DETERMINING SOUTH AMERICAN CAMELID DOMESTICATION THROUGH SKELETAL MORPHOLOGY

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A thesis submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Master of Arts

Graduate Program in Anthropology

Written under the direction of

Dr. Susan Cachel

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New Brunswick, New Jersey

May 2017

ABSTRACT OF THE THESIS

Determining South American Camelid Domestication Through Skeletal Morphology

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South American camelids were domesticated approximately 6000 to 7000 years ago for their meat, coats and usage as beasts of burden. There are two genera of South American camelids, *Lama* and *Vicugna*, each with an extant wild and domesticated species. This thesis looks at assorted collections from Northern Chile in an attempt to find differences in skeletal morphology that will be able to identify a domesticated camelid from a wild one. This was accomplished by performing a series of measurements on collections from the Museo Arqueológico de La Serena in La Serena, Chile. Statistical analysis was performed to see if there is a difference in the bone sizes between the time periods represented in the collections and to determine if it is significant. While a statistical significance was found for some measurements, the hypothesis that a morphological difference would be present to identify domesticates was unable to be supported because species of the same genera in this area of Chile are too similar in overall size.

Acknowledgements:

I would first like to thank my family for their support in my research and travel. I would like to thank my friends, Stefanie Stoffa and Enrico Cabredo, for helping me with my data management and statistical analysis respectively. This project would not have been possible without Dr. Maria Rosado and the entire staff of Museo Arqueológico de La Serena for allowing me the opportunity to study their collections. Finally, I would like to thank my advisor, Dr. Susan Cachel, as well as Dr. Hylke de Jong and Dr. Carmel Schrire.

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Introduction

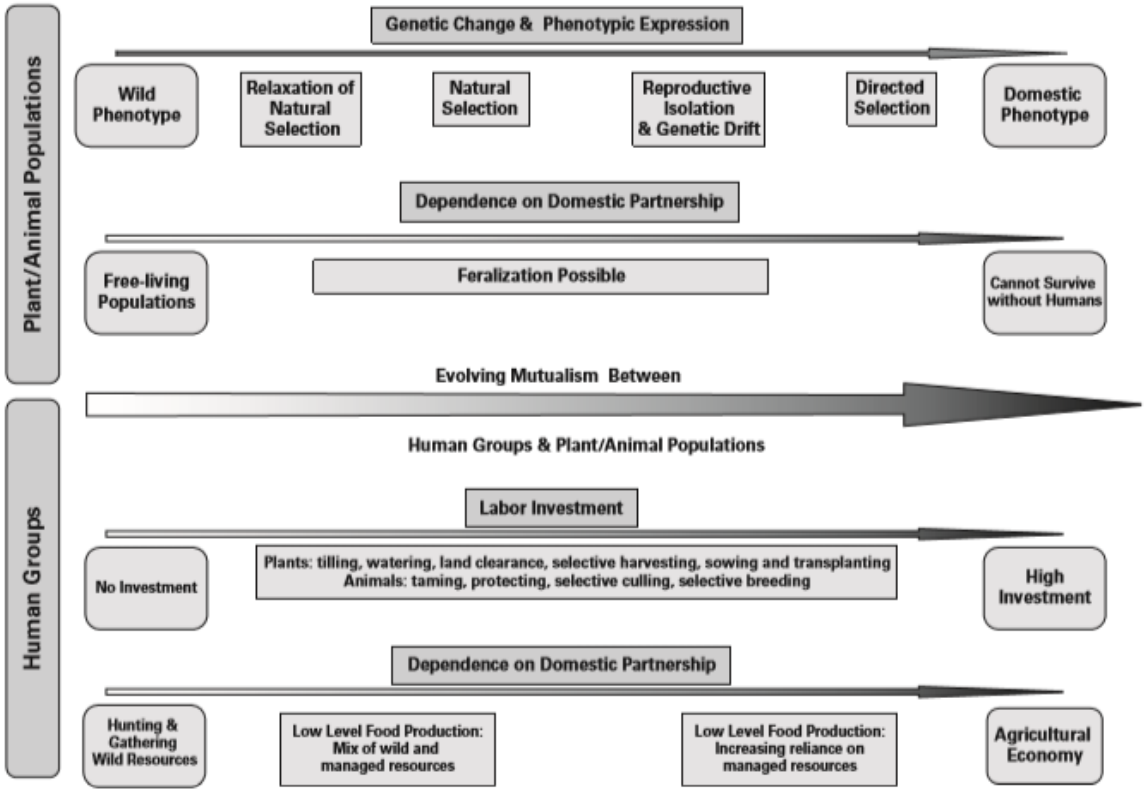
Domestication is a mutualistic relationship that develops between a group of humans and a chosen plant or animal species. Through selective breeding, desirable traits are reinforced to each group's mutual benefit. The types of traits that are considered favorable vary by species, but, in animals, the tolerance of humans is one that is standard. Whether one is discussing the domestication of wolves or cattle, the tolerance for being around humans had to have been a favorable trait that was selectively bred for. This tolerance takes the form of short flight distances away from humans, low reactivity to humans, or sudden changes in environment, and being readily habituated (Zeder 2012). One of the common outcomes shared across domesticated species is a reduction in total brain mass compared to wild ancestral species. This is not a directly selected trait, but it is affected by other selective pressures of domestication (ibid.). The types of domestication-induced changes vary from species to species based on what being selected for.

