surface is cut by numerous dry riverbeds (*arroyos*), most of which carry water only seasonally or inter-annually during El Niño events. Paleoclimatic data suggests that these areas were also arid during the Pleistocene (Churcher 1966, Tellkamp 2005), however, they must have been more heavily vegetated in order to support the abundance of large animals found in the fossil deposits. Most data suggests that late-Pleistocene ecosystems in both regions comprised open grassland savannah crossed by permanent or semi-permanent river courses supporting dense wetland vegetation (Lemon & Churcher 1961, Sarma 1974, Campbell 1976, Tellkamp 2005, Stothert 2011).

Materials and Methods

Of the four sites in this study, only Tanque Loma was originally excavated using modern paleontological techniques, including stratigraphic control. Controlled excavations were conducted at Tanque Loma in 2009 – 2011 (Chapter 1). Detailed geostratigraphic, taphonomic, and sedimentological studies were made of the site during the excavations. Visits were also made to the La Carolina, Coralito, and Talara localities to try to learn more about the geomorphology of these sites. Geomorphological data obtained from these activities were compared with published information for Talara and data from field notes of the Coralito excavations (Edmund *unpublished field notes*).

Investigations were made of the fossil material collected at La Carolina, Coralito, Tanque Loma, and Talara localities now held in museum collections. Material from La Carolina was examined at the Escuela Politécnica Nacional (EPN) in Quito, Ecuador and the Museum National d'Histoire Naturelle (MNHN) in Paris, France. Material from Coralito and Talara was examined at the Royal Ontario Museum (ROM) in Toronto, Canada. And material from Tanque Loma was examined at the Museo Paleontológico Megaterio in La Libertad, Ecuador.

Fossil material was examined to confirm taxonomic identification in the museum records; establish minimum number of elements (MNE) and minimum number of individuals (MNI) counts for different taxa; and compare taphonomic characteristics of the bones between different localities. Geomorphological, taxonomic, and taphonomic data from these four localities were compared with published data from the Rancho La Brea and McKittrick localities in California, USA.

Results & Discussion

Chronology

The faunal composition at all four sites studied place them in the late Pleistocene (Lujanian). In addition, radiocarbon dates have been conducted on material from three of the localities. No dates have yet been obtained for Coralito. Four dates have been reported for Talara: two on plant material purportedly representing stomach contents of the giant ground sloth *Eremotherium*, and two on “large pieces of wood associated with the bones” (Churcher 1966). All four dates cluster closely between 13,500 and 14,500 Radiocarbon Years Before Present (BP) (Table 3.1 – radiocarbon dates). All samples were purified in a Soxhlet extractor with carbon tetrachloride, until the solvent was clear. One date of 18,400 +/- 600 BP has also been reported for La Carolina, on twigs supposedly “chewed” by *Eremotherium* (Churcher 1966). Three dates were obtained on bone of extinct megafauna from Tanque Loma -- one date on an *Eremotherium* phalanx yielded an age of 23,560 +/- 180 BP, and dates on a caudal vertebra and metapodial of the gomphothere *cf. Notiomastodon* from slightly higher in the deposit yielded ages of 17,170 +/- 920 and 19,110 +/- 1,260 BP, respectively (Chapter 1). These three samples were prepared using ultrafiltration, but no solvent was used, as the bones did not appear to contain any asphalt. Nonetheless, all dates reported from these sites should be considered equivocal, both due to the limited number of dates and because of the problems inherent in dating hydrocarbon-contaminated materials (Aufderheide *et al.* 2004).

Geomorphology

The two examined sites, Tanque Loma on the SEP and Talara in Peru, present dramatically different geomorphologies. At Talara, the asphaltic sediments occur as numerous isolated, irregular lenticular deposits often in the form of inverted cones (Lemon & Churcher 1961, Churcher 1966). These deposits range up to 2 m in thickness and can

extend for up to 10 m in length. Vertebrate remains are encountered only in some of these deposits. These characteristics are similar to the geomorphological context reported for Rancho La Brea in California, USA (Stock & Harris 1992), which is suggestive of accumulation of remains via entrapment in exposed pools of asphalt.

In contrast, the asphaltic sediments at Tanque Loma occur as one continuous deposit approximately 75 cm in thickness with a broad lateral extent (Figure 3.2). Bones in this deposit are distributed densely and uniformly throughout the asphaltic layer and 10 – 20 cm above it. Overall, the character is much more typical of a bonebed, suggesting that the asphalt infiltrated the sediments secondarily after the bones were deposited and buried.

Unfortunately, the La Carolina and Coralito localities are no longer accessible for geological investigation, and no formal studies were made at the time of their excavation. Therefore, the origin of these deposits must be inferred through taxonomic and taphonomic characteristics alone.

Taxonomic composition

Mammalian taxonomic richness for Talara, La Carolina, Coralito, and Tanque Loma was calculated by examination of museum collections and from published records in the literature. Of these four localities, Talara presents the highest diversity of mammals (Figure 3.3; Table 3.2). One explanation for this may be increased sampling effort (more than 17,000 prepared vertebrate specimens from Talara are repositied in the Royal Ontario Museum in Toronto, Canada, and approximately 5,000 more specimens have been collected over the past ten years that are now repositied at the Universidad Nacional de Piura (J.N. Martinez, *pers. comm.*). This is in comparison with approximately 3,000 specimens from Coralito in the ROM collections; 2,000 specimens from La Carolina that are repositied in the Escuela Politécnica Nacional in Quito, Ecuador and the Museum National d'Histoire Naturelle in Paris, France; and 1,000 specimens from Tanque Loma in the Museo Paleontológico Megaterio in Santa Elena, Ecuador. A second factor that may have contributed to this pattern is increased study and publication of these collections: more than a dozen published studies exist reporting taxa from Talara (e.g. Churcher 1959, 1962, 1965, & 1966, Lemon & Churcher 1961, Churcher & Zyll de Jong 1965, Campbell 1979, Czaplewski 1990, Martinez & Cadenillas 2004, Alván *et al.* 2009, Oswald & Steadman 2010), and several of these were made on the more recently-collected fossils that focused on smaller, extant taxa which were often overlooked during earlier excavations. In comparison, only about half that number report fauna from La Carolina (Hoffstetter 1948a-c, 1949, 1952, Campbell 1976, Martinez & Cadenillas 2006), and most of these are older publications dealing exclusively with the megafauna, much of which has since been synonymized. Finally, only a couple of studies have been made so far on the fauna of Coralito and Tanque Loma (Spillman 1931, 1948; Chapter 1). Publication bias has been shown to affect diversity estimates, including richness (Davis & Pyenson 2007), and the results presented here should be considered with this in mind.

However, some of the differences in observed mammalian diversity between the four localities probably cannot be explained by differences in either sampling or

publication effort, and are more likely related to factors inherent in the formation of the deposits. For instance, the locality in this study with the lowest observed diversity is Tanque Loma, with only six mammalian taxa discovered in the asphaltic deposit. While this locality has the fewest identified specimens of all the localities in this study, it was excavated the most recently, and substantial efforts were made during the excavations to recover all faunal remains in the deposit, including screening for small elements and use of solvent to look for microfossils. Thus, the low diversity at this site (principally dominated by one species of ground sloth, *see below*) must be explained by some other factor. Likewise, the fact that the La Carolina and Talara localities exhibit a higher proportion of carnivores and small mammals than Coralito and Tanque Loma may be related to the fact that the former two localities functioned as a Rancho La Brea-style trap, as these groups tend to be the best-represented mammal taxa in such deposits (Lemon & Churcher 1961, Stock & Harris 1992).

This model is supported by the great abundance of bird fossils found at La Carolina and Talara. Birds, particularly water fowl, are among the most abundant organisms in “tar pit” traps, presumably because they are attracted by the perception of a watering hole given by a film of water covering the surface of the asphalt (Churcher 1966, Campbell 1979, Stock & Harris 1992). Moreover, studies made of the avifauna from Talara and La Carolina (Campbell 1976 & 1979) reveal that the bird taxa at these localities bear a close resemblance both to one another and to that found at the well-studied asphalt trap locality Rancho La Brea. The beetle fauna at Talara corresponds to the model of entrapment of hydrophilic taxa, as it comprises a large proportion of species typical of standing-water habitats, and is also similar to that found at Rancho La Brea (Churcher 1966). Despite directed searching for microvertebrates, Tanque Loma has yielded fewer than half a dozen remains of Aves in the megafaunal deposit. And, only a half dozen bird bones are in the ROM collections from Coralito, although 50 sacks of matrix were collected and processed in hot kerosene to search for microfauna during the excavations (Edmund *unpublished field notes*); in fact, Edmund (*unpublished field notes* 1959) notes that at Coralito “small bones were not nearly as abundant as . . . at Talara.”

Other associated fauna at these sites suggest differences in local paleoenvironments between these four localities. In addition to the mammalian, avian, and insect fauna, Talara has yielded remains of reptiles, including crocodylians and turtles, indicative of nearby aquatic environments (Lemon & Churcher 1961). La Carolina has a few remains of frogs, caiman, and indeterminate testudines, but also terrestrial tortoises and lizards, so overall the signature is less aquatic than that of Talara. Tanque Loma, on the other hand, has no remains of aquatic taxa, only a few bird bones, and no reptiles; the most abundant invertebrate at this locality are terrestrial snails of the genus *Porphyrobaphe*. This genus occurs on the Ecuadorian coast today, but is associated with somewhat wetter climates further north (Barker 1933). Finally, the associated fauna at the Coralito locality has a strongly marine signature, comprising beds containing abundant marine shell and shark teeth. Turtle, tortoise, and otter remains are also present at this locality.

Abundance Data

Perhaps even more interesting than the differences in species richness between the four localities is the great difference in the relative abundances of taxa at these sites (Figure 3.4). Broadly, these localities fall into two categories: Talara and La Carolina are both dominated by carnivores, principally canids. Coralito and Tanque Loma, on the other hand, both contain predominantly giant ground sloths.

Overabundance of carnivores is one of the classic characteristics of “tar pit” style traps (Stock & Harris 1992), and is the pattern observed at the well-known North American site Rancho La Brea, as well as the less-studied McKittrick locality, both in California, USA. When compared against these sites, La Carolina is seen to most closely resemble the McKittrick locality, as both contain similar proportions of canids, felids, and equids, and similar relative proportions of carnivores and herbivores. Talara, on the other hand, is more similar to Rancho La Brea, in having more than 75% of the specimens represented by carnivores, and similar low proportions of perissodactyls, artiodactyls, proboscideans and sloths. Furthermore, while Talara does not have the very high proportion of felids that is seen at Rancho La Brea, the proportion is significantly higher than at La Carolina. These differences are interesting, as they reinforce the idea that fossil accumulations generated through entrapment in asphalt may be more complex than originally thought, as even geographically close localities with presumably similar paleocommunities may preserve different segments of the population in different proportions.

Similarly intriguing taxonomic differences are evident in the case of Coralito and Tanque Loma. Although both these localities are heavily dominated by giant ground sloths, and are separated by only a few kilometers, the most common taxon at Coralito – *Scelidodon* – is not found at Tanque Loma. Remains of another sloth, *Eremotherium*, are abundant at both localities. At both these sites, the dominant taxa are represented by multiple age classes. At Coralito, a minimum of five *Eremotherium* sloths are represented, at least one of which is a neonate; and at least eight *Scelidodon* individuals are preserved at this site, most of which appear to be juveniles or neonates. At Tanque Loma, *Eremotherium* is represented by at least 16 individuals, including three neonates, two subadults, six or seven prime adults, and two to three very old individuals, as well as two probable fetuses. Other taxa are also represented by multiple individuals at these sites; these include, at Coralito: *Glossotherium* (MNI = 3), *Didelphis* (MNI = 4), *Holmesina* (MNI = 5), *Palaeolama* (MNI = 5), and *Odocoileus* (MNI = 3); and, at Tanque Loma: *Notiomastodon* (MNI = 3) and *Glossotherium* (MNI = 3). However, these taxa are represented by many fewer elements than are *Scelidodon* and *Eremotherium*. Thus, both localities appear to comprise multigenerational assemblages of ground sloths, with occasional elements of other taxa. Such monodominant assemblages can form either through attritional (e.g. Agenbroad 1984, Barnosky 1985) or catastrophic (e.g. Voorhies 1985, Hunt 1990) mortality. Either situation strongly implies gregarious behavior in *Eremotherium* (discussed further in Chapter 2) and *Scelidodon*, a phenomenon that has been previously suggested at least in the case of *Eremotherium* (Cartelle & Bohoroquez 1982, Rosetti *et al.* 2004) but never conclusively demonstrated (Hubbe *et al.* 2013).

Taphonomy

In comparing bones from the four localities in this study, two features are particularly striking. First, the bones collected from Talara and, for the most part, La Carolina, tend to be substantially darker in color than those from Coralito, while bones from Tanque Loma present a range of shades (Figure 3.5). This is consistent with the hypothesis that the Talara fossils and most of the La Carolina fossils were accumulated in pools of asphalt, while Tanque Loma, Coralito, and at least some parts of La Carolina represent bonebed deposits in which the sediments were later saturated – sometimes incompletely – with asphalt. This coincides with Hoffstetter's (1948a) interpretation of the locality as an estuarine deposit. The variations in color of the Tanque Loma bones are clearly associated with the degree of asphalt saturation of the sediments in which they are found.

The second notable pattern is that the Coralito, Tanque Loma, and Talara localities contain a very high proportion of juvenile taxa. Between 45% and 55% of megafauna individuals at these localities are juveniles or neonates. In contrast, > 90% of megafauna remains at La Carolina pertain to adult individuals. This pattern also may be related to differences in the formation of the localities: if Tanque Loma and Coralito represent assemblages formed through either attritional or drought- or disease-related catastrophic mortality, these deposits would be expected to comprise an overabundance of juveniles, as these are the members of a population most likely to succumb to “natural” mortality agents (Conybeare & Haynes 1984, Olsen & Shipman 1988). Meanwhile, if the fossil deposits at La Carolina were formed by entrapment in asphalt, juvenile animals may have been light enough not to become mired in the seeps. Low abundances of juveniles also appear to be typical of most of the megafauna deposits Rancho La Brea, with the exception of Project 23 (part of which is thought to comprise fluvial deposits with secondary infiltration of tar, rather than faunal accumulations formed through entrapment) (A. Farrell, *pers. comm.*). The high abundance of juvenile individuals encountered at Talara is therefore perplexing. One possible explanation is that the asphalt at this site was more liquid than at La Carolina or Rancho La Brea, and therefore more likely to capture small individuals. A second possibility is that the Talara deposit was formed during a period of greater environmental stress than the other two “tar pit trap” localities, and thus more closely resembles the catastrophic assemblages. Additional paleoenvironmental reconstructions and improved chronological resolution of these localities may help to resolve this mystery.

Conclusions

There is great variation in geomorphology, taxonomic composition and taphonomy of the asphaltic vertebrate deposits in the western Neotropics. Of the localities examined in this study, Talara in Peru and La Carolina in Ecuador conform to the typical “tar pit” trap in terms of taxonomic composition, bone taphonomy and (at least in the case of Talara) geomorphology, although variations in bone color among the La Carolina specimens suggest that some bones at this locality may have been deposited before the sediments became saturated with hydrocarbons. Meanwhile, the Ecuadorian localities Coralito and Tanque Loma have taxonomic, taphonomic and, where discernable, geomorphological signatures suggestive of fluvial fossiliferous deposits with secondary infiltration of asphalt.

Tanque Loma and Coralito probably comprise mass mortality assemblages of large intergenerational populations of extinct giant ground sloths, which may imply gregarious behavior in these taxa. The fact that the dominant ground sloth species at these two sites are different may be due to a true ecological/chronologic difference, such as the later arrival of *Scelidodon* on the Santa Elena Peninsula, but more likely reflects behavioral and/or habitat differences between these taxa.

Radiocarbon dates currently exist for three of the localities in this study: Talara in NW Peru, and La Carolina and Tanque Loma in SW Ecuador. The chronology of these localities places all of them after the last interglacial, but well before the beginning of the Holocene. These data correspond to an apparent paleoecological pattern of earlier extinctions of Pleistocene megafauna in the tropics as compared with more temperate regions of South America. However, given the paucity of dates that currently exist in this region, and especially given the difficulty of obtaining reliable dates on asphalt-impregnated bone, further chronological analyses will be required at these and other localities to verify this pattern.

Finally, it is notable that despite the rich fossil assemblages described here, very few publications exist for any of these localities. The data presented in this study highlights the fact that asphalt seeps warrant further investigation by paleoecologists, especially in the Neotropics where they represent one of the best possibilities for preservation of Quaternary fossils, and thus for understanding recent paleocommunities in these important ecological regions.



Figure 3.1: Asphaltic Quaternary vertebrate localities in southwestern Ecuador and northwestern Peru. TA = Talara. LC = La Carolina. CA = Cautivo. TL = Tanque Loma.

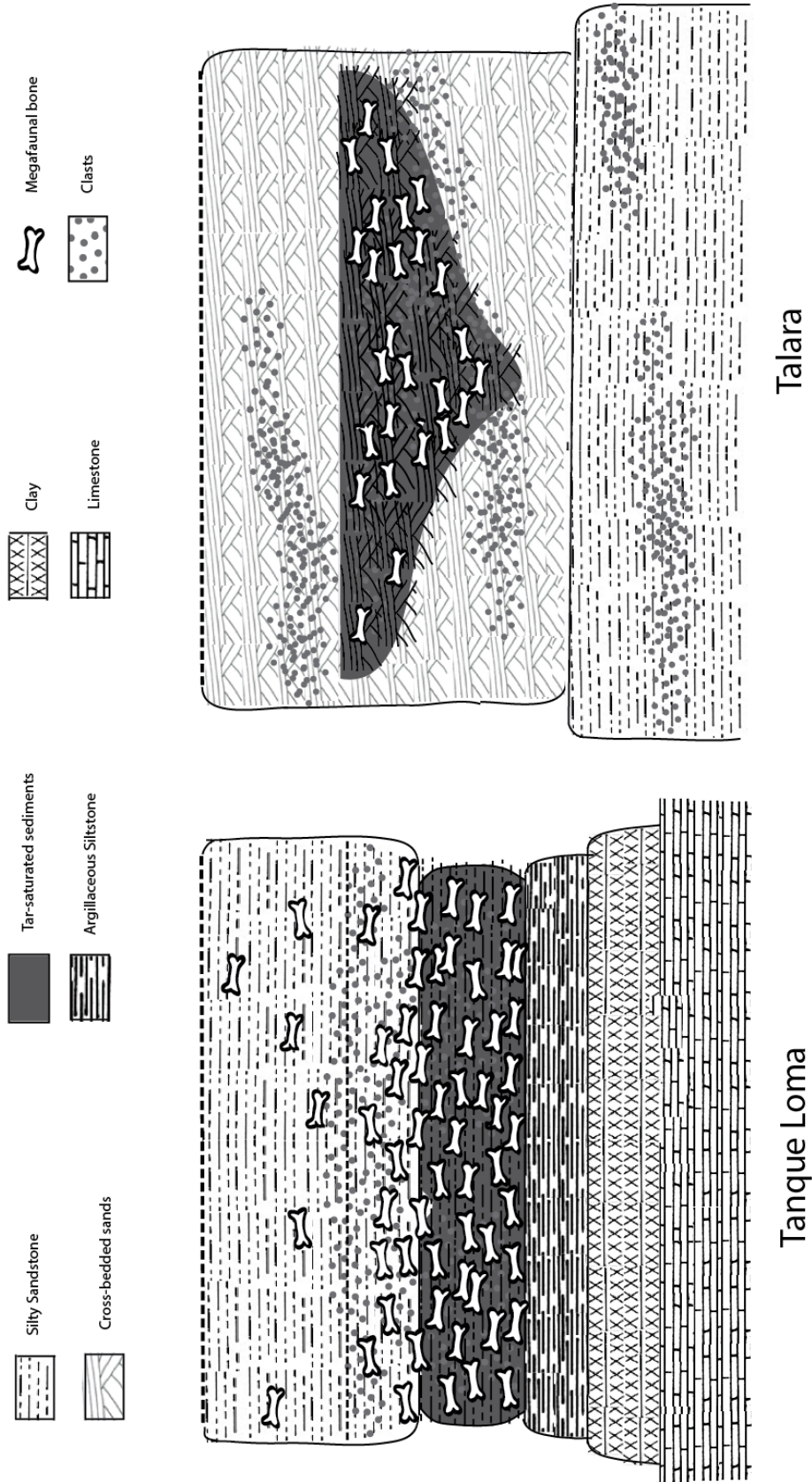


Figure 3.2: Generalized stratigraphic profiles showing geomorphology and bone and clast distribution in asphaltic deposits at Tanque Loma, Ecuador and Talara, Peru

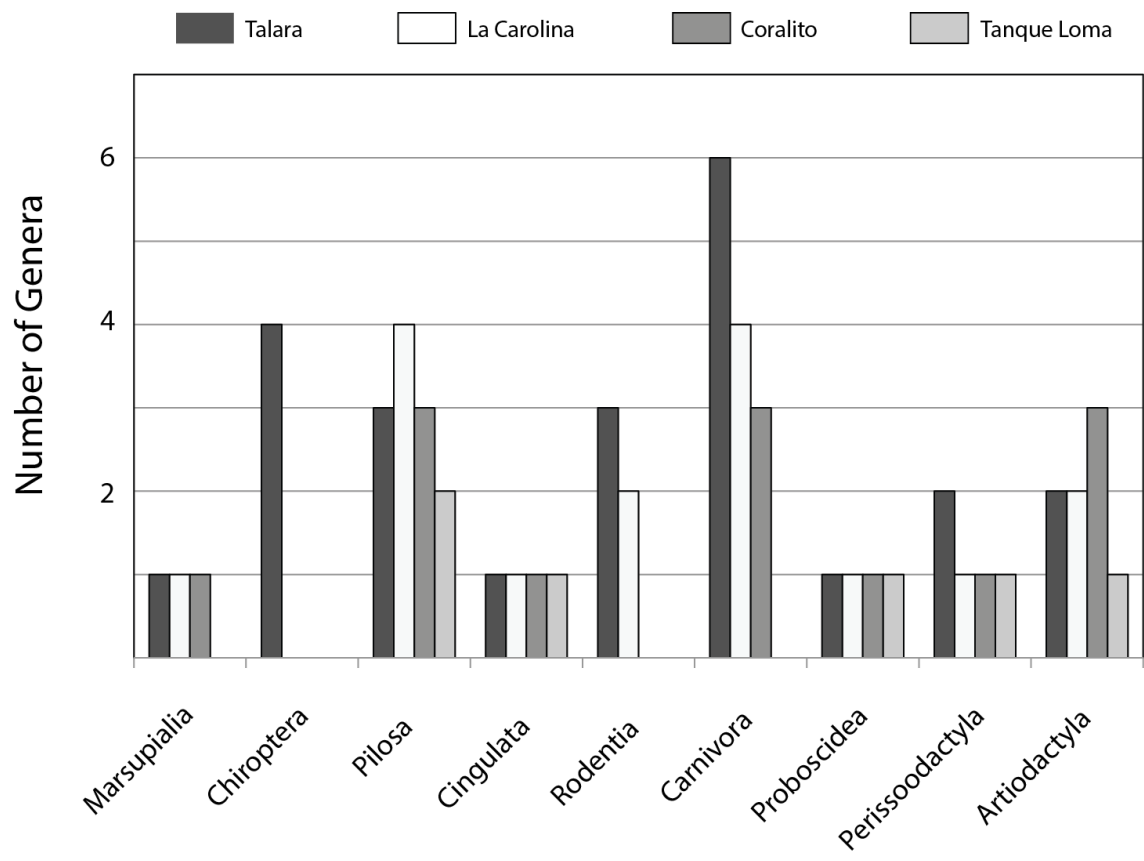


Figure 3.3: Bar graph showing taxonomic richness of different mammalian clades at asphaltic Quaternary vertebrate localities in the western neotropics. TA = Talara. LC = La Carolina. CA = Cautivo. TL = Tanque Loma.

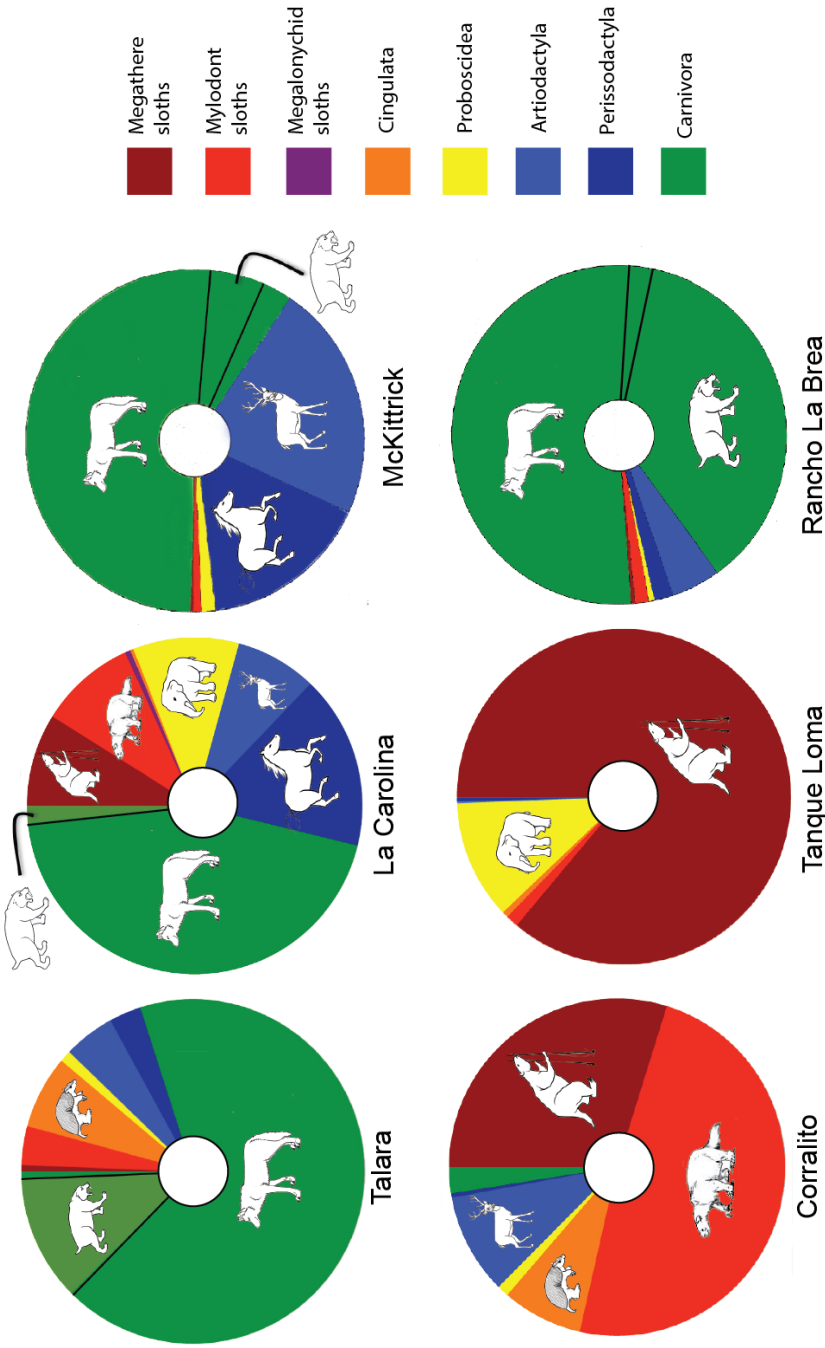


Figure 3.4: Pie charts showing relative representation of mammalian taxa at neotropical asphaltic localities Talara, La Carolina, Corralito, and Tanque Loma, as well as the California, USA, localities Rancho La Brea and McKittrick. Dominant groups represented by icons. *NB:* while the South American locality graphs are based on Numbers of Individual Specimens (NISP) counts, the California locality graphs are based on Minimum Number of Individuals (MNI) calculations. However, because the numbers in the latter two are so large, the proportions of MNI should not be substantially different from NISP counts.



A



B

Figure 3.5: (A) *Palaeolama* metapodials collected from Coralito (left) and Talara (right), showing typical coloration of bone from the two localities. (B) Carnivore bones from La Carolina, showing range of asphalt saturation observed on bones from this deposit.

| Locality | Lab Number | Material | Date (RCYBP) |
|-----------------|-------------------|---------------------------------|---------------------|
| Talara | SM 852 | sticks "chewed" by ground sloth | 13,616 +/- 600 |
| Talara | SM 853 (1) | "wood associated with the bone: | 14,418 +/- 500 |
| Talara | SM 853 (2) | sticks "chewed" by ground sloth | 14,150 +/- 564 |
| Talara | SM 854 | wood | 13,790 +/- 535 |
| La Carolina | GX0339 | sticks "chewed" by ground sloth | 18,400 +/- 600 |
| Tanque Loma | CAMS 147211 | Eremotherium phalanx | 23560 +/- 180 |
| Tanque Loma | CAMS 160800 | Notiomastodon caudal vertebra | 17170 +/- 920 |
| Tanque Loma | CAMS 160801 | Notiomastodon metapodial | 19110 +/- 1,260 |

Table 3.1: Radiocarbon dates obtained for asphaltic vertebrate localities in Ecuador and Peru.

| | Talara | La Carolina | Coralito | Tanque Loma |
|------------------------|--------|-------------|----------|-------------|
| MARSUPIALIA | | | | |
| Didelphidae | | | | |
| <i>Didelphis</i> | x | | x | |
| <i>Marmosa</i> | x | | | |
| XENARTHRA | | | | |
| CINGULATA | | | | |
| Pampatheridae | | | | |
| <i>Holmesina</i> | x | x | x | x |
| PILOSA | | | | |
| Mylodontidae | | | | |
| <i>Glossotherium</i> | x | x | x | x |
| <i>Scelidodon</i> | x | x | x | |
| Megaheriidae | | | | |
| <i>Eremotherium</i> | x | x | x | x |
| RODENTIA | | | | |
| Caviidae | | | | |
| <i>Nechoerus</i> | x | x | | |
| <i>Hydrochoerus</i> | x | | | |
| CARNIVORA | | | | |
| Canidae | | | | |
| <i>Canis</i> | x | | | |
| <i>Dusicyon</i> | x | x | x | |
| <i>Procyon</i> | | x | | |
| Felidae | | | | |
| <i>Leopardus</i> | x | | | |
| <i>Panthera</i> | x | | | |
| <i>Puma</i> | x | x | | |
| <i>Smilodon</i> | x | x | x | |
| Mustelidae | | | | |
| <i>Conepatus</i> | x | | | |
| PROBOSCIDEA | | | | |
| Gomphotheriidae | | | | |
| <i>Notiomastodon</i> | x | x | x | x |
| PERISSODACTYLA | | | | |
| Equidae | | | | |
| <i>Equus</i> | x | x | x | x |
| ARTIODACTYLA | | | | |
| Camelidae | | | | |
| <i>Palaeolama</i> | x | x | x | |
| Cervidae | | | | |
| <i>Odocoileus</i> | x | x | x | x |
| <i>Mazama</i> | x | | | |
| Tayassuidae | | | | |
| <i>Tayassu</i> | x | | x | |

Table 3.2: Taxon lists for all vertebrate taxa reported from Talara, La Carolina, Coralito, and Tanque Loma localities.

References

- Agenbroad, Larry D, Martin, PS, & Klein, RG. (1984). Hot Springs, South Dakota. Entrapment and taphonomy of Columbian mammoth. *Quaternary extinctions: a prehistoric revolution*, 113-127.
- Agenbroad, Larry D, & Mead, Jim I. (1994). *The Hot Springs Mammoth Site: a decade of field and laboratory research in paleontology, geology, and paleoecology: Mammoth Site of Hot Springs, South Dakota, Incorporated.*
- Akersten, William A, Shaw, Christopher A, & Jefferson, George T. (1983). Rancho La Brea: status and future. *Paleobiology*, 9(3), 211-217.
- Alberdi, María T, Alonso, María A, Azanza, Beatriz, & Morales, Jorge. (2001). Vertebrate taphonomy in circum-lake environments: three cases in the Guadix-Baza Basin (Granada, Spain). *Palaeogeography, Palaeoclimatology, Palaeoecology*, 165(1), 1-26.
- Allen, John RL. (1982). *Sedimentary structures, their character and physical basis (Vol. 1): Elsevier Science.*
- Alván, Aldo; Tuesta, Jose; Navarro, Juan Pablo; Martinez, Jean-Noel; Romero, Lidia. (2009). Evolucion sedimentaria y paleoambiental durante el Pleistoceno en la Quebrada el Muerto, La Brea, Talara. *Boletín de la Sociedad Geológica del Perú*, 103, 171-183.
- Araújo-Júnior, Hermínio Ismael de, Porpino, Kleberon de Oliveira, & Bergqvist, Lillian Paglarelli. (2013). Taphonomic analysis of a late Pleistocene vertebrate accumulation from Lage Grande Paleontological Site, Pernambuco State, northeastern Brazil: New remarks on preservational aspects of tank deposits. *Quaternary International*, 317, 88-101.
- Arribas, Alfonso, & Palmqvist, Paul. (1998). Taphonomy and palaeoecology of an assemblage of large mammals: hyaenid activity in the lower Pleistocene site at Venta Micena (Orce, Guadix-Baza Basin, Granada, Spain). *Geobios*, 31, 3-47.
- AUFDERHEIDE, Arthur C, NISSENBAUM, Arie, & CARTMELL, Larry. (2004). Radiocarbon date recovery from bitumen-containing Egyptian embalming resins. *J. Soc. Study Egyptian Antiquities (JSSEA)*, 31, 87-96.
- Bai, Bin, Wang, Yuanqing, Meng, Jin, Jin, Xun, Li, Qian, & Li, Ping. (2011). Taphonomic analyses of an early Eocene *Litolophus* (*Perissodactyla*, *Chalicotherioidea*) assemblage from the Erlan Basin, Inner Mongolia, China. *Palaios*, 26(4), 187-196.
- Bargo, M Susana. (2001). The ground sloth *Megatherium americanum*: skull shape, bite forces, and diet. *Acta Palaeontologica Polonica*, 46(2), 173-192.
- Bargo, M Susana, De Iuliis, Gerardo, & Vizcaíno, Sergio F. (2006). Hypsodonty in Pleistocene ground sloths. *Acta Palaeontologica Polonica*, 51(1), 53.
- Barker, R Wright. (1933). Notes on the Tablazo faunas of SW Ecuador. *Geological Magazine*, 70(02), 84-90.
- Barnosky, Anthony D. (1985). Taphonomy and herd structure of the extinct Irish elk, *Megaloceros giganteus*. *Science(Washington)*, 228(4677), 340-343.
- Barnosky, Anthony D, & Lindsey, Emily L. (2010). Timing of Quaternary megafaunal extinction in South America in relation to human arrival and climate change. *Quaternary International*, 217(1), 10-29.