Though the first instance of domestication is as yet unknown, the location and time of specific species undergoing domestication is based on the known archaeological evidence. The first known species to have been domesticated was the wolf (*Canis lupus*) by hunter-gatherers in Europe and Asia. This may have occurred between 15-17 thousand years before present (kyrs BP) but may have also been as early as 20-30 kyr BP (Vigne 2011). A mitochondrial DNA sequence analysis shows that a divergence between dogs (*Canis familiaris*) and wolves has been found to have occurred more than 100 kyr BP, but the archaeological record only gives data for the aforementioned time spans as possible domestication dates (Vigne 2011). Wolf domestication did not accompany a major change in the way of life for humans at the time, but it did offer aid in hunting strategies, tactics and techniques. The next group of species to be

domesticated included *Capra hircus*, *Sus scrofa*, *Ovis aries*, *Bos taurus* (goat, pig, sheep and cattle respectively) where domestication accompanied the transition from a hunter-gatherer lifestyle to a more sedentary one.

The process of domestication can be expressed along multiple axes when pertaining to both the plant/animal side and the human side. Figure 1 is a flow chart that shows the multiple

Figure 1- Flowchart of Domestication (Zeder 2012)



axes of domestication and what occurs as a result of domestication (Zeder 2012). The primary axis for the plant and animal side has to do with the phenotypic expression of the traits that change as the species shifts from a wild phenotype to a domesticated one. Along the axis, different random and selective processes occur, either isolated or at the same time depending on the species being domesticated and the nature of its relationship to its human partners (Price 1984, 1999, 2002). The directed selection by humans for desirable traits is only one force that

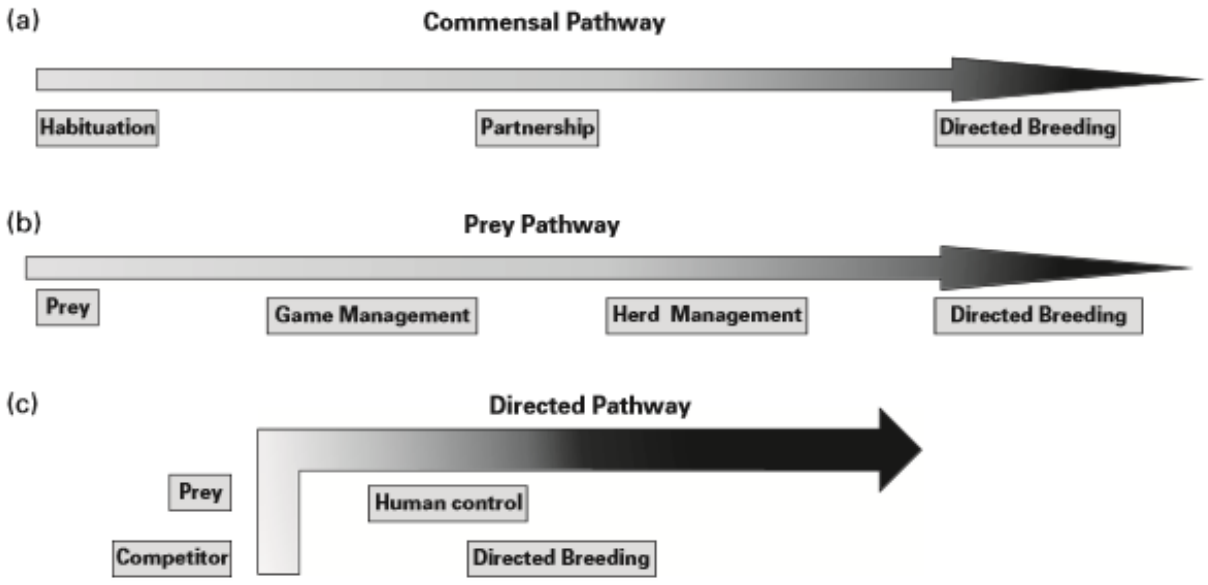
acts on a plant or animal to go from a wild to domesticated species. The easing of natural selection is another factor as the animal or plant comes under human control and it has to adapt to the human environment (Zeder 2012). One of the random forces that comes into play when the small population of plants or animals are isolated from the larger breeding pool and create a "founder" population with more narrow amount of random selection compared to the broader range of genetic variation of the parent population (ibid). As shown in the figure, these factors lie along the "genetic change & phenotypic expression" axis for plants and animals. The other axis for this group is the "dependence on domestic partnership" which starts with these populations being independent but eventually being unable to survive outside of their relationship with humans. The human side of the flow chart also has two axes, "labor investment" and "dependence on domestic partnership". Labor investment ranges from not having to do any labor to a large number of intensive activities that may alter the plant or animal's environment by providing nourishment, protection from predation or intervening into its reproductive cycle (Harris 1996, Smith 2007a,b). The increase of dependence on the domesticated species axis can range from being able to subsist completely on free-living populations to an agricultural economy in which domesticates are ~50% of the caloric intake (Smith 2001). For animals, the behavioral characteristics were the key for determining if a species was a target for domestication (Price 1984, 2002). To be able to identify the behaviors selected for and the impacts of those selections on the domesticated animals is necessary to be able to understand animal domestication. These favorable characteristics include elements of social structure, sexual behavior, parent-young interactions, responses to humans as well as feeding behavior and habitat choice (ibid.). Many of the behaviors allow for humans to become part of the animal community by taking leadership, determining breeding partners or assuming a parental role for young

animals after birth (Zeder 2012). Some other factors of note are that promiscuous mating systems, short flight distance from humans, low reactivity to humans and low reactivity changes in environment are all favorable characteristics for an animal that is the target of being domesticated (ibid.). The latter two are considered to be the most important behavioral responses in domesticated animals and is true for all domesticated mammals (Price 1998, 2002).