- Behrensmeyer, Anna K. (1978). Taphonomic and ecologic information from bone weathering. *Paleobiology*, 150-162.
- Behrensmeyer, Anna K. (1987). Taphonomy and hunting. *The Evolution of Human Hunting*: Plenum Press, New York, 423-450.
- Behrensmeyer, Anna K. (1988). Vertebrate preservation in fluvial channels. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 63(1), 183-199.
- Behrensmeyer, Anna K, & Hill, Andrew P. (1988). *Fossils in the making: vertebrate taphonomy and paleoecology*: University of Chicago Press.
- Behrensmeyer, Anna K, Western, David, Badgley, Catherine, Miller, Joshua H, & Odock, Fredrick L. (2012). THE IMPACT OF MASS MORTALITY ON THE LAND SURFACE BONE ASSEMBLAGE OF AMBOSELI PARK, KENYA. Paper presented at the Journal of Vertebrate Paleontology.
- Bengtson, Nels A. (1924). Some essential features of the geography of the Santa Elena Peninsula, Ecuador. *Annals of the Association of American Geographers*, 14(3), 150-158.
- Bezerra, Bruna Martins, da Silva Souto, Antonio, Halsey, Lewis George, & Schiel, Nicola. (2008). Observation of brown-throated three-toed sloths: mating behaviour and the simultaneous nurturing of two young. *Journal of Ethology*, 26(1), 175-178.
- Blair, KG. (1927). Insect remains from oil sand in Trinidad. *Transactions of the Royal Entomological Society of London*, 75(1), 137-142.
- Blois, Jessica L, McGuire, Jenny L, & Hadly, Elizabeth A. (2010). Small mammal diversity loss in response to late-Pleistocene climatic change. *Nature*, 465(7299), 771-774.
- Bogin, Barry. (1982). Climate change and human behavior on the southwest coast of Ecuador. *Central Issues in Anthropology*, 4(1), 21-31.
- Breure, Abraham SH, & Borrero, F. (2008). An annotated checklist of the land snail family Orthalicidae (Gastropoda: Pulmonata: Orthalicoidea) in Ecuador, with notes on the distribution of the mainland species. *Zootaxa*, 1768, 1-40.
- Brooks, Thomas M, Mittermeier, Russell A, Mittermeier, Cristina G, Da Fonseca, Gustavo AB, Rylands, Anthony B, Konstant, William R, . . . Magin, Georgina. (2002). Habitat loss and extinction in the hotspots of biodiversity. *Conservation Biology*, 16(4), 909-923.
- Bunn, Henry T. (1987). Patterns of skeletal representation and hominid subsistence activities at Olduvai Gorge, Tanzania, and Koobi Fora, Kenya. *Journal of Human Evolution*, 15(8), 673-690.
- Bushnell, Geoffrey Hext Sutherland. (1951). *The archaeology of the Santa Elena Peninsula in south-west Ecuador*: University Press.
- Cadenillas, R, & Martínez, JN. (2005). Additional bats from late Pleistocene Talara tar seeps (northwestern Peru) paleoenvironmental implications. Paper presented at the Boletim de Resumos, II Congresso de Paleontología de vertebrados, Museu Nacional, Rio de Janeiro, Brasil.
- Cadenillas, Richard, & Martínez, Jean-Noël. (2006). Cuatro especies de murciélagos (Mammalia, Chiroptera) registradas en el Pleistoceno superior de La Brea (Provincia de Talara, Departamento de Piura). Paper presented at the XIII Congreso Peruano de Geología.

- Campbell Jr, KE. (1976). The late Pleistocene avifauna of La Carolina, southwestern Ecuador. Collected papers in avian paleontology honoring the 90th birthday of Alexander Wetmore (Olson, SL, ed.). *Smithson. Contrib. Paleobiol.*, 27, 155-168.
- Campbell, Kenneth E, & Museum, Royal Ontario. (1979). The non-passerine Pleistocene avifauna of the Talara Tar Seeps, northwestern Peru: Royal Ontario Museum.
- Carbone, Chris, Maddox, Tom, Funston, Paul J, Mills, Michael GL, Grether, Gregory F, & Van Valkenburgh, Blaire. (2009). Parallels between playbacks and Pleistocene tar seeps suggest sociality in an extinct sabretooth cat, *Smilodon*. *Biology Letters*, 5(1), 81-85.
- Cartelle, Cástor, & Bohórquez, GA. (1982). *Eremotherium laurillardi* Lund, 1842. Determinação específica e dimorfismo sexual. *Iheringia, Séria Geologia*, 7, 45-63.
- Cartelle, Cástor, & De Iuliis, Gerardo. (1995). *Eremotherium laurillardi*: the Panamerican late Pleistocene megatheriid sloth. *Journal of Vertebrate Paleontology*, 15(4), 830-841.
- Cartelle, Cástor, & De Iuliis, Gerardo. (2006). *Eremotherium laurillardi* (Lund)(*Xenarthra*, Megatheriidae), the Panamerican giant ground sloth: taxonomic aspects of the ontogeny of skull and dentition. *Journal of Systematic Palaeontology*, 4(2), 199-209.
- Churcher, CS. (1959). Fossil *Canis* from the tar pits of La Brea, Peru. *Science*, 130(3375), 564-565.
- Churcher, Charles Stephen. (1962). *Odocoileus salinae* and *Mazama* sp. from the Talara tar seeps, Peru: Toronto, Royal Ontario Museum.
- Churcher, Charles Stephen. (1965). Camelid material of the genus *Palaeolama* Gervais from the Talara tar-seeps, Peru, with a description of a new subgenus, *Astylolama*. *Proceedings of the Zoological Society (London)*, 145, 161-205.
- Churcher, CS. (1966). The insect fauna from the Talara tar-seeps, Peru. *Canadian Journal of Zoology*, 44(6), 985-993.
- Churcher, Charles Stephen, & Van Zyll de Jong, CG. (1965). *Conepatus Talarae* N. Sp. from the Talara Tar-seeps, Peru by CS Churcher and CG Van Zyll de Jong: Toronto, Royal Ontario Museum.
- Cione, Alberto L, Tonni, Eduardo P, & Soibelzon, Leopoldo. (2009). Did humans cause the late Pleistocene-early Holocene mammalian extinctions in South America in a context of shrinking open areas? *American Megafaunal extinctions at the end of the Pleistocene* (pp. 125-144): Springer.
- Colman, JAR. (1970). Guidebook to the geology of the Santa Elena Peninsula: Ecuadorian Geol. and Geophys. Soc. Field Trip Guidebook.
- Coltorti, M, Ficarelli, G, Jahren, H, Espinosa, M Moreno, Rook, L, & Torre, D. (1998). The last occurrence of Pleistocene megafauna in the Ecuadorian Andes. *Journal of South American Earth Sciences*, 11(6), 581-586.
- Coltrain, Joan Brenner, Harris, John M, Cerling, Thure E, Ehleringer, James R, Dearing, Maria-Denise, Ward, Joy, & Allen, Julie. (2004). Rancho La Brea stable isotope biogeochemistry and its implications for the palaeoecology of late Pleistocene, coastal southern California. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 205(3), 199-219.
- Conard, Nicholas J, Walker, Steven J, & Kandel, Andrew W. (2008). How heating and cooling and wetting and drying can destroy dense faunal elements and lead to differential preservation. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 266(3), 236-245.

- Conybeare, A, & Haynes, Gary. (1984). Observations on elephant mortality and bones in water holes. *Quaternary Research*, 22(2), 189-200.
- Czaplewski, NICHOLAS J. (1990). Late Pleistocene (Lujanian) occurrence of *Tonatia silvicola* in the Talara tar seeps, Peru. *Anais da Academia Brasileira de Ciências*, 62, 235-238.
- Czaplewski, NICHOLAS J, Rincón, ASCANIO D, & Morgan, GARY S. (2005). Fossil bat (Mammalia: Chiroptera) remains from Inciarte Tar Pit, Sierra de Perijá, Venezuela. *Caribbean Journal of Science*, 41(4), 768-781.
- Czerwonogora, Ada, Fariña, Richard A, & Tonni, Eduardo Pedro. (2011). Diet and isotopes of Late Pleistocene ground sloths: First results for *Lestodon* and *Glossotherium* (Xenarthra, Tardigrada). *Neues Jahrbuch für Geologie und Paläontologie-Abhandlungen*, 262(3), 257.
- Dalquest, Walter W, & Mamay, Sergius H. (1963). A remarkable concentration of Permian amphibian remains in Haskell County, Texas. *The Journal of Geology*, 641-644.
- Damp, Jonathan E, Jackson, Donald, Vargas, Patricia, & Zambrano, Pilar. (1990). On the waterfront: Quaternary environments and the Formative occupation of southwestern Ecuador. *Geoarchaeology*, 5(2), 171-185.
- Davis, Edward Byrd, & Pyenson, Nicholas D. (2007). Diversity biases in terrestrial mammalian assemblages and quantifying the differences between museum collections and published accounts: a case study from the Miocene of Nevada. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 250(1), 139-149.
- De Iuliis, Gerardo, & Cartelle, Cástor. (1994). The medial carpal and metacarpal elements of *Eremotherium* and *Megatherium* (Xenarthra: Mammalia). *Journal of Vertebrate Paleontology*, 13(4), 525-533.
- De Muizon, C, & McDonald, HG. (1995). An aquatic sloth from the Pliocene of Peru.
- Dean, Walter E. (1974). Determination of carbonate and organic matter in calcareous sediments and sedimentary rocks by loss on ignition; comparison with other methods. *Journal of Sedimentary Research*, 44(1), 242-248.
- Dodson, P. (1973). The significance of small bones in paleoecologic interpretation. *Contributions to Geology*, 12(1), 15-19.
- Eberth, David A, Shannon, Matthew, & Noland, Brent G. (2010). A Bonebeds Database: Classification, Biases, and Patterns of Occurrence. *Bonebeds: Genesis, Analysis, and Paleobiological Significance*, 103.
- Ecuador, Instituto Geografico Militar del (Cartographer). (1974). *Mapa Geologico del Ecuador*.
- Edmund, A Gordon, & Division, Royal Ontario Museum. Life Sciences. (1965). A Late Pleistocene Fauna from the Santa Elena Peninsula, Ecuador: Royal Ontario Museum. Life Sciences Division.
- Edmund, A Gordon. (1996). A review of Pleistocene giant armadillos (Mammalia, Xenarthra, Pamphathiidae). In K. M. S. a. K. L. Seymour (Ed.), *Palaeoecology and Palaeoenvironments of Late Cenozoic Mammals, Tributes to the career of C.S. (Rufus) Churcher* (pp. 300-321). Toronto: University of Toronto Press.
- Estes, Richard D, & Goddard, John. (1967). Prey selection and hunting behavior of the African wild dog. *The Journal of Wildlife Management*, 52-70.
- Farina, RA. (2002). *Megatherium*, the hairless: appearance of the great Quaternary sloths (Mammalia; Xenarthra). *AMEGHINIANA*, 39(2), 241-244.

- Feranec, Robert S. (2004). Isotopic evidence of saber-tooth development, growth rate, and diet from the adult canine of *Smilodon fatalis* from Rancho La Brea. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 206(3), 303-310.
- Ferretti, MP. (2008). A review of South American gomphotheres. *Bull New Mexico Mus Nat Hist, Albuquerque*.
- Ficcarelli, Giovanni, Borselli, Vittorio, Herrera, Gonzalo, Moreno Espinosa, Miguel, & Torre, Danilo. (1995). Taxonomic remarks on the South American Mastodons referred to *Haplomastodon* and *Cuvieronius*. *Geobios*, 28(6), 745-756.
- Ficcarelli, G, Coltorti, M, Moreno-Espinosa, M, Pieruccini, PL, Rook, L, & Torre, D. (2003). A model for the Holocene extinction of the mammal megafauna in Ecuador. *Journal of South American Earth Sciences*, 15(8), 835-845.
- Gates, Terry A. (2005). The Late Jurassic Cleveland-Lloyd dinosaur quarry as a drought-induced assemblage. *Palaaios*, 20(4), 363-375.
- Gaudin, Timothy J. (2004). Phylogenetic relationships among sloths (Mammalia, Xenarthra, Tardigrada): the craniodental evidence. *Zoological Journal of the Linnean Society*, 140(2), 255-305.
- Gill, Jacquelyn L, Williams, John W, Jackson, Stephen T, Lininger, Katherine B, & Robinson, Guy S. (2009). Pleistocene megafaunal collapse, novel plant communities, and enhanced fire regimes in North America. *Science*, 326(5956), 1100-1103.
- Hanks, J. (1972). Reproduction of elephant, *Loxodonta africana*, in the Luangwa Valley, Zambia. *Journal of Reproduction and Fertility*, 30(1), 13-26.
- Hansen, Barbara CS, Wright, HE, & Bradbury, JP. (1984). Pollen studies in the Junin area, central Peruvian Andes. *Geological Society of America Bulletin*, 95(12), 1454-1465.
- Haury, Emil W, Sayles, Edwin Booth, & Wasley, William W. (1959). The Lehner mammoth site, southeastern Arizona. *American Antiquity*, 2-30.
- Haynes, Gary. (1983). A guide for differentiating mammalian carnivore taxa responsible for gnaw damage to herbivore limb bones. *Paleobiology*, 164-172.
- Haynes, Gary. (1985). On watering holes, mineral licks, death, and predation. *Environments and extinctions in late glacial North America*. Center for the Study of Early Man, University of Maine, Orono, 53-71.
- Haynes, Gary. (1988). Longitudinal studies of African elephant death and bone deposits. *Journal of Archaeological Science*, 15(2), 131-157.
- Heusser, Linda E, & Shackleton, Nicholas J. (1994). Tropical climatic variation on the Pacific slopes of the Ecuadorian Andes based on a 25,000-year pollen record from deep-sea sediment core Tri 163-31B. *Quaternary Research*, 42(2), 222-225.
- Ho, Tong-Yun. (1965). The amino acid composition of bone and tooth proteins in late Pleistocene mammals. *Proceedings of the National Academy of Sciences of the United States of America*, 54(1), 26.
- Hoffstetter, Robert. (1948a). Notas sobre el cuaternario de la peninsula de Santa Elena (Ecuador). *Boletin de Informaciones Cientificas Nacionales II* (11-12), 19-44.

- Hoffstetter, Robert. (1948b). Nota preliminar sobre los Edentata Xenarthra del Pleistoceno Ecuatoriano. *Boletín de Informaciones Científicas Nacionales*, 2, 20-33.
- Hoffstetter, Robert. (1948c). Sobre la presencia de un Camélido en el Pleistoceno superior de la Costa ecuatoriana. *Boletín de Informaciones Científicas Nacionales* (Quito), 2, 23-25.
- Hoffstetter, Robert. (1949). Sobre los Megatheriidae del Pleistoceno del Ecuador, *Schaubia*, gen. nov. *Boletín de Informaciones Científicas Nacionales*, 3(25).
- Hoffstetter, Robert. (1952). Les mammifères pléistocènes de la République de l'Equateur: deuxième thèse: Traits géologiques généraux du territoire de la République de l'Equateur. Société géologique de France.
- Hofreiter, Michael, Poinar, Hendrik N, Spaulding, W Geoffrey, Bauer, Karin, Martin, Paul S, Possnert, Goran, & Pääbo, S. (2000). A molecular analysis of ground sloth diet through the last glaciación. *Molecular Ecology*, 9(12), 1975-1984.
- Holanda, Elizete C, & Rincón, Ascanio D. (2012). Tapirs from the Pleistocene of Venezuela. *Acta Palaeontologica Polonica*, 57(3), 463-473.
- Hubbe, Alex, Hubbe, Mark, & Neves, Walter A. (2013). The Brazilian megamastofauna of the Pleistocene/Holocene transition and its relationship with the early human settlement of the continent. *Earth-Science Reviews*.
- Hunt, Robert M. (1990). Taphonomy and sedimentology of Arikaree (lower Miocene) fluvial, eolian, and lacustrine paleoenvironments, Nebraska and Wyoming; A paleobiota entombed in fine-grained volcanoclastic rocks. *Geological Society of America Special Papers*, 244, 69-112.
- Iturralde-Vinent, Manuel A, MacPhee, Ross DE, Franco, S Díaz, Rojas-Consuegra, Reinaldo, Suárez, William, & Lomba, Alina. (2000). Las Breas de San Felipe, a Quaternary fossiliferous asphalt seep near Martí (Matanzas Province, Cuba). *Caribbean Journal of Science*, 36(3/4), 300-313.
- Jaillard, E, Ordoñez, Martha, Benitez, Stalin, Berrones, Gerardo, Jiménez, Nelson, Montenegro, Galo, & Zambrano, Italo. (1995). Basin development in an accretionary, oceanic-floored fore-arc setting: southern coastal Ecuador during late Cretaceous-late Eocene time.
- Jull, AJT, Iturralde-Vinent, M, O'malley, JM, MacPhee, RDE, McDonald, HG, Martin, PS, . . . Rincón, A. (2004). Radiocarbon dating of extinct fauna in the Americas recovered from tar pits. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*, 223, 668-671.
- Korth, William W. (1979). Taphonomy of microvertebrate fossil assemblages: Carnegie Museum of Natural History.
- Koutavas, Athanasios, Lynch-Stieglitz, Jean, Marchitto, Thomas M, & Sachs, Julian P. (2002). El Niño-like pattern in ice age tropical Pacific sea surface temperature. *Science*, 297(5579), 226-230.
- Laurin, Michel. (2012). Recent progress in paleontological methods for dating the Tree of Life. *Frontiers in genetics*, 3.
- Laws, RM, & Clough, G. (1966). Observations on reproduction in the hippopotamus, *Hippopotamus amphibius*. Paper presented at the Symp. Zool. Soc. London.
- Lebon, Matthieu, Müller, Katharina, Bahain, Jean-Jacques, Fröhlich, François, Falguères, Christophe, Bertrand, Loïc, . . . Reiche, Ina. (2011). Imaging fossil bone alterations at the microscale by SR-FTIR microspectroscopy. *Journal of Analytical Atomic Spectrometry*, 26(5), 922-929.

- Lemon, RRH, & Churcher, CS. (1961). Pleistocene geology and paleontology of the Talara region, northwest Peru. *American Journal of Science*, 259(6), 410-429.
- Lima-Ribeiro, Matheus Souza, Varela, Sara, Nogués-Bravo, David, Diniz-Filho, José Alexandre Felizola, & Alexandre, Jose. (2012). Potential Suitable Areas of Giant Ground Sloths Dropped Before its Extinction in South America: the Evidences from Bioclimatic Envelope Modeling. *Natureza & Conservação*, 10, 145-151.
- Lucas, Spencer G, & Alvarado, GE. (1991). Comentario sobre la clasificación del mastodonte de Barra Honda (= Rio Nacaome), Guanacaste, Costa Rica. *Rev. Geol. Amér. Central*, 13.
- Lyman, R Lee. (1987). On the analysis of vertebrate mortality profiles: sample size, mortality type, and hunting pressure. *American Antiquity*, 125-142.
- Marchant, S. (1958). The birds of the Santa Elena peninsula, SW Ecuador. *Ibis*, 100(3), 349-387.
- MARCHANT, STEPHEN. (1961). A photogeological analysis of the structure of the western Guayas province, Ecuador: with discussion of the stratigraphy and Tablazo Formation, derived from surface mapping. *Quarterly Journal of the Geological Society*, 117(1-4), 215-231.
- Markgraf, Vera, & Anderson, Lysanna. (1994). Fire history of Patagonia: climate versus human cause. *Revista do Instituto Geológico*, 15(1-2), 35-47.
- Marlon, JR, Bartlein, PJ, Walsh, MK, Harrison, Sandy P, Brown, KJ, Edwards, ME, . . . Briles, C. (2009). Wildfire responses to abrupt climate change in North America. *Proceedings of the National Academy of Sciences*, 106(8), 2519-2524.
- Martínez, J, & Cadenillas, R, R. (2006). El zorro del Pleistoceno superior de La Carolina (Ecuador): ¿Una forma diferente del actual “zorro de Sechura”? Paper presented at the Resúmenes extendidos del XIII Congreso Peruano de Geología.
- Mcafee, Robert K. (2009). Reassessment of the cranial characters of *Glossotherium* and *Paramylodon* (Mammalia: Xenarthra: Mylodontidae). *Zoological Journal of the Linnean Society*, 155(4), 885-903.
- McDonald, H Gregory. (2005). Paleoecology of extinct xenarthrans and the Great American Biotic Interchange. *Bulletin of the Florida Museum of Natural History*, 45(4), 313-333.
- McDonald, H Gregory and Lundelius, Ernest L. Jr. (2009). The giant ground sloth *Eremotherium laurillardi* (Xenarthra, Megatheriidae) in Texas. In L. B. Albright (Ed.), *Papers on Geology, Vertebrate Paleontology, and Biostratigraphy in Honor of Michael O. Woodburn*. Bulletin 65 of the Museum of North Arizona. Flagstaff, Arizona.
- McGuire, JL. (2010). Geometric morphometrics of vole (*Microtus californicus*) dentition as a new paleoclimate proxy: Shape change along geographic and climatic clines. *Quaternary International*, 212(2), 198-205.
- McHorse, Brianna K, Orcutt, John D, & Davis, Edward B. (2012). The carnivoran fauna of Rancho La Brea: Average or aberrant? *Palaeogeography, Palaeoclimatology, Palaeoecology*, 329, 118-123.
- McMenamin, Mark AS, Blunt, David J, Kvenvolden, Keith A, Miller, Scott E, Marcus, Leslie F, & Pardi, Richard R. (1982). Amino acid geochemistry of fossil bones from the Rancho La Brea asphalt deposit, California. *Quaternary Research*, 18(2), 174-183.

- Metcalfe, Duncan, & Jones, Kevin T. (1988). A reconsideration of animal body-part utility indices. *American Antiquity*, 486-504.
- Millar, John S, & Zammuto, Richard M. (1983). Life histories of mammals: an analysis of life tables. *Ecology*, 631-635.
- Miller, Loye. (1935). A second avifauna from the McKittrick Pleistocene. *The Condor*, 37(2), 72-79.
- Mothé, Dimila, Avilla, Leonardo S, Cozzuol, Mário, & Winck, Gisele R. (2012). Taxonomic revision of the Quaternary gomphotheres (Mammalia: Proboscidea: Gomphotheriidae) from the South American lowlands. *Quaternary International*, 276, 2-7.
- Muleady-Mecham, Nancy Eileen. (2003). Differential preservation of fossil elements in the Maricopa Brea, California. *Bulletin of the Southern California Academy of Sciences*, 102(2), 79-88.
- Nichols, Gary. (2009). *Sedimentology and stratigraphy*: Wiley. com.
- Njau, Jackson K, & Blumenschine, Robert J. (2006). A diagnosis of crocodile feeding traces on larger mammal bone, with fossil examples from the Plio-Pleistocene Olduvai Basin, Tanzania. *Journal of Human Evolution*, 50(2), 142-162.
- Olsen, Sandra L, & Shipman, Pat. (1988). Surface modification on bone: trampling versus butchery. *Journal of Archaeological Science*, 15(5), 535-553.
- Olson, David M, & Dinerstein, Eric. (1998). The Global 200: a representation approach to conserving the Earth's most biologically valuable ecoregions. *Conservation Biology*, 12(3), 502-515.
- Oswald, Jessica A. and Steadman, David W. (2010). Late Pleistocene passerines from South American semi-arid scrub habitats. Paper presented at the XV Congreso Peruano de Geología, Cusco.
- Patterson, Bryan, & Pascual, Rosendo. (1968). The fossil mammal fauna of South America. *Quarterly Review of Biology*, 409-451.
- Pausas, Juli G, & Keeley, Jon E. (2009). A burning story: the role of fire in the history of life. *BioScience*, 59(7), 593-601.
- Pedoja, K, Ortlieb, Luc, Dumont, Jean-François, Lamothe, Mathieu, Ghaleb, B, Auclair, M, & Labrousse, B. (2006). Quaternary coastal uplift along the Talara Arc (Ecuador, Northern Peru) from new marine terrace data. *Marine Geology*, 228(1), 73-91.
- Peláez-Samaniego, MR, Garcia-Perez, M, Oscullo, J, & Olmedo, G. (2007). Energy sector in Ecuador: Current status. *Energy policy*, 35(8), 4177-4189.
- Pilsbry, Henry A, & Olsson, Axel A. (1941). A Pliocene fauna from western Ecuador. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 93, 1-79.
- Pitana, Vanessa Gregis, Esteban, Graciela Irene, Ribeiro, Ana Maria, & Cartelle, Cástor. (2013). Cranial and dental studies of *Glossotherium robustum* (Owen, 1842)(Xenarthra: Pilosa: Mylodontidae) from the Pleistocene of southern Brazil. *Alcheringa: An Australasian Journal of Palaeontology*, 37(2), 147-162.
- Ponnamperuma, FN. (1972). *The chemistry of submerged soils* (Vol. 24): Academic Press NY and London.

- Power, Mitchell James, Marlon, J, Ortiz, N, Bartlein, PJ, Harrison, SP, Mayle, FE, . . . Cordova, C. (2008). Changes in fire regimes since the Last Glacial Maximum: an assessment based on a global synthesis and analysis of charcoal data. *Climate Dynamics*, 30(7-8), 887-907.
- Prado, Jose L, & Alberdi, Maria T. (1994). A quantitative review of the horse *Equus* from South America. *Palaeontology*, 37(2), 459.
- Prado, José Luis, Alberdi, Maria Teresa, Azanza, Beatriz, Sánchez, Begonia, & Frassinetti, Daniel. (2005). The Pleistocene Gomphotheriidae (Proboscidea) from South America. *Quaternary International*, 126, 21-30.
- Prevosti, Francisco J, & Rincon, Ascanio D. (2007). A new fossil canid assemblage from the Late Pleistocene of northern South America: The canids of the Inciarte asphalt pit (Zulia, Venezuela), fossil record and biogeography. *Journal Information*, 81(5).
- Pujos, François, & De Iuliis, Gerardo. (2007). Late Oligocene Megatherioidea fauna (Mammalia: Xenarthra) from Salla-Luribay (Bolivia): new data on basal sloth radiation and Cingulata-Tardigrada split. *Journal of Vertebrate Paleontology*, 27(1), 132-144.
- Pujos, François, & Salas, Rodolfo. (2004). A systematic reassessment and paleogeographic review of fossil Xenarthra from Peru. *Bulletin de l'Institut Français d'Etudes Andines*, 33(2), 331-377.
- Reeves, Brian OK. (1978). Head-Smashed-In: 5500 years of bison jumping in the Alberta plains. *The Plains Anthropologist*, 23(82), 151-174.
- Reeves, Corwin C. (1976). *Caliche: origin, classification, morphology and uses*: Estacado books Texas.
- Retallack, Greg J. (1988). Field recognition of paleosols. *Geological Society of America Special Papers*, 216, 1-20.
- Retallack, Greg John. (1997). *Colour guide to paleosols*: John Wiley & Sons Ltd.
- Retallack, Gregory J. (2008). *Soils of the past: An introduction to paleopedology*: John Wiley & Sons.
- Rincón, AD. (2005). Los roedores fósiles presentes en el Mene de Inciarte, Sierra de Perijá, estado Zulia, Venezuela. Bioestratigrafía e implicaciones paleoambientales. Unpublished doctoral dissertation, Instituto Venezolano de Investigaciones Científicas (IVIC), Caracas.
- Rincón, AD, Parra, GE, Prevosti, FJ, Alberdi, MT, & Bell, CJ. (2009). A preliminary assessment of the mammalian fauna from the Pliocene-Pleistocene El Breal De Orocal locality, Monagas State, Venezuela. *Museum of Northern Arizona Bulletin*, 64, 593-620.
- Rincón, Ascanio D. (2011). New remains of *Mixotoxodon larensis* Van Frank 1957 (Mammalia: Notoungulata) from mene de inciarte tar pit, north-western Venezuela. *Interciencia*, 36(12), 894-899.
- Rincón, Ascanio D, Alberdi, María Teresa, & Prado, José Luis. (2006). Nuevo registro de *Equus (Amerhippus) santeaeleae* (Mammalia, Perissodactyla) del pozo de asfalto de Inciarte (Pleistoceno Superior), estado Zulia, Venezuela. *AMEGHINIANA*, 43(3), 529-538.
- Rincón, Ascanio D, Prevosti, Francisco J, & Parra, Gilberto E. (2011). New saber-toothed cat records (Felidae: Machairodontinae) for the Pleistocene of Venezuela, and the Great American Biotic Interchange. *Journal of Vertebrate Paleontology*, 31(2), 468-478.

- Rincón, Ascanio D, White, Richard S, & McDonald, H Gregory. (2008). Late Pleistocene cingulates (Mammalia: Xenarthra) from Mene de Inciarte Tar Pits, Sierra de Perijá, western Venezuela. *Journal of Vertebrate Paleontology*, 28(1), 197-207.
- Rincón R, Ascanio D. (2006). A first record of the Pleistocene saber-toothed cat *Smilodon populator* Lund, 1842 (Carnivora: Felidae: Machairodontinae) from Venezuela. *AMEGHINIANA*, 43(2), 499-501.
- Rogers, Raymond R. (1990). Taphonomy of three dinosaur bone beds in the Upper Cretaceous Two Medicine Formation of northwestern Montana: evidence for drought-related mortality. *Palaios*, 394-413.
- Román Carrión, José Luis. (2007). Nuevos Datos Sobre la Distribución Geográfica de los “Perezosos Gigantes” del Pleistoceno del Ecuador.
- Rossetti, Dilce de Fátima, de Toledo, Peter Mann, & Moraes-Santos, Heloísa Maria. (2004). Reconstructing habitats in central Amazonia using megafauna, sedimentology, radiocarbon, and isotope analyses. *Quaternary Research*, 61(3), 289-300.
- Ryan, Michael J, Russell, Anthony P, Eberth, David A, & Currie, Philip J. (2001). The taphonomy of a *Centrosaurus* (Ornithischia: Certopsidae) bone bed from the Dinosaur Park Formation (Upper Campanian), Alberta, Canada, with comments on cranial ontogeny. *Palaios*, 16(5), 482-506.
- Sander, Martin P. (1992). The norian *Plateosaurus* bonebeds of central Europe and their taphonomy. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 93(3), 255-299.
- Sarma, Akkaraju VN. (1974). Holocene paleoecology of south coastal Ecuador. *Proceedings of the American Philosophical Society*, 93-134.
- Sarma, Akkaraju V. N. (1970). The Cultural Implications of Upper Pleistocene and Holocene Ecology of the Santa Elena Peninsula, Ecuador. (Ph.D. Dissertation), Columbia University, New York.
- Schaller, George B. (1972). *The Serengeti lion: a study of predator-prey relations. Wildlife behavior and ecology series*: University of Chicago Press, Chicago, Illinois, USA.
- Schwartz, Hilde L, & Gillette, David D. (1994). Geology and taphonomy of the *Coelophysis* quarry, Upper Triassic Chinle Formation, Ghost Ranch, New Mexico. *Journal of Paleontology*, 1118-1130.
- Scillato-Yané, GJ, Carlini, AA, Tonni, EP, & Noriega, JI. (2005). Paleobiogeography of the late Pleistocene pampatheres of South America. *Journal of South American Earth Sciences*, 20(1), 131-138.
- Seymour, Kevin. (2010). The late Pleistocene fossil vertebrates from the Talara tar seeps, Peru, and Corralito, Ecuador, with particular reference to the Carnivora. Paper presented at the X Congreso Argentino de Paleontología y Bioestratigrafía-VII Congreso Latinoamericano de Paleontología.
- Sheppard, George. (1928). The Geology of Ancon Point, Ecuador, South America. *The Journal of Geology*, 113-138.
- Sheppard, George. (1930). Notes on the climate and physiography of Southwestern Ecuador. *Geographical Review*, 20(3), 445-453.
- Sheppard, George. (1937). *The geology of south-western Ecuador*: Thomas Murby & Company. London. 275 pp.

- Smuts, GL, & Whyte, IJ. (1981). Relationships between reproduction and environment in the Hippopotamus Hippopotamus Amphibius in the Kruger National Park. *Koedoe-African Protected Area Conservation and Science*, 24(1), 169-185.
- Spencer, Lillian M, Van Valkenburgh, Blaire, & Harris, John M. (2003). Taphonomic analysis of large mammals recovered from the Pleistocene Rancho La Brea tar seeps. *Paleobiology*, 29(4), 561-575.
- Spillmann, Franz. (1931). *Die Säugetiere Ecuadors im Wandel der Zeit*: Universidad Central.
- Spillmann, Franz. (1935). Die Fossilen Pferde Ekuadors der Gattung Neohippus. *Palaeobiologica*, 372-393.
- Spillmann, Franz. (1940). Contribucion al conocimiento de fosiles nuevos de la avifauna ecuatoriana en el Pleistoceno de Santa Elena. Paper presented at the Eighth American Scientific Congress, Washington.
- Stiner, Mary C. (1990). The use of mortality patterns in archaeological studies of hominid predatory adaptations. *Journal of Anthropological Archaeology*, 9(4), 305-351.
- Stock, C, Harris, JM, & La Brea, Rancho. (1992). A record of Pleistocene life in California. Los Angeles County Museum of Natural History, Los Angeles, CA.
- Stohtert, Karen E. (1983). Review of the early preceramic complexes of the Santa Elena Peninsula, Ecuador. *American Antiquity*, 122-127.
- Stohtert, Karen E. (1985). The preceramic Las Vegas culture of coastal Ecuador. *American Antiquity*, 613-637.
- Stohtert, Karen E. (2011). Coastal Resources and the Early Holocene Las Vegas Adaptation of Ecuador *Trekking the Shore* (pp. 355-382): Springer.
- Stohtert, Karen E, Piperno, Dolores R, & Andres, Thomas C. (2003). Terminal Pleistocene/early Holocene human adaptation in coastal Ecuador: the Las Vegas evidence. *Quaternary International*, 109, 23-43.
- Taube, Erica, Keravec, Joël, Vié, Jean-Christophe, & Duplantier, Jean-Marc. (2001). Reproductive biology and postnatal development in sloths, *Bradypus* and *Choloepus*: review with original data from the field (French Guiana) and from captivity. *Mammal Review*, 31(3-4), 173-188.
- Tellkamp, Markus Patricio. (2005). Prehistoric exploitation and biogeography of birds in coastal and Andean Ecuador. University of Florida.
- Tito, Giuseppe. (2008). New remains of *Eremotherium laurillardi* (Lund, 1842) (Megatheriidae, Xenarthra) from the coastal region of Ecuador. *Journal of South American Earth Sciences*, 26(4), 424-434.
- Tomiami, Camilla, & Abbazzi, Laura. (2002). Deer fauna from Pleistocene and Holocene localities of Ecuador (South America). *Geobios*, 35(5), 631-645.
- Turnbull, William D, & Martill, David M. (1988). Taphonomy and preservation of a monospecific Titanotherium assemblage from the Washakie formation (Late Eocene), southern Wyoming. An ecological accident in the fossil record. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 63(1), 91-108.
- Udvardy, Miklos DF. (1975). A classification of the biogeographical provinces of the world (Vol. 8): International Union for Conservation of Nature and Natural Resources Morges, Switzerland.
- Van der Hammen, Thomas. (1978). Stratigraphy and environments of the Upper Quaternary of the El Abra corridor and rock shelters (Colombia). *Palaeogeography, Palaeoclimatology, Palaeoecology*, 25(1), 111-162.