Domestication pathways

Each domesticated animal species reached their current state by following highly variable pathways that is contingent on broadly defined biological parameters as well as factors that influenced the trajectories of each case of domestication (Zeder 2009). The three different pathways for domestication are the commensal pathway, the prey pathway and the directed pathway. Figure 2 shows a flowchart of the three different pathways and the methods of how a

Figure 2- Flowchart for Pathways to Domestication (Zeder 2012)



species is handled on its way to becoming domesticated. Each pathway contains unique stages that the chosen species experienced as it was being domesticated.

The commensal pathway is mostly associated with species such as chickens, cats, dogs and guinea pigs which came into contact with humans to feed on refuse or other animals near their settlements (Zeder 2012). When referencing Figure 2, the species in the commensal pathway had to get used to being around humans then would interact with each other and finally lead to directed breeding by humans. Archaeological evidence for cat domestication has been pushed back to at least 8,500 years ago (Vigne et al 2004). It is likely that both cats (*Felis* catus) and dogs were initially drawn to human settlements to feast upon the small rodents, birds and human refuse, but cats did not experience the types of changes in cranial morphology or social ecology normally altered in domesticated species (Zeder 2012). Chickens (*Gallus domesticus*) are a species that were domesticated multiple times throughout China and Southeast Asia (Liu et al 2006). The wild jungle fowl that they descended from were likely seeking out easy sources of grain that were able to be found in human waste and a similar pathway is suggested for the domestication of turkeys (*Meleagris gallopavo*) in the southwestern US (Munro 2011). The guinea pig (*Cavia porcellus*) was first domesticated in the Andes around 7,000 years ago and was known to be a food source for humans living in those regions (Spotorno et al 2006). Along with chickens and turkeys, the other domesticate that is a main food source that followed the commensal pathway is the pig. The archaeological evidence is found in southeastern Anatolia as the site of Cayonu has multiple lines of evidence of a relationship between pigs and humans from 10,500 to 8,300 years BP (8,550-6,350 BCE) (Ervynck et al 2001). The indicator used to identify the domesticated pigs is the gradual reduction in molar length resulting from the neotenization of the pig skull morphology.

The species that mark the transition from a hunter-gatherer to agriculturalist lifestyles were used as a source of food through slaughter, as well as the use of by-products such as milk,

wool and leather**.** These species follow the prey pathway. Many of the major livestock species were domesticated due to the prey relationship with humans. This could have further evolved into actual herd management and controlled breeding strategies. The species that followed this pathway include goats, cattle and sheep as the main target species with other members of the genus *Bos*, South American camelids, and reindeer later in time. A distinctive herd management profile was shown in the assemblages of goat remains from an archaeological site in the Zagros Mountains that dates back to 10,000 years ago (Zeder and Hesse 2000).

When selecting for favorable traits such as ability to produce secondary goods, these herds would have had to have been kept separate from wild animals to prevent admixture. These secondary goods would have included sheep wool goat and cow milk. The domestication-induced morphological changes in the species that followed this pathway were only able to be detectable once humans had separated their herds from wild ones (Zeder 2012). An example of a morphological change a domesticated species may undergo once separated from wild progenitors in the archaeological record is a change in size and shape of the horns of managed sheep and goats approximately 9,500 to 9,000 years BP (7,600-7,100 BCE) in the archaeological site of Ali Kosh in lowland Iran (Zeder 2006b). These types of changes may have arisen from a combination of factors such as the relaxation of selective pressures for larger horns for sexual competition and selection and the selective pressures against larger horns due to them being easier to manage and the animals not having to spend excess energy on the unnecessary horn development (Zeder 2012). Body size is another factor that changes with domestication, including the reduction of sexual dimorphism. A smaller overall body size was observed approximately 9,000 years BP (7,100 BCE) in sheep and goat populations, but it is not clear if it is an product of domestication or due to the warming of the Holocene interglacial period,

introduction of smaller domestic individuals from different areas or a general process of body size reduction that corresponds with the end of the last Ice Age and is seen in both domestic and wild ungulates (Zeder 2012). South American camelids are included in this pathway due to heavy predation of the guanaco (*Lama guanaco*) and vicuña (*Vicugna vicugna*) by humans. It later developed into the management and domestication of the llama (*Lama glama*) and the alpaca (*Vicugna pacos*) (Wheeler et al 2006).

The final pathway of domestication is the directed pathway. This could be identified as mostly regenerative secondary animal resources. Secondary products were found to become prevalent during the 4th millennium BCE (Sherratt 1983). The origin on secondary animal exploitation looks closely at agriculture and the beginnings of the use of plows to cultivate fields in areas such as Mesopotamia during the 4th and 5th millennia BCE. During the same time period, an increase of sheep that were kept to a greater age as well as the appearance of cattle suggests the usage of milk and wool (ibid.). Long distance trade also became more common during the 4th millennium BCE as Egypt and Mesopotamia traded via land routes using caravans of pack animals to Palestine, Syria and Iran. The horse (*Equus caballus*), for which there is archaeological evidence suggesting multiple domestication events, provides many primary and secondary resources such as meat, hides, milk, and transportation (Olsen 2006). There are no apparently morphological markers in the postcranial skeleton that can be used to distinguish domestic from wild horses, but archaeologists use evidence of butchery and corrals to identify the presence of domesticated horses. Morphometric analyses conducted on the metapodials of ritually slaughtered donkeys (*Equus asinus*) revealed a considerable amount of compression-induced pathologies, due to carrying heavy loads (Rossel et al 2008). However, the analyses showed that the metapodials of these specimens were similar to the wild donkeys and different

from modern domestic donkeys. The only hint of domestication-induced morphological change is a slight modification in metapodial mid-shaft depth and distal breadth dimensions (Zeder 2012). Other species to have followed this pathway include the Bactrian camel (*Camelus bactrianus*), the mink (*Mustela vison*), and the chinchilla (*Chinchilla lanigera*). The mink and chinchilla were selectively bred for their coat quality only over the past 100-200 years. The Bactrian camel does not have any archaeologically detectable morphological difference between the domestic and wild camels (Peters and von den Driesch 1997).