- VanValkenburgh, Blaire, & Hertel, Fritz. (1993). Tough times at La Brea: tooth breakage in large carnivores of the late Pleistocene. *Science*, 261(5120), 456-459.
- Varricchio, David J, Sereno, Paul C, Xijin, Zhao, Lin, Tan, Wilson, Jeffery A, & Lyon, Gabrielle H. (2008). Mud-trapped herd captures evidence of distinctive dinosaur sociality. *Acta Palaeontologica Polonica*, 53(4), 567-578.
- Venkatesan, Mahalakshmi I, Linick, Timothy W, Suess, Hans E, & Buccellati, Giorgio. (1982). Asphalt in carbon-14-dated archaeological samples from Terqa, Syria. *Nature*, 295(5849), 517-519.
- Voorhies, Michael R. (1969). Taphonomy and population dynamics of an early Pliocene vertebrate fauna, Knox County, Nebraska. *Rocky Mountain Geology*, 8(special paper 1), 1-69.
- Voorhies, Michael R. (1985). A Miocene rhinoceros herd buried in volcanic ash. *National Geographic Society Research Reports*, 19, 671-688.
- Williams, John W, Jackson, Stephen T, & Kutzbach, John E. (2007). Projected distributions of novel and disappearing climates by 2100 AD. *Proceedings of the National Academy of Sciences*, 104(14), 5738-5742.
- WING, ELIZABETH SCHWARZ. (1962). Succession of mammalian faunas on Trinidad, West Indies. University of Florida.
- Woodard, Geoffrey D, & Marcus, Leslie F. (1973). Rancho La Brea fossil deposits: a re-evaluation from stratigraphic and geological evidence. *Journal of Paleontology*, 54-69.
- Xing, Xu, & Norell, Mark A. (2006). Non-avian dinosaur fossils from the Lower Cretaceous Jehol Group of western Liaoning, China. *Geological Journal*, 41(3-4), 419-437.

Appendix

Appendix A: Museo Paleontologico Megaterio database of prepared Tanque Loma specimens, as of September, 2013. Curatorial efforts are ongoing, so not all specimens have yet been assigned Museum numbers, and there may be some uncorrected errors, including duplications or omissions of specimen numbers.