South American Camelid Domestication History

A Natural History of Camelids

Camelids are the only large herd animal native to South America. The guanaco and llama are part of the genus *Lama,* while the vicuña and alpaca are part of the genus *Vicugna*. The vicuña and guanaco are the wild species and the alpaca and the llama are the domesticated ones. They were domesticated originally for food and coats in the case of the guanaco and vicuña respectively. DNA analyses have been used when researching the South American camelids to determine the relationship between species. The vicuña, guanaco, llama and alpaca fall into two genera, with a wild and domesticated species in each. Body sizes of those species grouped together are closer as the guanaco and llama are larger than the species of genus *Vicugna*. The guanaco has the largest geographic distribution, ranging from Peru to Tierra del Fuego and residing on both sides of the Andes, and though it was originally thought to have four subspecies, DNA analysis only shows two (Mengoni Goñalons 2008, Wheeler 1995). These two are the *Lama guanicoe cacsilensis* and the *Lama guanicoe guanicoe* and are classified as the northern and southern forms respectively. The northern form has been suggested to be the ancestor to the llama based on genetic research. The vicuña also has two subspecies that can be described based

on physical appearance such as body size and fleece color. The subspecies are the *Vicugna vicugna mensalis* and the *vicugna vicugna vicugna* and they are also classified as a northern and southern form respectively (Mengoni Goñalons 2008). DNA analyses of these two subspecies confirm that they are separate subspecies and it suggests that the northern form is the ancestor for the alpaca.

Figure 4- Map of Chile with Regions

Figure 3- Map of Chile with Cities

The alpaca is not as widely spread as the other species, mostly being found in northern Chile and central Peru. Two maps of Chile are shown in Figures 3 and 4. Figure 3 shows Chile with the main cities and names. Figure 4 is a map showing Chile with its various regions and the names of those regions. There are two recognized varieties of alpaca, which can be identified by their coats. The *huacaya* has a short and crimped fleece while the *suri* has longer and wavy fibers (Calle Escobar 1984). The llama has a larger geographic range than the alpaca and is found in Ecuador, Peru, Bolivia, northwestern Argentina and northern and central Chile. It has been

recorded in valleys, high elevations and coastal locations, making it the most adaptable of the South American camelids. The two variations of llama are the *chaku* and the *ccara*. The *chaku* has finer fibers than the *ccara* but both can and have been used as pack animals. Table 1 displays the distribution of the variations and subspecies of the South American camelids.

Genus Name	Species Name	Subspecies/Variation Name	Location
Lama	*Lama glama* (Llama)	1. Chaku 2. Ccara	Ecuador, Peru, Bolivia, NW Argentina, Northern Chile.
Lama	*Lama guanicoe* (Guanaco)	1. *Lama guanicoe cacsilensis* 2. *Lama guanicoe guanicoe*	1. Peru, Bolivia, Northern Chile 2. Central and Southern Chile, Argentina
Vicugna	*Vicugna pacos* (Alpaca)	1. Huacaya 2. Suri	Northern Chile and Central Peru
Vicugna	*Vicugna vicugna* (Vicuña)	1. Vicugna vicugna mensalis 2. Vicugna vicugna vicugna	1. Peru, Bolivia, Northern Chile 2. Central Chile, Argentina

Table 1- South American Camelid Variations and Locations (Mengoni Goñalons 2008)

The llama and alpaca variations do not have different locations they are found in but the two wild South American camelids do, separating into northern and southern variations. Mummified camelids revealed that there was greater diversity of forms prior to the Spanish conquest and that there are no present counterparts for those forms (Wheeler et al 1995). The present day species differ in size to an extent as the vicuña is the smallest, followed by the alpaca and then the llama and guanaco having the same size gradient as they can overlap based on location. Guanacos living in low or mid-latitudes are smaller than those living at higher latitudes. Llamas have been noted to have some of the same latitudinal variation with the smaller ones overlapping in size with guanacos from northwestern Argentina and Northern Chile. It has been discussed that these individuals are a more appropriate standard for osteometric studies than the

larger animals near Tierra del Fuego if the research is looking at local size grouping, regional size variation or changes in size along time on a local or larger scale (Mengoni Goñalons 2008).

Camelid domestication pathways

As stated in Zeder 2012, the South American camelids, *Lama glama* and *Vicugna pacos*, were domesticated via the prey pathway but the Bactrian camel (*Camelus bactrianus*) is listed as a species that was domesticated in the final pathway of domestication, the directed pathway. With the camelids, the separation in pathways occurs due to the fact that the South American camelids were domesticated through a predator and prey relationship that later became herd management, while the Bactrian camels were domesticated primarily for transportation and secondary resources. The presence of camel remains in settlements starting during the third millennium and spreading during the fourth millennium suggests its usage as a transport animal (Sherratt 1983). While the Bactrian camel does not have any archaeologically detectable morphological differences between wild and domestic, the dromedary (*Camelus dromedaries*) does not have any extant wild camels to compare to the domestic ones. There is little evidence of morphological differences in skeletons of camels possibly from pre- and post-domestication contexts in the Arabian Peninsula (Clutton-Brock 1981). Since these camelids have not yet been able to be identified in an archeological assemblage via morphological differences, the presence of domesticated individuals can be identified via pathologies, the presence of corrals and written accounts (Cartajena et al 2007). These techniques are used for the South American camelids as well, but with these camelids following the prey pathway to domestication, the evidence of the same types of pathologies will not be present as they were associated with the additional stresses the animal took on. This study aims to find if the South American camelids in northern Chile have a morphological difference between species or between domesticates and wild individuals.

South American camelids

The guanaco and vicuña are the wild progenitors to the llama and alpaca. These are the separation for the two genera of South American camelids, *Lama* and *Vicugña*. The South American camelids are believed to have been domesticated between 6000 and 7000 BP (4,050-5,050 BCE) (Wheeler et al 1995). The first evidence of herding is present by 3800 BP (1,850 BCE) in the valleys of Peru and northern Chile and the first instance of herding to be documented occurred approximately 1600 years ago.

Characteristics	guanaco L. *guanicoe*	vicuña V. *vicugna*	llama L. *glama*	alpaca L. *pacos*
Withers height in cm	small 100 large 110 120	70 90	109 119	94 104
Adult weight in kg	small 96 large 120 130	40 55	130 150	59.4 ± 7.3
Gestation in days	small ? large 345 360	342 345	348 368	330 350
Birth weight in kg	small ? large 8 15	4 6	8 16	6 7
Condylo-basal length of skull in mm	small 244 large 280 ± 25	225	250	221
Feeding habits	browser-grazer	grazer	browser-grazer	grazer
Behaviour	polygynous migratory and sedentary	polygynous sedentary territorial	polygynous territorial	polygynous territorial
1991 Andean population	602 907	92 882	3 776 793	2 811 612
Status	wild, vulnerable species	wild, endangered species	domestic, population steady	domestic, population in decline

Figure 5- Comparison of South American Camelids (Wheeler 1995)

The earliest fossil evidence of the guanaco is from Argentina during the Pleistocene which date back to approximately 2 million years ago (Wheeler 1995). Before European contact, the guanaco was found along the Pacific coast into the high Andes from 8 degrees South latitude to Tierra del Fuego. Figure 5 is a graphic from Wheeler (1995) that compares all of the camelid species in basic measurements and behaviors. This demonstrates how variable the guanaco size

can be with its small and large variations. The vicuña is the smallest of the South American camelids and fossil evidence suggests that the genus *Vicugna* could have originated on the Argentine plains as early as two million years ago (Harrison 1985). This is supported by mitochondrial DNA sequence data that shows a divergence between vicuña and guanaco at least 2 million years ago (Stanley et al 1994). The vicuña is known for its long coat that was harnessed for fine textiles. The earliest evidence of camelid domestication comes from archaeological sites between elevations of 4000m and 4900m in the Peruvian Andes in which archaeological sites contain evidence of pens and have camelid bones present. Both the guanaco and the vicuña were known to have inhabited this area and faunal material that suggests occupation of the area between 12,000 and 7,500 years ago. The number of camelid remains increased from 65% to 82% of the total faunal sample with over a third coming from fetal or neonatal individuals (Wheeler 1995). This is consistent with a hunting economy and shows the increased dependence on camelids as a dietary component. The llama was similar in almost all aspects of morphology and behavior to its presumed ancestor, the guanaco. Believed to be the guanaco's domestic descendent, the llama also lives in a wide range of environments but was domesticated in the Peruvian Andes between 7,000 and 6,000 years ago. While they were used as a food source, they also were used as pack animals and for their fibers. The alpaca, the domestic descendant of the vicuña, was used primarily for its fine fibers. This species is of similar size and behavior to the vicuña, being smaller than the llama and guanaco. The conquest by the Spanish devastated the camelid populations when they were displaced from their natural habitat to extremely high elevation pastures (Wheeler 1995).

The place of camelids in present-day and past South American society

Camelids yield both primary and secondary products as a domesticated species, including meat, hide and fiber (Mengoni Goñalons and Yacobaccio 2006). Members of both genera were used for rituals and ceremonies and still are used today. In the times of the Inca, the vicuñas were captured, sheared and released to make use of their coats as a renewable resource while the guanaco were hunted for their meat, grease and hides (Sherratt 1983). As the only large herd animal in the Andean region, the camelids were used in similar ways as that of cattle or sheep which were not introduced into South America until after European colonization. The llama was used as a beast of burden as well, due to its larger size and stature. Its use as a pack animal is believed to have allowed the Incan empire to move extensive goods within its own territories in caravans. One of the essential goods that was not only traded via the caravans but are a product of the camelids themselves is textile.

Textiles were used in both ritual and utilitarian functions and large herds of camelids were maintained to use llamas as pack animals for the royal armies and alpaca fiber for textile productions (Wheeler et al 1995). There was also a herd that was raised to obtain high quality individuals of pure color for ritual sacrifices and these animals were left in the care for hereditary specialists known as the *llama camayoc*. Different coat colors were used for different ceremonies, including white coats to be sacrificed to the sun, red-brown at the beginning of the agricultural year and black coated camelids, which were starved and sacrificed in times of crisis (Murra 1978). The meat from the camelids was used in the form of dried *ch'akri*, which is where the word "jerky" is derived from (Stahl 1999). This meat was able to be transported over a longer distance because of its longer "shelf-life." When observing a marketplace in Cuczo, it was discovered that the meat is never made from the foot or head elements, but only body or limb

parts. This led to the hypothesis that sites with the absence of foot elements could be correlated with areas where *ch'arki* was traded (Browman 1989). Today, alpacas are still kept as wool producers as their wool can be traded or sold on international markets while llamas have seen their roles as beasts of burden get replaced by the likes of mules or trucks (McGreevy 1989).