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|----------------|--------------------|---------------|----------------|-------------------------|------------|-----------|--------------------|---------|
| | U9, 398 | L245 | Artiodactyla | Cervidae | cf Odocoileus | cf virginianus | Antler | | unknown | tip | unknown |
| | U9, 630 | L301 | Artiodactyla | Cervidae | cf Odocoileus | cf virginianus | Antler | | unknown | tip | adult |
| MPM 200 | | L647 | cf Artiodactyl | | | | Tooth frag | | | | |
| MPM 283 | B 267 | L659 | cf Carnivora | | | | rib | | | midshaft frag | |
| MPM 284 | B 271 | L661 | cf Carnivora | | | | rib | | | medial end present | |
| MPM 286 | B 269 | L658 | cf Carnivora | | | | rib | | | midshaft frag | |
| MPM 287 | B 268 | L660 | cf Carnivora | | | | rib | | | midshaft frag | |
| MPM 331 | 079/109 | | cf Proboscidea | cf Gomphotheriidae | | | Femur/Humerus? | | ~5 | lateral condyle | ? |
| | 79 | | cf Proboscidea | | | | Scapula? | | | glenoid fossa? | adult |
| MPM 195 | | L239 | Mammalia | | | | Femur | | ~5 | distal condyle | juv |
| MPM 289 | B 288 | L656 | Mammalia | | | | rib | | | midshaft frag | |
| MPM 347 | 000 E | RS | Mammalia | | | | fragment (unidentified) | | ~10 | | adult |
| MPM 351 | 76 | 102 | Mammalia | | | | fragment (unidentified) | | ~3 | | adult |
| MPM 393 | 000 E | RS | Mammalia | | | | fragment (unidentified) | | | | |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|----------|-------|----------------|---------|-------|------------------|-------------------------|-----------------|-----------|--------------|-------|
| MPM 397 | 000 D | RS | Mammalia | | | | fragment (unidentified) | | | | adult |
| MPM 469 | 000 D-RS | | Mammalia | | | | fragment (unidentified) | | ~15 | | |
| | 284 | | Mammalia | | | | fragment (unidentified) | | | | |
| | 701 | | Mammalia | | | | fragment (unidentified) | | | | |
| | 0 46 | | Mammalia | | | | fragment (unidentified) | | | | |
| | 0 57 | | Mammalia | | | | fragment (unidentified) | | | | |
| | 0 80 | | Mammalia | | | | fragment (unidentified) | | | | |
| | 000 A | | Mammalia | | | | fragment (unidentified) | | | | |
| | B1 | | Mammalia | | | | fragment (unidentified) | | | | |
| | U2, 079 | L089 | Perissodactyla | Equidae | Equus | cf santaelena | Molar | 3rd upper right | ~100 | | adult |
| | U9, 511 | L285 | Perissodactyla | Equidae | Equus | cf santaelena | Molar | lower | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|----------------|-----------------|------------------|--------------------|-----------------|-------------|-----------|--|-------|
| | U10, 2025 | L474 | Perissodactyla | Equidae | Equus | cf santaelenaee | Molar | upper right | ~100 | | adult |
| MPM 306 | 377/428 | L211 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 2nd Phalanx | | ~100 | | adult |
| | | L176 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 2nd Phalanx | | ~100 | | adult |
| MPM 307 | 750/936 | L232 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Carpal | | ~85 | broken along palmar edge | adult |
| MPM 308 | 413/478 | L266 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Carpal | | ~100 | | adult |
| MPM 321 | 712/916 | L230 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Carpal | | ~100 | | adult |
| MPM 486 | 387/438 | L808 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Carpal | | ~75 | | adult |
| MPM 291 | 340/390 | L202 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~80 | neural arch & right transverse process broken; proximal epiphysis missing | juv |
| MPM 292 | 408/471 | L262 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~100 | | juv |
| MPM 293 | 2023/1014 | L458 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~60 | centrum & transverse process only | juv |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-------------|-----------------|------------------|--------------|-----------------|------------|-----------|---|-----|
| MPM 294 | 443/508 | L275 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~80 | neural arch & zygopophyses broken | juv |
| MPM 295 | | L276 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~98 | prezygopophyses broken | juv |
| MPM 297 | 2018/1007 | L455 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~70 | neural arch, left transverse process & zygopophyses missing | juv |
| MPM 299 | 2030/1014 | L459 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~70 | neural arch missing; left transverse process broken | juv |
| MPM 300 | 750/961 | L233 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~90 | | juv |
| MPM 630 | 630/666 | L349 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~100 | | juv |
| MPM 631 | 627/653 | L336 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~98 | prezygopophyses broken | juv |
| MPM 632 | 399/462 | L246 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~100 | | juv |
| MPM 633 | 2021/1010 | L457 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Caudal Vertebra | | ~100 | | juv |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-------------|-----------------|------------------|--------------|------------------|------------|-----------|----------------------|---------------|
| MPM 488 | 150-154 | L242 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Femur | left | ~30 | midshaft | young adult? |
| MPM 489 | 130/171 | L92 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Femur | right | ~70 | proximal end missing | young adult? |
| MPM 301 | 630/665 | L347 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Lumbar Vertebra | | ~100 | | juv |
| MPM 302 | 623/649 | L334 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Lumbar Vertebra | | ~100 | | juv |
| MPM 303 | 623/649 | L333 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Lumbar Vertebra | | ~100 | | juv |
| MPM 99 | 2030/1245 | L589 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Lumbar Vertebra | 1st | ~90 | | adult (small) |
| MPM 315 | 745/863 | L430 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Lunar | | ~100 | | adult |
| MPM 312 | 371/422 | L210 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Metapodial | | ~95 | | adult |
| MPM 316 | 720/814 | L413 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Metapodial | | ~75 | highly eroded | adult |
| MPM 319 | 414/479 | L268 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Metapodial | | ~100 | | adult |
| MPM 325 | 431/496 | L273 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Metapodial | | ~100 | | adult |
| MPM 306 | | L211 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Proximal Phalanx | | ~100 | | adult |
| MPM 313 | 404/467 | L252 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Proximal Phalanx | | ~100 | | adult |
| MPM 314 | 653/691 | L368 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Proximal Phalanx | | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-------------|-----------------|------------------|--------------|-------------------|------------|-----------|---|---------------|
| MPM 317 | 404/467 | L253 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Proximal Phalanx | | ~100 | | adult |
| MPM 634 | 622/648 | L332 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sacral vertebra | | ~100 | | juv |
| MPM 635 | 622/648 | L331 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sacral vertebra | | ~90 | neural spine & phlanges missing | juv |
| MPM 636 | 622/648 | L330 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sacral vertebra | | ~95 | neural spine & pre-zygepophyses missing | juv |
| MPM 309 | 404/467 | L260 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sesamoid | | ~100 | | adult |
| MPM 310 | 404/467 | L256 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sesamoid | | ~100 | | adult |
| MPM 311 | 404/467 | L259 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sesamoid | | ~100 | | adult |
| MPM 318 | 404/467 | L257 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sesamoid | | ~100 | | adult |
| MPM 320 | 404/467 | L255 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Sesamoid | | ~100 | | adult |
| MPM 504 | 411/476 | L807 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Thoracic Vertebra | | ~50 | centrum only | adult |
| MPM 95 | 2029/1147 | L570 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Thoracic Vertebra | | ~80 | | adult (small) |
| | | L608 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Tibia | left | ~100 | | juv |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-------------|-----------------|------------------|--------------|----------------------|------------|-----------|--------------|-------|
| | | L90 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Tibia | right | ~100 | | juv |
| | 0 | | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Ulnari? | | ~95 | | adult |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 2nd Metatarsal | left | ~100 | | juv |
| | U9, 404 | L250 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 3rd Metatarsal | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 4th 2nd phalanx | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 4th distal phalanx | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 4th metatarsal | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 4th proximal phalanx | left | ~100 | | juv |
| | U9, 653 | L378 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | 5th Metatarsal | left | ~100 | | juv |
| | U9, 413 | L265 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Astragalus | right | ~100 | | adult |
| | U9, 413 | L267 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Astragalus | left | ~100 | | juv |
| | U9, 403 | L249 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Calcaneum | right | ~100 | | adult |
| | U9, 625 | L391 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Calcaneum | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Cuboid | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Ectocuneiform | left | ~100 | | juv |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-------------|-----------------|------------------|--------------|----------------|------------|-----------|--------------|-------|
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Entocuneiform | left | ~100 | | juv |
| | U9, 631 | L350 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Femur | left | ~100 | | juv |
| | U9, 654 | L374 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Fibula | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Mesocuneiform | left | ~100 | | juv |
| | | ? | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Navicular | left | ~100 | | juv |
| | U9, 631 | L351 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Patella | left | ~100 | | juv |
| | U9, 629 | L329 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Pelvis | left | ~50 | | juv |
| | U9, 402 | L248 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Tibia | right | ~100 | | adult |
| | U9, 625 | L335 | Proboscidea | Gomphotheriidae | cf Notiomastodon | cf platensis | Tibia | left | ~100 | | juv |
| | U9, 445 | L277 | Xenarthra | Gomphotheriidae | cf Notiomastodon | cf platensis | Fibula | right | ~100 | | adult |
| MPM 55 | 653 | L371 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 2nd Metacarpal | left | ~100 | | adult |
| MPM 50 | 712 | L236 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 2nd Phalanx | | ~90 | | adult |
| MPM 51 | 749 | L451 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 2nd Phalanx | | ~100 | | adult |
| MPM 53 | 626 | L404 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 2nd Phalanx | | ~75 | | adult |
| MPM 54 | 626 | L456 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 2nd Phalanx | | ~75 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------------------------|------------|-----------|--------------|---------------|
| | | L325 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 2nd Phalanx | | ~100 | | adult |
| MPM 138 | | L227 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | manus | ~100 | | adult (small) |
| MPM 139 | | L32 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | manus | ~100 | | adult |
| MPM 203 | | L315 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | manus | ~95 | | adult |
| MPM 204 | | L414 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | manus | ~60 | | adult |
| MPM 221 | | L109 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | pes | ~85 | | adult |
| MPM 225 | | L410 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | pes | ~95 | | adult |
| MPM 229 | | L440 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | pes | ~80 | | adult |
| MPM 515 | U2, 069 | L076 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | | ~100 | | adult |
| | U10, 2030 | L534 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | | ~100 | | adult |
| | | L226 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd distal phalanx (claw) | pes | ~80 | | adult |
| MPM 34 | 603 | L321 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | left | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|----------------------|------------|-----------|-----------------|-------|
| MPM 35 | 684 | L401 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | left | ~100 | | adult |
| MPM 36 | 2029 | L562 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | left | ~100 | | adult |
| MPM 37 | 092 | L137 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | left | ~100 | | adult |
| MPM 38 | 2028 | L508 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | left | ~50 | proximal end | adult |
| MPM 39 | 2030 | L578 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | right | ~100 | | adult |
| MPM 40 | 748 | L439 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | right | ~100 | | adult |
| MPM 43 | 749 | L447 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | | ~95 | | adult |
| MPM 44 | 065 | L72 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | right | ~100 | | adult |
| | | L385 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metacarpal | left | ~100 | | adult |
| MPM 23 | 752 | L470 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metatarsal | left | ~100 | | adult |
| MPM 24 | 005 | L5 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metatarsal | right | ~100 | | adult |
| MPM 25 | 2028 | L472 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metatarsal | right | ~90 | | adult |
| MPM 26 | 2029/1025 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd Metatarsal | right | ~50 | distal end only | adult |
| MPM 139 | | L32 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd middle Phalanx | manus | ~100 | | adult |
| MPM 139 | | L32 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 3rd proximal phalanx | manus | ~100 | with sesamoids | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------------|-----------|---------------|--------------|-------------|---------------------------|-------------|-----------|--------------------------|-------|
| MPM 140 | | L311 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th distal phalanx (claw) | right manus | ~80 | | adult |
| MPM 141 | | L214 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th distal phalanx (claw) | left manus | ~100 | | adult |
| | | L79 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th distal phalanx (claw) | | ~80 | | adult |
| MPM 41 | 2030 | L591 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metacarpal | left | ~100 | | adult |
| MPM 42 | 751 | L454 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metacarpal | left | ~100 | | adult |
| MPM 43 | 749 | L447 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metacarpal | | ~95 | | adult |
| MPM 44 | 065 | L72 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metacarpal | right | ~80 | | adult |
| | | L366 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metacarpal | left | ~100 | | adult |
| MPM 10 | 579 | L308 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metatarsal | right | ~95 | | adult |
| MPM 11 | 577 & 504 | L278 & L307 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metatarsal | right | ~95 | | adult |
| MPM 12 | 505 | L279 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metatarsal | right | ~100 | | adult |
| MPM 13 | 2030 | L487 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metatarsal | right | ~95 | missing distal epiphyses | juv |
| MPM 14 | 748 | L432 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metatarsal | left | ~90 | missing distal end | adult |
| MPM 20 | 408 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metatarsal | right | ~25 | proximal end only | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|----------------------|------------|-----------|-----------------------|-------------|
| MPM 9 | 000 | L638 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th Metatarsal | right | ~80 | missing distal end | adult |
| MPM 141 | | L214 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th middle phalanx | left manus | ~100 | | adult |
| MPM 141 | | L214 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 4th proximal phalanx | left manus | ~100 | with sesamoids | adult |
| MPM 30 | 602 | L388 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metacarpal | left | ~100 | | adult |
| MPM 31 | 2029 | L565 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metacarpal | left | ~90 | epiphysis missing | juv (large) |
| MPM 32 | 535 | L460 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metacarpal | left | ~50 | proximal end | adult |
| MPM 33 | 720 | L469 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metacarpal | left | ~50 | proximal end | adult |
| | | L305 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metacarpal | left | ~100 | | adult |
| MPM 4 | 2027/1018 | L462 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metatarsal | right | ~100 | | adult |
| MPM 5 | 143/551 | L110 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metatarsal | right | ~100 | | adult |
| MPM 6 | 2030 | L576 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metatarsal | left | ~100 | | adult |
| MPM 7 | 612 | L324 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metatarsal | left | ~100 | | adult |
| MPM 8 | 000 | L639 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | 5th Metatarsal | left | ~75 | posterior end missing | |
| MPM 227 | 000 | L707 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~15 | odontoid process | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|------------|------------|-----------|-----------------------------------|-------|
| MPM 228 | 000 | L708 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | | ~15 | navicular process (frag) | adult |
| MPM 232 | 035/057 | L018 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~100 | | adult |
| MPM 233 | 618/644 | L326 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~100 | | adult |
| MPM 234 | 2029/1136 | L599 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | right | ~90 | | adult |
| MPM 235 | 046/068 | L703 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~40 | odontoid process & lat troch frag | adult |
| MPM 236 | 046/068A | L702 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~30 | navicular process | adult |
| MPM 237 | 000 A | L704 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~30 | lateral trochlea | adult |
| MPM 238 | 000-RS | L705 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | right | ~20 | lateral trochlea | adult |
| MPM 239 | 282 | L706 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~40 | lateral margin | adult |
| | U10, 2030 | L533 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | right | ~100 | | adult |
| | U6, 242 | L177 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~100 | | adult |
| | U2, 016 | L061 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~100 | | adult |
| | U9, 740 | L428 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | right | ~100 | | adult |
| | U2, 56 | L59 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | right | ~95 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|----------------|------------|-----------|--|-------|
| | | L312 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | left | ~100 | | adult |
| | | L364 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Astragalus | right | ~100 | | adult |
| MPM 215 | | L590 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Atlas Vertebra | | ~95 | | adult |
| MPM 324 | 000-B1 | L237 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Atlas Vertebra | | ~85 | | adult |
| | | L54 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Atlas Vertebra | | ~100 | | adult |
| MPM 216 | | L586 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Axis Vertebra | | ~98 | missing tip of left transverse process | adult |
| MPM 222 | | L68 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Axis Vertebra | | ~100 | | adult |
| MPM 322 | 149/193 | L112 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Axis Vertebra | | ~95 | | adult |
| MPM 323 | 2028/1236 | L504 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Axis Vertebra | | ~90 | | juv |
| MPM 487 | 632/668 | L701 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Axis Vertebra | | ~50 | left half | adult |
| | | L122 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Axis Vertebra | | ~95 | missing posterior epiphysis | adult |
| MPM 240 | 748/969 | L445 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | right | ~100 | | adult |
| MPM 241 | B1-RS | L035 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | right | ~90 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|-----------------|------------|-----------|---|-------|
| MPM 242 | 2030/1251 | L618 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | left | ~100 | | adult |
| MPM 243 | 2030/F1113 | L709 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | | ~25 | Tuber Calcis only | |
| MPM 244 | 550/576 | L295 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | right | ~75 | lacking tuber caldis | adult |
| MPM 245 | 085/121 | L132 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | left | ~50 | lacking tuber caldis | adult |
| | 09, 644 | L359 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | right | ~100 | | adult |
| | U10, 2029 | L522 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | left | ~100 | | adult |
| | U10, 2029 | L520 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | right | ~90 | back end missing | adult |
| | | L60 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | left | ~100 | | adult |
| | | L87 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Calcaneum | right | ~100 | | adult |
| MPM 100 | 506 | L280 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~75 | transverse processes & part of centrum broken | adult |
| MPM 101 | 583 | L310 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~95 | | adult |
| MPM 103 | 553 | L296 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~95 | | adult |
| MPM 106 | 749 | L449 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-----------------|------------|-----------|--|-------|
| MPM 142 | | L4 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~5 | epiphysis only | adult |
| MPM 143 | | L2 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~5 | epiphysis only | adult |
| MPM 246 | 676/756 | L515 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~85 | neural arch missing | adult |
| MPM 247 | 2030/1248 | L601 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~70 | neural arch missing, epiphyses unfused | adult |
| MPM 248 | 2028/1159 | L501 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | 1st | ~80 | neural arch missing | adult |
| MPM 249 | 392/618 | L316 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~95 | epiphyses unfused | adult |
| MPM 250 | B2/RS | L38 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~75 | transverse processes broken; centrum bored out | adult |
| MPM 251 | 575/601 | L485 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~90 | transverse processes broken | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-----------------|------------|-----------|---|-------|
| MPM 252 | | L481 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~95 | transverse processes broken; epiphyses unfused | adult |
| MPM 253 | 266/313 | L185 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~80 | transverse processes broken; epiphyses unfused | adult |
| MPM 254 | B2/RS | L39 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~85 | transverse processes broken | adult |
| MPM 255 | 2028/1120 | L498 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~95 | transverse processes broken | adult |
| MPM 256 | 2028/1067 | L489 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~85 | transverse processes broken; epiphyses unfused/broken | adult |
| MPM 257 | | L183 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~90 | transverse processes broken | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|-----------------|-----------------|-----------|--|-------|
| MPM 258 | 302/352 | L193 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~90 | transverse processes broken, anterior centrum broken | adult |
| MPM 259 | 067/093 | L67 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~95 | epiphysis broken | adult |
| MPM 260 | 191/235 | L121 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~90 | transverse processes broken | adult |
| MPM 261 | | L519 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~90 | transverse processes broken | adult |
| MPM 262 | | L120 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~100 | | adult |
| MPM 263 | 2028//1232 | L483 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| MPM 271 | 560/586 | L300 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~85 | centrum & neural arch | adult |
| MPM 272 | B1-B2/RS | L033 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior series | ~80 | | adult |
| MPM 273 | 1247/2030 | L756 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~70 | centrum & neural arch | adult |
| MPM 304 | B 163 | L654 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~80 | most of centrum & neural arch | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|-----------------|------------------|-----------|---|-------|
| MPM 400 | 2030/F1255 | L758 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior series | ~20 | neural arch & post-zygopophysys | adult |
| MPM 402 | RS31 | L757 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~80 | | adult |
| MPM 408 | 712B | L755 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~85 | part of centrum & transverse processes broken | adult |
| MPM 472 | 059/085 | L726 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~20 | left part of centrum & transverse spine | adult |
| MPM 508 | 190 | L120 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~95 | medial | adult |
| MPM 56 | 624/650 | L191 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~50 | lacking processes, epiphyses | adult |
| MPM 88 | 241 | L176 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior (1st?) | ~100 | | adult |
| MPM 89 | 214 | L157 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| MPM 90 | 2030 | L580 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior (last?) | ~100 | | adult |
| MPM 91 | 687 | L402 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-----------------|------------|-----------|--|-------|
| MPM 94 | 676 | L387 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~90 | lacking tip of left transverse process | adult |
| MPM 96 | 732 | L425 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~85 | lacking transverse processes | adult |
| MPM 98 | 749 | L452 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~85 | lacking transverse processes | adult |
| | | L33 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~60 | centrum & neural arch; centrum broken | adult |
| | | L300 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~80 | | adult |
| | 712 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~75 | | adult |
| | 2030/1247 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~80 | | adult |
| | B531 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | mid-series | ~60 | neural arch & part of centrum | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | posterior | ~30 | Centrum & part of neural arch; epiphyses unfused | adult |
| | 2030 | | | | | | | | | | |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|--------------------|------------|-----------|------------------------|-------|
| | 2030/F1255 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | | ~20 | Neural arch (superior) | adult |
| | | L19 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| | | L523 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| | | L527 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| | | L530 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| | | L537 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| | | L95 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | anterior | ~100 | | adult |
| | | L407 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |
| | | L477 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |
| | | L535 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |
| | | L541 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |
| | | L546 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |
| | | L64 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |
| | | L65 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal Vertebra | middle | ~100 | | adult |
| | U3, 181 | L117 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Caudal(?) Vertebra | | ~25 | neural arch | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|--|-------|
| MPM 104 | 2029 | L563 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~95 | lacking tip of left transverse process | adult |
| MPM 105 | 2029 | L558 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~95 | | adult |
| MPM 111 | | L115 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~90 | | adult |
| MPM 267 | 000-RS | L129 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~85 | neural arch broken; epiphyses unfused | adult |
| MPM 268 | | L11 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~100 | | adult |
| MPM 269 | | L475 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~90 | epiphyses unfused | juv |
| MPM 270 | 341/391 | L203 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~60 | centrum & part of neural arch | adult |
| MPM 274 | 728/823 | L222 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~70 | transverse processes broken | adult |
| MPM 401 | RS30 | L759 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~40 | centrum & part of transverse process | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|--|-------|
| MPM 404 | RS32 | L760 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~70 | centrum & neural arch | adult |
| MPM 77 | 2029 | L567 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | 7th | ~90 | | adult |
| MPM 93 | 2030 | L582 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~90 | | adult |
| MPM 97 | 2029 | L569 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~75 | lacking transverse processes | adult |
| | | | | | | | | | | | |
| | | L203 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~85 | neural arch & transverse processes broken; posterior epiphysis missing | juv? |
| | | | | | | | | | | | |
| | | L222 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~80 | | adult |
| | 591 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~10 | | adult |
| | RS30 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~55 | centrum & transverse process | adult |
| | RS32 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cervical Vertebra | | ~90 | | adult |
| MPM 212 | B2-RS | L37 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~95 | missing medial end | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|------------|------------------|-----------|-------------------------|-------|
| MPM 213 | 2029/1175 | L573 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~100 | | adult |
| MPM 214 | 148/192 | L94 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~100 | | adult |
| MPM 430 | 655/693 | L395 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~100 | | adult |
| MPM 460 | 2030/1217 | L616 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~85 | missing medial portion | adult |
| MPM 461 | 605/631 | L804 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~40 | mid-section | adult |
| MPM 73 | 2029/1046 | L514 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~90 | lacking epiphyses | juv |
| | U6, 212 | L155 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | left | ~100 | | adult |
| | U7, 307 | L194 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | left | ~95 | epiphyses missing | baby |
| | U8, 704 | L216 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | left | ~100 | | adult |
| | U9, 608 | L322 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | left | ~95 | | juv |
| | | L1215 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~100 | | adult |
| | | L73 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Clavicle | | ~100 | | adult |
| MPM 115 | 2030 | L587 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end incomplete | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|--------------|------------|-------------------------|-----------|-------------------------|-------|
| MPM 116 | B2 | L42 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | right, posterior series | | proximal end present | adult |
| MPM 117 | 2030 | L581 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | left, mid-series | | proximal end present | adult |
| MPM 118 | 438 | L274 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | | | mid-shaft | adult |
| MPM 119 | 328 | L208 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | left | | mid-shaft | adult |
| MPM 120 | 2028 | L495 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | left | | mid-shaft | adult |
| MPM 121 | 718 | L412 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | right, mid-series | | proximal end incomplete | adult |
| MPM 122 | 37/36/53 | L70 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | right, mid-series | | proximal end present | adult |
| MPM 123 | 2029/1100 | L631 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | | | distal portion | adult |
| MPM 124 | 629 | L340 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | | | mid-shaft | adult |
| MPM 126 | 2029 | L575 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | 1st right | ~80 | | juv |
| MPM 127 | 2029 | L561 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | right, anterior series | | proximal end incomplete | adult |
| MPM 128 | 195 | L124 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Costal rib | left, posterior series | | proximal end present | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|------------|-------------------------|-----------|-------------------------|-------|
| MPM 129 | 674 | L306 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, anterior series | | proximal end incomplete | adult |
| MPM 130 | 676 | L435 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, anterior series | | proximal end present | adult |
| MPM 131 | 601 | L320 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, posterior series | | proximal end present | adult |
| MPM 132 | 2029/F1184 | L630 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | | | mid-shaft | adult |
| MPM 133 | 2029 | L629 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, posterior series | | proximal end incomplete | adult |
| MPM 134 | 000 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, posterior series | | proximal end present | adult |
| MPM 135 | 000 | L633 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, posterior series | | proximal end incomplete | adult |
| MPM 136 | 000 | L632 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| MPM 137 | 748 | L443 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | | | mid-shaft | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|------------|------------------------|-----------|-------------------------|-------|
| MPM 144 | | L461 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | | ~1 | proximal epiphysis only | adult |
| MPM 157 | 2029 | L574 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left (1st?) | ~100 | | adult |
| MPM 158 | 2029 | L559 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right | ~95 | | adult |
| MPM 159 | | L139 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right (1st?) | ~100 | | adult |
| MPM 160 | 136 | L107 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right (1st?) | ~100 | | adult |
| MPM 207 | | L152 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, anterior series | | proximal end missing | adult |
| MPM 217 | | L492 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | | | mid-shaft | adult |
| MPM 218 | | L126 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end incomplete | adult |
| MPM 219 | | L167 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | | | mid-shaft | adult |
| MPM 220 | | L409 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end missing | adult |
| MPM 226 | | L556 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right | | proximal end present | juv |
| MPM 230 | 000 | L628 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, anterior series | ~95 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|------------|------------------|-----------|----------------------|-------|
| MPM 231 | | L532 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| MPM 296 | | L156 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right | ~02 | | adult |
| MPM 596 | 2029/1074 | L713 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~40 | proximal end present | adult |
| MPM 597 | 748/875 | L714 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~60 | proximal end present | adult |
| MPM 598 | 749/974 | L715 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~40 | proximal end present | adult |
| MPM 599 | 079/109 | L716 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~80 | proximal end present | adult |
| MPM 600 | 749/947A | L717 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~40 | proximal end present | adult |
| MPM 601 | 749/947B | L718 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~50 | proximal end present | adult |
| MPM 602 | 731 | L719 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~40 | proximal end present | adult |
| MPM 603 | 617/643 | L720 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~40 | proximal end present | adult |
| MPM 604 | 2030 | L721 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~85 | proximal end present | adult |
| | | L106 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal Rib | 1st | | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|------------|------------------|-----------|----------------------|-------|
| | | L163 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L22 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L25 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L293 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L353 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L358 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~90 | proximal end present | adult |
| | | L361 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L362 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~100 | proximal end present | adult |
| | | L396 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L408 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L43 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|------------|-------------------|-----------|----------------------|-------|
| | | L512 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | ~95 | proximal end present | adult |
| | | L78 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | left, mid-series | | proximal end present | adult |
| | | L119 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L153 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | juv |
| | | L289 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L356 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L397 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L411 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | ~100 | proximal end present | adult |
| | | L420 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L450 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L513 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|--------------|-------------------|-----------|--------------------------------|-------------|
| | | L531 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L543 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L544 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| | | L549 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | ~100 | proximal end present | adult |
| | | L550 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Costal rib | right, mid-series | | proximal end present | adult |
| MPM 211 | 2029/1090 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranial frag | | | palate | adult |
| MPM 183 | | L143 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~5 | basioccipital only | prob. Fetal |
| MPM 490 | 685/748 | L697 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~2 | right jugal frag | adult |
| MPM 491 | 567/593 | L698 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~2 | right jugal frag | adult |
| MPM 492 | 2030/1204 | L696 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~7 | right jugal | adult |
| MPM 493 | 276/325 | L693 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~5 | Parietal? | fetal? |
| MPM 494 | 335-349 | L244 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~10 | left squamosal frag w petrosal | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|---------|-----------------|-----------|---|--------------|
| MPM 495 | 084/120 | L130 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~5 | left jugal | small adult? |
| MPM 496 | 360/410 | L695 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~5 | palate frag | adult |
| MPM 497 | 595 | L694 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~2 | fragment over brain case | adult |
| MPM 553 | 693/810 | L692 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~10 | | adult |
| MPM 554 | 065/091 | L077 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~5 | right jugal | adult |
| MPM 555 | 000-RS | L699 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~5 | right jugal | juv |
| MPM 556 | 701/770 | L700 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~5 | right jugal | juv |
| MPM 67 | B1 | L29 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | right posterior | ~8 | parietal, squamosal & supraoccipital frag | juv |
| MPM 68 | A1 | L26 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | left posterior | ~15 | parietal, squamosal & supraoccipital frag | adult |
| MPM 69 | RS6 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | right posterior | ~15 | parietal, squamosal & supraoccipital frag | adult |
| MPM 70 | | L564 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | left | ~8 | jugal | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------------|------------|-----------|---|-------|
| | U6, 228 | L165 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~15 | supraoccipital | baby |
| | U10, 2029 | L505 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~25 | posterior; includes occipital condyle | adult |
| | U9, 676 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~10 | | baby |
| | | L415 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium | | ~90 | | adult |
| MPM 71 | 693 | L403 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cranium? | | | jugal? | adult |
| MPM 15 | 518 | L287 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cuboid | right | ~100 | | adult |
| MPM 16 | 748 | L438 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cuboid | right | ~100 | | adult |
| MPM 18 | RS9/000 | L640 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cuboid | right | ~100 | | adult |
| MPM 19 | 000 | L642 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cuboid | left | ~100 | | adult |
| MPM 58 | 2028 | L478 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Cyamelle | | ~100 | | adult |
| MPM 27 | 256 | L182 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ectocuneiform | | ~100 | | adult |
| MPM 62 | 109 | L102 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Falciform | | ~100 | | adult |
| MPM 332 | AT | 1 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | | adult |
| MPM 333 | AT | 2 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|----------------------|-------|
| MPM 334 | AT | 3 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~80 | | adult |
| MPM 380 | 163/207 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | head | adult |
| MPM 381 | 164 | RS15 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | medial condyle | adult |
| MPM 382 | B3 | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~10 | head & shaft frag | adult |
| MPM 383 | 619/645 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | left | ~5 | midshaft frag | adult |
| MPM 385 | 072/000 A | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~7 | medial condyle | adult |
| MPM 386 | 693/762 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | shaft frag | adult |
| MPM 387 | A | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~15 | shaft frag | adult |
| MPM 388 | | L678 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~40 | shaft frag | adult |
| MPM 389 | | L679 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~40 | shaft frag | adult |
| MPM 392 | 000 B | L677 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | medial condyle | adult |
| MPM 394 | 0 70 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | head | adult |
| MPM 395 | A1 | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | head | adult |
| MPM 396 | 0 31 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | head/epiphysis | juv |
| MPM 398 | 000 A | L676 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~12 | head & prox-med frag | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|----------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|----------------|-------|
| MPM 399 | B1-000 | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~7 | distal condyle | adult |
| MPM 498 | 248/295 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | head | adult |
| MPM 499 | 282/332 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | head | adult |
| MPM 500 | 205 | L675 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~10 | shaft frag | adult |
| MPM 501 | 383-380 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~10 | shaft frag | adult |
| MPM 502 | 737/F848 | L145 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | left | ~85 | diaphysis only | baby |
| MPM 541 | 0 | L674 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | left | ~100 | | adult |
| MPM 542 | S/P | L623 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | left | ~100 | | adult |
| MPM 792 | | L427 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | right | ~100 | | adult |