Previous Studies on SA Camelid domestication

Until the discovery of 26 perfectly preserved llama and alpaca mummies, it was not known what the pre-contact species looked like. These mummies come from the site of El Yaral in Peru. They date to 950-1350CE and allowed for extensive analysis of the fibers used to create the famed South American textiles (Wheeler et al 1995). They were identified by phenotypic attributes and incisor morphology. Most of the valuable information obtained from these mummified camelids revolved around the fibers and skin samples as these were not previously preserved in such a way. Values such as fiber diameter were measured and were compared to the contemporary specimens. The fibers for the ancient specimens were much finer than their modern day counterparts indicating the great deal of care that went into caring for and maintaining the herds of camelids used for their coats. The mummified remains also allowed for the different shades of coats to be identified. Of the 26 specimens, two of them were multicolored, the coarse fiber llama male which was eliminated from the gene pool at 3 months, and a brown and white alpaca coat (Wheeler et al 1995). An interesting possibility is that the coarse fibered llama represented an individual that was not bred for fiber production, but rather to be a beast of burden.

Prior studies that have looked at indicators of camelid domestication mostly have been based on the size differences between the four South American camelid species. This is founded on the assumption that body size should be linked with the size of the bones and is supported by

a study of a large sample of alpaca of different age groups that exhibit a strong correlation between individual body size and bone measurements (Mengoni Goñalons and Yacobaccio 2006). Sexual dimorphism of camelid species does not have significant size differences and does not hinder the study of inter-species size differences (Del Papa 2015). Crania were used when possible to determine the genus of an individual based on the size as well as age from the teeth in the maxilla or mandible. Most osteometric distinctions are focused on postcranial bones.

Figure 6- Camelid (Llama) Skeleton Diagram (Exploring Nature 2017)

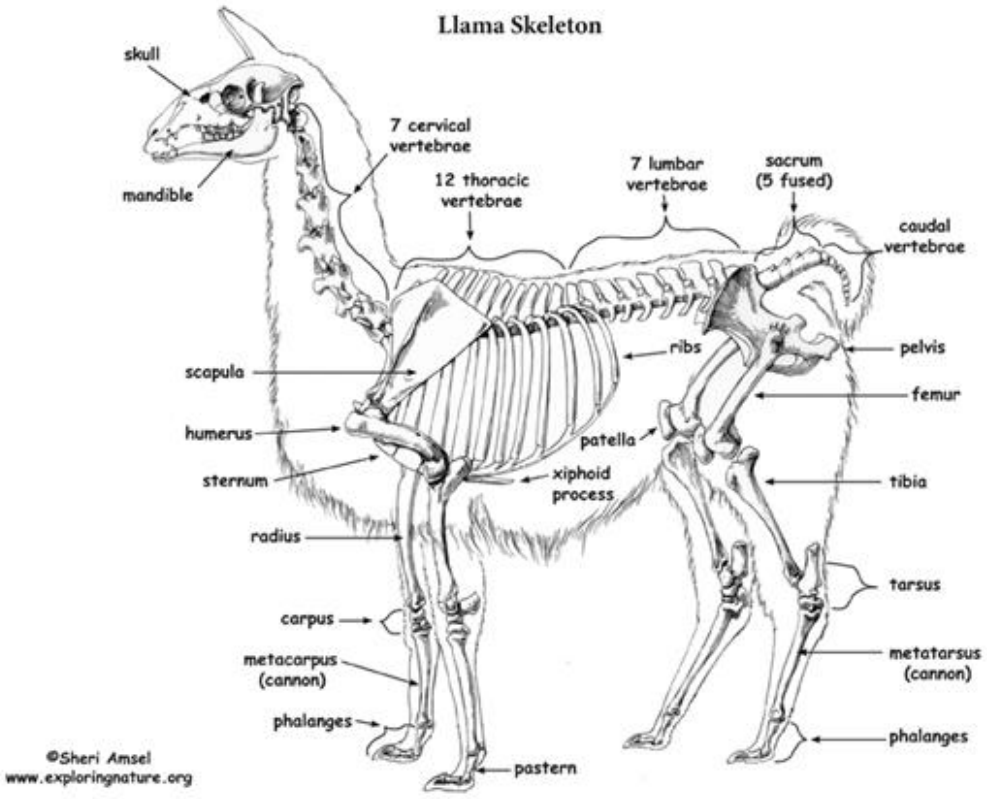


Figure 6 shows a skeletal model of a modern llama. Like other ungulates, the South American camelids have long metapodials that resemble long bones and their carpals and tarsals are equivalent to knee joints in other mammals. Skeletal elements are well-preserved and, as such, are well represented in the archaeological record. They are usually the bones of choice for such studies. It has been stated previously that it is not possible to distinguish among the

different species from the morphology of fragmentary bone remains alone (Pollard and Drew 1975). One element that is effective in discerning between species is the proximal end of the first phalanx as univariate analyses of the breadth and width measurements of that feature differ between species (Miller 1979). The length measurements of the first phalanx are not useful mostly due to it being difficult to distinguish between the first phalanges of the front and hind limbs. Other elements that corroborate the univariate analyses of first phalanx measurements include astragali, calcaneum and distal metapodials when analyzed with multiple variables.

These osteometric measurements aid in what is normally a difficult process of identifying the species based on differences. While there are the two separate genera (*Lama*, *Vicugna)*, the wild and domestic species within each genus can differ in size and the degree of overlap between various domestic and wild forms is difficult to measure (Mengoni Goñalons and Yacobaccio 2006). It becomes even more difficult to discern due to known interbreeding and hybridizatio5n. The guanaco is widespread, ranging from Peru to Tierra del Fuego, but the populations in lower latitudes are the smallest. This strong clinal variation in size is also suspected to be evident in the vicuña but requires more studies (ibid.). This pattern is similar to modern wild goats in Iran and it is inferred for pigs in the Alps. These cases seem to be a function of Bergmann's rule as the body size increases with decreasing temperature. Bergmann's rule states that an individual's body size will be larger in a location where the temperature is lower. If one only compares species from the same geographical region, a different set of results would be obtained due to the elimination of bias in size variation (ibid.).

One element that has been used in previous studies when attempting to identify different species of camelids from faunal remains is the proximal or first phalanx. It has a very high survivorship as a complete specimen in collections. Some of the measurements used in the past

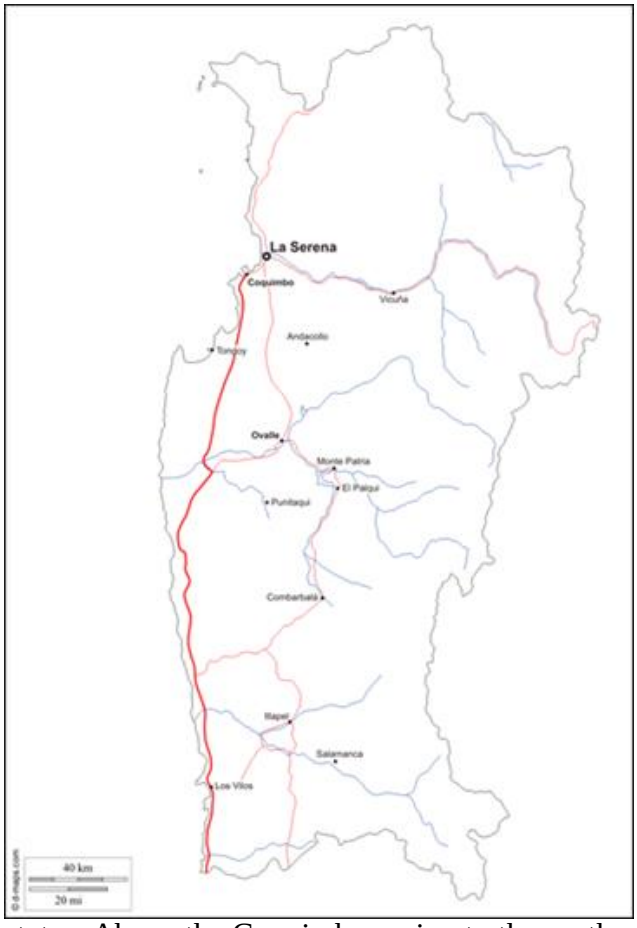
for proximal phalanx studies include maximum length, thickness of proximal end and thickness of distal articular surface (Del Papa 2015). Both of the thickness measurements are also used for density scan sites. The scan sites for bone density pose a problem by not knowing the cortical bone thickness, but this does not effect a size measurement of the articular surfaces (Stahl 1999). Forelimb and hindlimb phalanges differ in that a forelimb phalanx is larger on average. It has been previously observed that the hindlimb phalanges have a more marked difference between species compared to the forelimb phalanges (Del Papa 2015). Some studies continued research by using pathological marks on the bones to determine the stress of being a pack animal and these studies focused on phalanges and metapodials (Labarca and Gallardo 2015). Morphological change has been seen via pathologies brought on by keeping animals confined (Meadow 1989).

In a study that analyzed remains from the Puna de Atacama in Northern Chile, osteometric criteria were used to find the best taxonomic determination of remains of camelids (Cartajena et al 2007). One of the few morphological differences known that can be used to identify the species is the incisors of the vicuña. It is stated that taxonomic assignation by osteometric means is difficult as there are no significant size differences between domestic and wild species, but multivariate statistical methods can easily display a difference between the large and small size camelid groups (Wheeler 1991). It is particularly difficult to determine between llama and guanaco due to the overlapping sizes between the species. The study continued by focusing on metapodials and first phalanx, as the most numerous bones due to their high survivability in the chosen sites, but also using the presence of pathologies on the bone to find conditions relating to degenerative diseases that are related to domesticated animals when they experience long periods of exercise, movement restrictions or poor diet (Cartajena et al 2007). It is stated that the presence of the pathologies in the Late Archaic period (3,100-1,900

BCE) indicates stress conditions which can be considered as evidence of human control over camelids. The pathologies only occur on larger camelids, not those in the *Vicugna* genus.

Differences between the species in the skeletal morphology are hard to find, but previous studies have identified 51 qualitative features that show clear and precise identification (Adaro and Benavente 1990a, 1990b; Benavente and Adaro 1991; Benavente et al 1993). One problem with this technique is deciding if a feature is "very developed", "less developed", or "little developed" with distinction due to the subjectivity of the criteria. These morphological differences may also be the result of individual difference such as robusticity of muscles and do not allow for clear taxonomic distinctions. With many of the remains from archaeological assemblages being fragmentary, it adds to the difficulty of using those techniques to identify morphological differences between the species.

Figure 7- Map of Coquimbo (4th) Region



Regional Background

The area encompassing this study is the semiarid north of Chile. This includes parts of the Atacama region (3rd region), the Coquimbo region (4th region), and parts of the Valparaiso region (5th region). Figure 7 is a map focusing on the Coquimbo region. Chile is made up of regions rather which can be likened to the United States being comprised of states. Above the Coquimbo region to the north