| | 587 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | head/epiphysis | juv |
| | 0 43 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | distal condyle | adult |
| | 0 50 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~10 | shaft frag | adult |
| | 0 80 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~5 | distal condyle | adult |
| | F1200 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~10 | shaft frag | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | left | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------------|-----------|---------------|--------------|-------------|-----------------------|------------|-----------|---------------------------------|-------|
| | U9, 645 | L360 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | left | ~80 | epiphyses missing | baby |
| | U9, 731 | L421 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | right | ~80 | epiphyses missing | baby |
| | U9, 619 | L328 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | | ~95 | | adult |
| | U9, 530 | L314 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | right | ~100 | | adult |
| | | L528 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Femur | left | ~100 | | adult |
| MPM 524 | | L394 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Fibula | right | ~100 | | adult |
| | 0 48 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Fibula | right | ~10 | distal end only | adult |
| | 569 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Fibula | left | ~35 | distal end only | adult |
| | | L323 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Fibula | right | ~85 | | adult |
| | U10, 2029 | L524 & L465 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Fibula | right | ~100 | | adult |
| | | L525 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Fibula | left | ~100 | | adult |
| | | L551 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Fibula | right | ~100 | | adult |
| | | L540 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | First Lumbar Vertebra | | ~98 | missing left transverse process | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-------------|-------|-----------|---------------|--------------|-------------|-------------|------------|-----------|----------------|-------|
| MPM 161 | | L555 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Haemal arch | | ~100 | | adult |
| MPM 191 | | L138 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Haemal arch | posterior | ~100 | | adult |
| MPM 192 | | L144 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Haemal arch | posterior | ~100 | | adult |
| | U5, 088-087 | L133 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hemal Arch | | ~100 | | adult |
| | U9, 693 | L406 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hemal Arch | | ~100 | | adult |
| MPM 436 | | L238 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hip | | ~1 | | adult |
| MPM 548 | 2029/1177 | L684 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hip | | ~25 | | adult |
| MPM 549 | 2028/1231 | L685 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hip | | ~10 | | adult |
| MPM 550 | 2030 | L686 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hip | | ~30 | | juv |
| MPM 551 | 667/705 | L687 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hip | | ~35 | | adult |
| MPM 552 | 749 | L688 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Hip | | ~25 | | adult |
| MPM 326 | 2028/1022 | L466 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~80 | diaphysis only | baby |
| MPM 328 | 2028/1058 | L509 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~90 | diaphysis only | juv |
| MPM 329 | RS16 | L649 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~40 | midshaft | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|--|-------------|
| MPM 330 | 131 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~5 | lateral margin including deltoid process | adult |
| MPM 335 | 748/957 | L444 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~40 | midshaft | adult |
| MPM 336 | 255/302 | L184 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~70 | midshaft w/ part of lateral trochlea | adult |
| MPM 337 | 850/058/08 1 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | | ~5 | head | adult |
| MPM 338 | 219/266 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~10 | lateral margin | small adult |
| MPM 339 | 341/391 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | | ~5 | trochlea | adult |
| MPM 358 | 000 C | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | | ~5 | trochlea | adult |
| MPM 359 | 527/553 | L298 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~60 | midshaft | adult |
| MPM 390 | 659/691 | L377 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~100 | | adult |
| MPM 391 | 2030/F1252 | L592 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~100 | | adult |
| MPM 485 | 2029/1173 | L606 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~95 | missing lateral epicondylar ridge | adult |
| MPM 516 | 172/173/17 4 | L100 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~80 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|--------------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|---|-------|
| MPM 517 | B1 | L034 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~80 | | adult |
| MPM 518 | 229/560 | L166 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~80 | diaphysis only | adult |
| MPM 519 | | L605 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~95 | missing lateral epicondylar ridge | adult |
| | 2029 | | | | | | | | | | |
| MPM 520 | 668/706 | L381 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~80 | diaphysis only | adult |
| MPM 521 | 2030/1201 | L613 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~100 | | adult |
| MPM 522 | 635/673 | L354 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~20 | distal end | adult |
| MPM 523 | 000 RS13 | L650 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~50 | distal end | adult |
| | B1 | L30 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~50 | midshaft | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~10 | distal end | adult |
| | 0 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~5 | distal trochlea | adult |
| | 2030/1203 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~85 | missing medial margin of distal end + epiphyses | baby |
| | RS1, 0 - 006 | L050 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~85 | | |
| | U10, 2029 | L529 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-----------------|------------|-----------|------------------------|-------|
| | U6, 222 | L161 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~30 | shaft | adult |
| | U10, 2029 | n/a | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~10 | distal condyle | adult |
| | U9, 748 | L429 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~100 | | adult |
| | U9, 560 | L299 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~80 | proximal end missing | adult |
| | | L526 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~100 | | adult |
| | | L218 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | right | ~100 | | adult |
| | | L592 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Humerus | left | ~100 | | adult |
| | | L27 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Jaw | L&R | ~75 | | adult |
| MPM 109 | 286 | L186 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Lumbar Vertebra | 1st | ~100 | | adult |
| MPM 415 | 731 | L762 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Lumbar Vertebra | | ~20 | Neural arch (superior) | adult |
| MPM 45 | 731 | L419 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Lunar | left | ~100 | | adult |
| MPM 46 | 563 | L302 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Lunar | left | ~100 | | adult |
| MPM 47 | 2029 | L560 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Lunar | left | ~100 | | adult |
| | | L319 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Lunar | left | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|----------|------------|-----------|---|-------|
| MPM 201 | 000-RS | L803 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | anterior | ~20 | frag including 1st alveolus | adult |
| MPM 462 | 2030/1140 | L802 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~25 | posterior portion with 4th molariform (broken) | adult |
| MPM 463 | 676/724 | L799 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~25 | anterior portion w/ 1st 2 molariforms | adult |
| MPM 464 | 343/393 | L795 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~25 | posterior portion with 3rd & 4th molariforms (broken) | adult |
| MPM 465 | 2028/1030 | L793 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | right | ~15 | right ascending ramus & alveolus for last tooth | adult |
| MPM 466 | 2030/1219 | L794 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | right | ~20 | posterior portion with 4th molariform | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|--------------|-------|-----------|---------------|--------------|-------------|----------|------------|-----------|---|-------|
| MPM 481 | 036-047/1140 | L75 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | right | ~20 | posterior portion with 3rd & 4th molariforms (4th broken) | adult |
| MPM 482 | 748/892 | L434 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~95 | | adult |
| MPM 483 | 2028/1064 | L800 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | right | | posterior portion with 4th molariform (broken) | adult |
| | 000 A | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~20 | posterior portion with 4th alveolus | adult |
| | RS33 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | | ~5 | w/ 3 alveoli | adult |
| | U1,004 | L003 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~60 | anterior part & condyle missing; 4 molariforms present | baby |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|----------|------------|-----------|---|-------|
| | U6, 246 | L179 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~50 | anterior; 1st 3 molariforms preserved | baby |
| | U9, 676 | L399 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~90 | Condyle & anterior tip missing; All 4 molariforms present | adult |
| | U10, 2030 | L539 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | left | ~85 | part of condyle missing; all 4 molariforms present | adult |
| | U1, 062 | L20 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | right | ~75 | anterior portion missing; all 4 molariforms present | adult |
| | U9, 529 | L292 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandible | right | ~90 | part f condyle & anterior tip missing; all 4 molariforms presnet; 1st molariform broken | juv |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side / type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|----------------------|-------------|-----------|---|-------------|
| MPM 484 | B2 | L797 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mandibular symphysis | | | includes right 1st alveolus | adult |
| MPM 166 | | L496 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Manubrium | | ~90 | | juv |
| MPM 145 | | L168 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Maxilla | right | ~50 | Teeth 2-5 present | prob. Fetal |
| MPM 467 | 000 C-RS | L798 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Maxilla | left | ~15 | includes infraorbital foramen & 4 alveoli | adult |
| | U10, 2030 | L547 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Maxilla | left | ~50 | 1st molariform alveolus + 2nd + 3rd molariforms | adult |
| | RS, RS5 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Maxilla | left | ~40 | middle: 1st-3rd molariforms present | baby |
| MPM 28 | 222 | L192 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mesocuneiform | | ~100 | | adult |
| MPM 29 | 581? | L309 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Mesocuneiform | | ~100 | | adult |
| MPM 630 | 000-RS | L809 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Metatarsal | | ~80 | | juv |
| MPM 146 | 038 | L74 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|------------|------------|-----------|--------------------------|--------------|
| MPM 147 | 216 | L158 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 148 | 295 | L190 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 149 | 005-010 | L9 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 150 | B3 | L45 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 151 | 118 | L140 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | possibly juv |
| MPM 152 | 250 | L180 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 153 | 316 | L1977 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | possibly juv |
| MPM 154 | 310 | L195 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface partial | possibly juv |
| MPM 156 | 116 | L105 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 175 | | L83 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 176 | | L188 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|------------|------------|-----------|--------------------------|-------------|
| MPM 177 | | L118 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 178 | | L14 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 179 | | L114 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 181 | | L23 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 186 | 001 | L1 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 187 | | L189 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | prob. Fetal |
| MPM 188 | | L171 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | prob. Fetal |
| MPM 189 | | L13 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | prob. Fetal |
| MPM 190 | | L281 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | prob. Fetal |
| MPM 198 | | L146 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | prob. Fetal |
| MPM 199 | | L181 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | prob. Fetal |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------------|-------|-----------|---------------|--------------|-------------|------------|------------|-----------|--------------------------|-------|
| MPM 202 | | L88 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal surface present | |
| MPM 210 | 000 | L646 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | occlusal end | adult |
| MPM 276 | HE 658 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | | |
| MPM 277 | HE 651 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | | |
| MPM 278 | HE 642 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | | |
| MPM 279 | HE 656 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | | | |
| | RS, A1 | L024 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | juv |
| | RS2, B3 - 003 | L044 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | adult |
| | U5, 90 | L135 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | juv |
| | U6, 233 | L170 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | baby |
| | U9, 510 | L282 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | baby |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|------------|------------|-----------|----------------------------|-------|
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | baby |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | baby |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | baby |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Molariform | | ~100 | | juv |
| MPM 49 | 722/846 | L645 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | N/N | | ~80 | | adult |
| MPM 1 | U9, 664 | L379 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Navicular | left | ~100 | | adult |
| MPM 2 | 623 | L389 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Navicular | left | ~100 | | adult |
| MPM 281 | HE 641 | L655 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Navicular | | ~95 | edges missing | adult |
| MPM 3 | 708 | L217 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Navicular | right | ~100 | | adult |
| MPM 21 | 2028 | L490 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Patella | | ~100 | | adult |
| MPM 22 | 000 | L643 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Patella | | ~90 | distal tip missing | adult |
| MPM 208 | | L141 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | | | acetabulum | juv |
| MPM 456 | 199/246 | L127 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | | ~7 | acetabulum & part of ilium | adult |
| MPM 457 | 2028/1072 | L494 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | | ~7 | part of acetabulum & pubis | baby |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|------------------|------------|-----------|--|-------|
| MPM 458 | 244/291 | L178 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | | ~10 | acetabulum & part of ilium | adult |
| MPM 459 | 704 | L691 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | | ~5 | acetabulum & part of ilium | adult |
| MPM 74 | 080 | L84 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | | ~5 | ischium frag | adult |
| | B1 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | | ~10 | acetabulum & part of ilium | adult |
| | U10, 2028 | L482 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pelvis | right | ~20% | right ilium | baby |
| MPM 50 | 712 | L236 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Proximal phalanx | | ~90 | | adult |
| MPM 51 | 749 | L451 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Proximal phalanx | | ~100 | | adult |
| MPM 52 | 632 | L353 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Proximal phalanx | | ~100 | | adult |
| MPM 57 | 626 | L464 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Proximal phalanx | | ~80 | | adult |
| | | L325 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Proximal phalanx | | ~100 | | adult |
| MPM 224 | 2030/1121 | L689 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Pubic symphysis | center | ~5 | | adult |
| MPM 298 | B 216 | L651 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~97 | | adult |
| MPM 345 | 073/099 | L082 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~40 | distal portion; part of distal end missing | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side / type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------|-------------|-----------|-------------------|-------|
| MPM 346 | 2030/1247 | L667 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~70 | midshaft | adult |
| MPM 348 | 000 A | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | | ~5 | proximal end only | adult |
| MPM 349 | 712/800 | L220 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~90 | diaphysis only | baby |
| MPM 350 | 000B | L666 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~20 | midshaft frag | adult |
| MPM 352 | 2030/1133 | L598 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~80 | diaphysis only | adult |
| MPM 353 | 127/168 | L091 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~50 | proximal part | adult |
| MPM 354 | 748/900 | L436 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~50 | distal end | adult |
| MPM 355 | 151/195 | U3 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~10 | proximal end only | adult |
| MPM 357 | B3-000 | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~10 | proximal end only | adult |
| MPM 360 | 079-A | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | | ~10 | proximal end | adult |
| MPM 361 | 000 D | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | | ~5 | | adult |
| MPM 363 | 676/758 | L398 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~80 | diaphysis only | juv |
| MPM 364 | 748/920 | L441 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~100 | | adult |
| MPM 384 | 000 C | RS | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~5 | proximal end only | adult |
| MPM 505 | 211/258 | L154 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|-------------------------|-------|
| MPM 506 | 323/317 | L200 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~80 | diaphysis only | juv |
| MPM 507 | 2030/1198 | L612 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~100 | | adult |
| MPM 538 | 2029 | L607 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~100 | | adult |
| MPM 539 | 75 | L056 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~100 | | adult |
| MPM 540 | 169 | L099 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~100 | | adult |
| | 169 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~100 | | adult |
| | U9, 593 | L317 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~95 | epiphyses missing | baby |
| | U9, 699 | L382 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~100 | | adult |
| | U10, 2030 | L552 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~100 | | adult |
| | | L365 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | left | ~100 | | adult |
| | | L538 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Radius | right | ~100 | | adult |
| MPM 182 | | L147 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Rib | | ~5 | proximal epiphysis only | |
| MPM 193 | | L213 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Rib | | ~5 | proximal epiphysis only | |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side / type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-----------------|-------------|-----------|---|-------|
| MPM 194 | | L648 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Rib | | ~5 | proximal epiphysis only | |
| | 703 | | | | | | | | | | |
| MPM 285 | B 307 | L657 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | rib | | | midshaft frag | adult |
| MPM 288 | B 283 | L662 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | rib | | | midshaft frag | adult |
| MPM 427 | 2030/1233 | L780 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sacral vertebra | last | ~30 | Centrum & transverse spine | adult |
| | | | | | | | | | | | |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sacral vertebra | | ~20 | frag | adult |
| MPM 455 | 594/620 | L318 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | | ~80 | glenoid & fragment of blade | juv |
| MPM 543 | 748/878 | L431 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | right | ~15 | glenoid fossa, coracoid process, coracoid foramen | adult |
| MPM 544 | 047/069 | L058 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | right | ~10 | glenoid, coracoid foramen & blade frag | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|---|-------|
| MPM 545 | 132/173 | L093 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | right | ~10 | glenoid, coracoid foramen & blade frag | adult |
| MPM 546 | 676 | L681 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | | ~10 | fragment of blade | adult |
| MPM 547 | 2029/1132 | L683 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | left | ~15 | | adult |
| MPM 66 | 2029/1132 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | right | ~7 | glenoid & fragment of blade | adult |
| MPM 92 | | L506 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | right | ~25 | spine | juv |
| | 2028 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | left | ~10 | posterior margin w/ part of secondary spine | adult |
| | 228 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | | ~5 | glenoid & coracoid foramen | adult |
| | 267 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | | ~5 | blade frag | adult |
| | 2028 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | | ~5 | chunk of glenoid | juv |
| | 2028/1235 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | | ~5 | glenoid & blade frag | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|-----------------|----------------|--|--------------|-----------|-----------------------------|--------------|
| | | L393 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | left | ~80 | | adult |
| | | L235 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula | right | ~70 | | adult |
| MPM 432 | 2030/1210 | L682 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Scapula? | | ~15 | glenoid & fragment of blade | small adult? |
| MPM 64 | 2030 | L588 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sesamoid (Ossified Meniscal Cartilage) | | ~100 | | adult |
| MPM 172 | | L104 | Xenarthra | Megatheriidae | cf Eremotherium | cf laurillardi | Squamosal | right | ~100 | | juv |
| MPM 157 | 2029 | L574 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | left (1st?) | ~100 | | adult |
| MPM 159 | | L139 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | right (1st?) | ~100 | | adult |
| MPM 223 | | L566 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~95 | | adult |
| MPM 296 | | L156 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | right | ~100 | | adult |
| MPM 362 | 270/317 | L128 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~75 | medial end | adult |
| MPM 431 | | L473 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | last | ~100 | | adult |
| MPM 433 | | L106 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | 1st | ~95 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------|------------------|-----------|------------------------------|-------|
| MPM 434 | | L422 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~5 | medial end partially present | adult |
| MPM 435 | B1 | L690 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | | medial end | adult |
| MPM 437 | | L594 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~100 | | adult |
| MPM 509 | | L600 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | posterior series | ~80 | medial end present | adult |
| MPM 510 | B1 | L625 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | medial end | adult |
| MPM 511 | 58 | L627 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | medial end | adult |
| MPM 512 | 2028 | L467 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~90 | medial end | adult |
| MPM 557 | 609/635 | L323 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~85 | | adult |
| MPM 558 | 2029/1213 | L615 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~98 | | adult |
| MPM 559 | 731/829 | L418 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~98 | | adult |
| MPM 560 | 732/828 | L423 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~98 | | adult |
| MPM 561 | 736/841 | L446 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~70 | | adult |
| MPM 562 | 2030/1196 | L611 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | | adult |
| MPM 563 | 748/879 | L433 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------|------------|-----------|--------------|-------|
| MPM 564 | 2030/1186 | L609 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | | adult |
| MPM 565 | 748/904 | L437 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | | adult |
| MPM 566 | 674/713 | L384 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~70 | | adult |
| MPM 567 | 194/241 | L123 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~60 | | adult |
| MPM 568 | 2030/1209 | L614 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~85 | | adult |
| MPM 569 | 2030/1239 | L614 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~70 | | adult |
| MPM 570 | 570/596 | L303 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~70 | | adult |
| MPM 571 | 2028 | L476 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~80 | | adult |
| MPM 572 | 732 | L416 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~100 | | adult |
| MPM 573 | 037/059 | L069 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~100 | | adult |
| MPM 574 | 2030/1115 | L597 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~100 | | adult |
| MPM 575 | 748/974 | L442 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~95 | | adult |
| MPM 576 | 2029/1076 | L593 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~85 | | adult |
| MPM 577 | 546/572 | L294 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~85 | | adult |
| MPM 578 | 675/721 | L386 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~90 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------|------------|-----------|--------------|-------|
| MPM 579 | 145/186 | L111 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~90 | | adult |
| MPM 580 | 2028/1026 | L468 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~60 | | adult |
| MPM 581 | 223/270 | L162 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~55 | | adult |
| MPM 582 | 712/888 | L226 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | | adult |
| MPM 583 | 128/169 | L098 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~85 | | adult |
| MPM 584 | 2029/1112 | L710 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~60 | | adult |
| MPM 585 | 137/178 | 108 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~60 | | adult |
| MPM 586 | 712/872 | L223 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~40 | | adult |
| MPM 587 | 2028/1164 | L602 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~80 | | adult |
| MPM 588 | 397/07 | L205 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~60 | | adult |
| MPM 589 | 2028/1126 | L499 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~55 | | adult |
| MPM 590 | 091/128 | L136 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~60 | | adult |
| MPM 591 | 318/368 | L198 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~80 | | adult |
| MPM 592 | 712/872 | L224 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~40 | | adult |
| MPM 593 | 2029/1093 | L711 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~60 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------------------|-------|-----------|---------------|--------------|-------------|-------------|------------|-----------|------------------------------|-------|
| MPM 594 | 331,351,381, 411 | L243 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~40 | | adult |
| MPM 595 | 2030/1220 | L712 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~45 | | adult |
| MPM 600 | 749/947A | L717 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~40 | | adult |
| MPM 602 | 731 | L719 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~40 | | adult |
| MPM 72 | 380 | L207 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~95 | medial end present | adult |
| MPM 75 | 55 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~10 | medial end only | adult |
| | | L28 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~75 | mid-section | adult |
| | | L471 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~80? | medial end partially present | adult |
| | 0 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~20 | medial end partially present | adult |
| | 58 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | ~50 | medial end partially present | adult |
| | B1 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal rib | | | medial end | adult |
| | U6, 140 | L148 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal Rib | | ~100 | | adult |
| | U9, 676 | L392 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal Rib | | ~95 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|--|-------|
| | U10, 2030 | L542 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternal Rib | | ~10 | | adult |
| MPM 155 | | L261 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternebrae | | ~100 | | adult |
| MPM 162 | | L620 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternebrae | | ~100 | | adult |
| MPM 163 | | L405 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Sternebrae | | ~100 | | adult |
| MPM 180 | | L206 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Stylohyoid | | ~90 | | adult |
| MPM 102 | 2030/1215 | L583 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~65 | lacking spinous & transverse processes | adult |
| MPM 107 | 2030 | L584 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | middle | ~90 | missing right transverse process | adult |
| MPM 108 | 2029 | L554 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~100 | | adult |
| MPM 110 | 2030 | L579 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | middle | ~100 | | adult |
| MPM 112 | 2029 | L568 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~100 | | adult |
| MPM 113 | 712 | L219 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~95 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|--|-------|
| MPM 125 | 618 | L327 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~95 | epiphyses missing | adult |
| MPM 264 | 2029/1098 | L595 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | mid-series | ~100 | | adult |
| MPM 265 | 2028/1158 | L500 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~95 | transverse processes broken; epiphyses unfused | adult |
| MPM 266 | 746/907 | L516 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | anterior | ~95 | | adult |
| MPM 275 | 29 | L241 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~75 | centrum only | adult |
| MPM 282 | HE 676 | L637 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~95 | transverse spines broken | |
| MPM 305 | HE 663 | L636 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~100 | | juv |
| MPM 403 | 085/121 | L131 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~75 | | adult |
| MPM 405 | 044/066 | L730 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 406 | 748 B | L742 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum & neural arch frag | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|---|-------|
| MPM 407 | 2028/F1052 | L745 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~10 | neural arch & spine (broken) | adult |
| MPM 409 | 385/438 | L727 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~90 | centrum & arco neural frag. | adult |
| MPM 411 | 550/582 | L770 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~40 | centrum | adult |
| MPM 412 | 2028/1132 | L747 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 413 | 2030/1205 | L769 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~60 | centrum & part of transverse spines & neural arch | adult |
| MPM 414 | 620/646 | L766 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~80 | Centrum, neural arch & spine | adult |
| MPM 417 | 550/576 | L774 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | 5th-8th | ~35 | centrum | adult |
| MPM 418 | 2030 A | L731 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~10 | neural arch & spine (broken) | adult |
| MPM 419 | 607/633 | L491 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | anterior | ~75 | transverse processes broken | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|------------------------------|-------|
| MPM 421 | 659/697 | L763 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~35 | centrum | adult |
| MPM 422 | 675 | L775 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | Neural arch & spine | adult |
| MPM 423 | 082/053 | L773 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~35 | Centrum & transverse process | adult |
| MPM 424 | 604/630 | L771 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | Neural arch & spine | adult |
| MPM 425 | 676 C | L776 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~35 | centrum | adult |
| MPM 426 | 548/574 | L768 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | Neural arch & spine | adult |
| MPM 428 | 625-676 A | L767 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~65 | Neural arch & spine | adult |
| MPM 429 | 000 E-RS | L790 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~40 | centrum only | adult |
| MPM 441 | 2029 | L748 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 442 | 748 A | L739A | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 443 | | L479 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~95 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|----------------------------------|-------|
| MPM 444 | 712/902 | L228 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~95 | | adult |
| MPM 445 | 045/067 | L63 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~85 | lacking transverse processes | adult |
| MPM 446 | 054/076 | L729 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | Neural arch & spine | adult |
| MPM 447 | 243/290 | L738 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | Neural arch & spine | adult |
| MPM 448 | 732/870 | L621 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~100 | | adult |
| MPM 449 | 731 | L740 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 450 | 2029/1123 | L746 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 451 | 215/262 | L737 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 452 | 677/725 | L741 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 453 | RS27 | L728 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum only | adult |
| MPM 468 | 693/762 | L765 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | transverse process & neural arch | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|----------------------------|-------|
| MPM 471 | 142/183 | L744 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | Neural spine only | adult |
| MPM 473 | 748 C | L743 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | centrum only (broken) | adult |
| MPM 474 | 2030/1230 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | Neural arch & spine | adult |
| MPM 475 | 2029/F1123 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | Neural arch & spine | adult |
| MPM 476 | 206/253 | L749 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum & neural arch frag | adult |
| MPM 477 | 180/224 | L116 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~90 | | adult |
| MPM 478 | 568/594 | L750 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | Neural arch & spine | adult |
| MPM 480 | 352/402 | L753 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~10 | neural arch frag | adult |
| MPM 513 | 2030 | L610 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~100 | | adult |
| MPM 608 | 2028/1036 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | Neural arch & spine | adult |
| MPM 609 | 2028/1063 | L735 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~25 | centrum only | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|-----------------------------------|-------|
| MPM 610 | 2028/1080 | L486 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~90 | | adult |
| MPM 76 | 732 | L424 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~85 | lacking transverse processes | adult |
| MPM 78 | 2030/1222 | L585 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~90 | neural & transverse spines broken | adult |
| MPM 79 | 2029 | L572 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | middle | ~98 | | adult |
| MPM 80 | 2029 | L557 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | middle | ~95 | end of neural spine missing | adult |
| MPM 81 | 2029 | L577 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | middle | ~100 | | adult |
| MPM 82 | 000 | L634 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~85 | lacking transverse processes | adult |
| MPM 83 | 2029 | L571 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~100 | | adult |
| MPM 84 | 613/639 | L725 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | anterior | ~50 | centrum & veinal canal | adult |
| MPM 85 | 112 | L103 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | anterior | ~95 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|-------------------|------------|-----------|---|-------|
| MPM 86 | 042 | L66 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | anterior | ~100 | | adult |
| MPM 87 | 749 | L448 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | posterior | ~100 | | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | Neural arch & spine | adult |
| | | 0 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~30 | centrum & neural arch frag | adult |
| | | 206 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | Neural spine | adult |
| | | 550 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~15 | Neural arch & spine | adult |
| | | 2030 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~75 | in fragments | adult |
| | 000 I | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~5 | neural spine | adult |
| | 2030 D | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~5 | neural spine | adult |
| | 2030 E | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~5 | neural spine | adult |
| | 675 A | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Thoracic Vertebra | | ~20 | Neural arch & spine & left transverse process | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|--------------|-------------------|------------|-----------|------------------------------|-------|
| | RS25 | | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | | ~10 | neural arch & spine (broken) | adult |
| | | L164 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | middle | ~100 | | adult |
| | | L36 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | middle | ~100 | | adult |
| | | L517 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | middle | ~100 | | adult |
| | | L545 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | middle | ~100 | | adult |
| | | L548 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | middle | ~100 | | adult |
| | | L76 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | middle | ~100 | | adult |
| | | L160 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | posterior | ~100 | | adult |
| | | L36 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | posterior | ~100 | | adult |
| | | L511 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Thoracic Vertebra | posterior | ~100 | | adult |
| MPM 340 | | L290 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Tibia | left | ~90 | | adult |
| | 524 | | | | | | | | | | |
| MPM 341 | RS-000 | L052 | Xenarthra | Megatheriidae | Eremotherium | laurillardii | Tibia | left | ~90 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|--|-------|
| MPM 342 | RS 000 | L663 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~85 | proximal end & chunk of distal end missing | adult |
| MPM 343 | A | L021 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~100 | | adult |
| MPM 344 | 337/387 | L201 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~85 | proximal end missing | adult |
| MPM 356 | 164/208 | RS 15 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | | ~5 | medial articular surface frag | adult |
| MPM 373 | | L664 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | | ~30 | midshaft | adult |
| MPM 524 | | L394 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~100 | | adult |
| MPM 525 | 033/055 | L86 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~85 | proximal epiphysis & chunk of distal end missing | adult |
| MPM 526 | 587/613 | L313 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~95 | chunk of distal end missing | adult |
| MPM 528 | 344/394 | L204 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~95 | diaphysis only | juv |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|---------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|---------------------------------|-------|
| MPM 528 | 2029 | L596 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~80 | diaphysis only | baby |
| MPM 529 | 166/210 | L097 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~95 | diaphysis only | adult |
| MPM 530 | B1 | L028 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~100 | proximal end of fibula attached | adult |
| MPM 532 | 236 | L172 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~100 | | adult |
| MPM 533 | 525 | L291 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~85 | proximal end missing | adult |
| MPM 534 | B2/RS | L040 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~80 | | adult |
| MPM 535 | RS-000 | L053 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~85 | diaphysis only | adult |
| MPM 536 | 2030 | L619 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~85 | | adult |
| MPM 537 | RS12 | L665 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~60 | proximal part | adult |
| MPM 671 | RS, RS3 | L822 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~95 | bottom point missing | adult |
| MPM 674 | U6, 238 | L174 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~100 | | adult |
| MPM 675 | RS, RS4 | L823 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~85 | proximal end missing | adult |
| | | L207 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~80 | diaphysis only | juv |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|---------------------------------|-------|
| | | L231 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~5 | medial proximal epiphysis only | adult |
| | | L323 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~100 | | adult |
| | | L77 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~100 | proximal end of fibula attached | adult |
| | 0 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~5 | distal end frag | adult |
| | 526 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~5 | medial proximal epiphysis only | juv |
| | 2030 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~5 | medial proximal epiphysis only | adult |
| | 2028/1482 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~10 | distal epiphysis (complete) | adult |
| | U6, 237 | L173 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~95 | epiphyses missing | baby |
| | RS, RS7 | n/a | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~95 | epiphyses missing | baby |
| | RS, B1 | L031 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~95 | epiphyses missing | baby |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|------------|-------|-----------|---------------|--------------|-------------|--------------|------------|-----------|---------------------------------|-------|
| | U7, 384 | L209 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~95 | epiphyses missing | baby |
| | U10, 2029 | L524 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~100 | | adult |
| | U6, 239 | L175 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~100 | | adult |
| | U10, 2029 | L521 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~100 | | adult |
| | RS, RS2 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~60 | shaft | adult |
| | | L525 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | left | ~100 | | adult |
| | | L551 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia | right | ~100 | | adult |
| MPM 531 | U9, 708 | L383 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Tibia/Perone | left | ~95 | | adult |
| MPM 55 | 653 | L371 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Trapezoid | left | ~100 | | adult |
| MPM 280 | B 295 | L653 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | Right | ~70 | distal end missing | juv |
| MPM 290 | B 325/2060 | L652 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~50 | proximal half | adult |
| MPM 365 | | L187 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~80 | midsection towards proximal end | adult |
| MPM 366 | | L604 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~60 | midsection towards proximal end | adult |

287

2029

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|---------|------------|-----------|---------------------------------|-------|
| MPM 367 | | L81 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~70 | midsection towards proximal end | adult |
| MPM 368 | 348 | L669 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | | ~20 | midshaft | adult |
| MPM 369 | 346 | L668 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | | ~20 | midshaft | adult |
| MPM 370 | 2029/1155 | L603 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~70 | midsection towards proximal end | adult |
| MPM 371 | 000-B1 | L51 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | | ~50 | midsection towards distal end | adult |
| MPM 372 | 000 B | L671 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~40 | midsection towards proximal end | juv |
| MPM 374 | 000 A | L670 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~25 | midsection towards proximal end | adult |
| MPM 375 | | L41 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~40 | midsection towards proximal end | adult |
| MPM 376 | 675 | L673 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~30 | midsection towards proximal end | baby |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|----------|------------|-----------|---------------------------------|-------|
| MPM 377 | | L672 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~25 | midsection towards proximal end | adult |
| MPM 378 | | L47 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~50 | midsection towards proximal end | adult |
| MPM 503 | 2030/1139 | L536 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~100 | | adult |
| | | L536 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~100 | | adult |
| | | L424? | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~70 | midsection towards proximal end | adult |
| | RS11 | n/a | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~75 | proximal | adult |
| | RS, RS1 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~60 | proximal (but missing prox tip) | adult |
| | RS7 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | left | ~100 | | adult |
| | | L380 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Ulna | right | ~100 | | adult |
| MPM 48 | 2028 | L484 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Unciform | left | ~100 | | adult |
| | | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Unciform | left | ~100 | | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|--------------|-------------|-------------------------|------------|-----------|--------------------------|-------|
| MPM 209 | | L199 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | fragment (unidentified) | | | | juv |
| MPM 410 | 641/67 | L777 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~15 | Neural arch & spine | adult |
| MPM 416 | 676 B | L778 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~20 | Neural arch & spine | adult |
| MPM 420 | 1062/2028 | L779 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~35 | centrum | adult |
| MPM 438 | B1C | L782 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~30 | centrum only | adult |
| MPM 439 | 000 H-RS | L782 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~30 | centrum only | adult |
| MPM 440 | 000 D-RS | L783 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~30 | centrum only | adult |
| MPM 470 | 008/012RS | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~15 | centrum frag | adult |
| | 352 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~5 | neural arch & spine frag | adult |
| | 0 36 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~10 | frag | adult |
| | 000 A | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~25 | centrum only | adult |
| | 000 B | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~30 | centrum only | adult |
| | 000 F | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~25 | Neural arch & spine | adult |
| | 000 G | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~15 | neural spine frag | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|---------------|------------------|---------------|--------------|-------------|-----------|--|-------------|
| | B1 A | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~25 | centrum & part of neural arch | juv |
| | B1 D | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~15 | Neural arch & spine | adult |
| | B1B | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~30 | centrum only | adult |
| | RS28 | | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Vertebra | | ~5 | neural arch frag | adult |
| MPM 479 | 2028/1071 | L754 | Xenarthra | Megatheriidae | | | Vertebra | | ~8 | neural spine frag | adult |
| MPM 164 | 2029/1096 | L644 | Xenarthra | Megatheriidae | Eremotherium | laurillardi | Xiphisternum | | ~100 | | adult |
| | U10, 2029 | L518 | Xenarthra | Mylodontidae | cf Glossotherium | cf tropicorum | Humerus | right | ~95 | epiphyses missing | juv |
| | | L493 | Xenarthra | Mylodontidae | Glossotherium | | Humerus | left | ~80 | diaphysis only | juv |
| | U3, 167 | L113 | Xenarthra | Mylodontidae | Glossotherium | cf tropicorum | Jaw | right lower | ~75 | | adult |
| MPM 197 | | L10 | Xenarthra | Mylodontidae | Glossotherium | | Molariform | | | occlusal surface present | prob. Fetal |
| | 2029/1154 | | Xenarthra | Mylodontidae | Glossotherium | | Sacrum | | ~25 | anterior two vertebrae of sacrum; one neural spine present | adult |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side/ type | % present | Part present | Age |
|----------|-----------|-------|-----------|----------------|---------------|--------------|-------------------------|-------------|-----------|--|-------|
| MPM 263 | | L503 | Xenarthra | Mylodontidae | Glossotherium | laurillardii | Thoracic Vertebra | | ~85 | epiphyses unfused; neural spine & lower centrum broken | juv |
| MPM 327 | 2028/1119 | L493 | Xenarthra | Mylodontidae | Glossotherium | | Ulna | right | ~80 | | juv |
| MPM 454 | 2029/1151 | L602 | Xenarthra | Mylodontidae | Glossotherium | | Ulna | right | ~100 | | adult |
| | U1, 017 | L016 | Xenarthra | Pampatheriidae | Holmesina | occidentalis | Scute | buckler | ~100 | | adult |
| | U1, 017 | L017 | Xenarthra | Pampatheriidae | Holmesina | occidentalis | Scute | buckler | ~100 | | adult |
| | U6, 156 | L149 | Xenarthra | Pampatheriidae | Holmesina | occidentalis | Scute | buckler | ~100 | | adult |
| | U1, 017 | L015 | Xenarthra | Pampatheriidae | Holmesina | occidentalis | Scute | imbricating | ~80 | | adult |
| MPM 17 | 000 | L641 | Xenarthra | | | | Cuboid | left | ~95 | | adult |
| MPM 114 | 2028,U10 | | | | | | fragment (unidentified) | | | | |
| MPM 170 | | L212 | | | | | fragment (unidentified) | | | | |
| MPM 171 | | L417 | | | | | fragment (unidentified) | | | | |
| MPM 173 | | L7 | | | | | fragment (unidentified) | | | | |

| Museum # | Field # | Lab # | Order | Family | Genus | Species | Element | Side / type | % present | Part present | Age |
|----------|---------|-------|-------|--------|-------|---------|----------------------------|-------------|-----------|--------------|-----|
| MPM 174 | | L369 | | | | | fragment (unidentified) | | | | |
| MPM 184 | | L6 | | | | | fragment (unidentified) | | | | |
| MPM 185 | | L142 | | | | | fragment (unidentified) | | | | |
| MPM 196 | | L8 | | | | | fragment (unidentified) | | | | |
| MPM 61 | 704 | L215 | | | | | fragment (unidentified) | | | | |
| | 165 | L553 | | | | | fragment (unidentified) | | | | |