is the Atacama region and the Valparaiso region lies to the south. The Museo Arqueológico de La Serena is located in La Serena, Chile in the Coquimbo region. It is in the southern area of the semiarid north and along the coast of the Pacific Ocean. In the winter, when this study was taking place, temperatures would range from 30 degrees Fahrenheit in the morning to 60 degrees Fahrenheit midday. The average rainfall for this area is approximately 127mm annually while areas further north have registered less than 10mm annually (Rosado 1994). Palynological studies were conducted for a period after 9,000 years ago have shown that there have only been minor fluctuations in humidity and temperature when compared to the present. The aridity in the Atacama region may have begun as early as the Eocene and became "hyperarid" by the middle Miocene (Latorre et al 2003). The hyperaridity occurs due to the rainshadow cast by the Andes which blocks the moisture from the Amazon Basin. Precipitation in the Atacama is very scarce and consists of fog and winter rains in coastal areas with summer storms that will cross the Altiplano plateau and spill over the Andes onto the coastal regions (Latorre et al 2003). This allows for a greater density of vegetation on the coast due to the moisture present from a thick fog that is present during the morning. This moisture from fog will get trapped in interior valleys and these are the locations used for vineyards to produce wine shipped internationally. The present type of vegetation was described by the Spanish, so habitats have not changed since 1500 CE. Vegetation included various *Cactaceae, Pinus, Acacia caven, Schinus molle* and *Lithrea caustic* (Rosado 1994).

The landscape of the northern parts of the 4th region is flat with gradual inclines, a large difference to the known rugged terrain that South American camelids traverse. The landscape and topography for the semiarid north has the Andes to the east and the Pacific Ocean to the west. Between those is a series of transverse tectonic valleys separated by smaller mountain

ranges known as the Coastal Cordillera. This lies to the west of the Altiplano-Puna plateau of the Central Andes. This plateau is only second to the Tibetan plateau in terms of height and extent (Allmendinger et al 1997). Altiplano means "high plain" in Spanish. Puna is a term used to describe the ecosystems of the high Central Andes between 3200-3400m above sea level. The Altiplano-Puna plateau of northern Chile underwent dramatic climatic change starting around 14,000 BP (12,050 BCE) until a culmination between 13,000 BP (11,050 BCE) and 9,500 BP (8,550 BCE) (Nunez et al 2002). The area began as very arid and shifted toward humid conditions during that time span. There was extensive grass coverage and a high level of plant diversity. Sites found at paleoshorelines of Altiplano lake basins at high elevations contained an abundance of lithic artifacts and bones of South American camelids, specifically *Vicugna vicugna* and *Lama* species (ibid.). Rainfall in the Altiplano-Puna plateau ranges from less than 20mm in the Atacama region to ~200mm annually. There is a system of eight rivers than drain the semiarid north into the Pacific Ocean and they originate between 90 and 100 kilometers inland. At the time of the materials studied for this thesis, the rivers were used to provide irrigation for agriculture (Rosado 1994).

Time Period	Approximate Year Range
Archaic	7,730-400 BCE
Formative	2,000 BCE-200 CE
Animas	~1300-~1100 years BP
Diaguita	~1100 years BP- 1536 CE

Table 2- Chronology Table (Rosado 1994)

The cultures that were present in the study area have provided radiocarbon dates ranging from 7,730 years BCE until 1536 CE. This ranges from the Archaic to the Diaguita time periods. Table 2 displays the chronology of the semiarid north of Chile and the time periods that are associated with the material in this thesis. For the Archaic time period, it was noted that a

chronological sequence was difficult to establish in the semiarid north (Kuzmanic and Castillo 1986). The earliest known culture to have been located here was the Huentelauquen culture, which resided in an interior valley. An approximate age for this culture was given of around 3,500 BCE but there is similar cultural material at a site with a date of 7,450 ± 160 BCE (Rosado 1994). Many of these early cultures are identified by lithics, projectile points, and grinding tools. In a period between 2955-500 BCE, there was a decrease in funerary offerings and instruments used for hunting, but an increase in tools used for grinding that suggests the increased consumption of plants. This subsistence pattern continues with the addition of maritime hunting and gathering throughout the Archaic period. The Diaguita period had ceramics with red, black and white geometric designs (Rosado 1994). The word "Diaguita" comes from the Spaniards first description of the local people. From sites dating to 1200 through 1450 CE, camelid skeletons were found in association with human remains, and interpreted as sacrifices. Sacrifice continued as a cultural behavior until 1536 CE when the Spanish arrived. All bones were labeled with the time period they came from based on the site they were found in. There were four different time periods that given, in Spanish, are Arcaico, Formativo, Diaguita, and Animas. Arcaico and Formativo translate to Archaic and Formative. The archaic material was noted as coming from the Late Archaic, so there is the chance of overlap with some formative material as they are back to back. The time periods are defined as follows: Late Archaic from 3,500-400 BCE, Formative from 2000 BCE-200 CE, Animas from ~650-~850 years before present and Diaguita which is continuous from ~850- 1536 CE. In 1536 CE, the Spanish arrived in Chile and it is used as a cut-off for the time period as it marks a large change in culture and society in the area. This area is known in the scientific community for its observatories. One observatory, known as Mamalluca, is part of the Falcon Telescope Network for the United States Air Force

(Chun et al 2014). It is located 100 kilometers east of La Serena and is only one of the few observatories in the vicinity. The dryness and altitude of these locations allows for the radio waves to penetrate the remaining gases and pass through the atmosphere with little distortion (ALMA 2017). With the accessibility of the Andes Mountains and the Atacama Desert as these ideal locations, Chile has become a location for astronomers to study the objects found in the southern sky, such as the center of the galaxy and the Large and Small Magellanic Clouds (ibid.)

Methods

In this study, camelid bones from Northern Chile, primarily the 3rd and 4th regions, were identified, measured and documented to be able to discern information about domestication from bone morphology. The bones were originally in boxes organized by site but within the boxes were various bags of bones that were sometimes identified but mostly not. The identifications were also not reliable as elements were not correctly identified. None of the prior identifications were used and all samples were reexamined to exclude non-camelid bones. All of the data was collected during a two week period in La Serena, Chile at the Museo Arqueológico de La Serena. I was given access to their labeled zooarchaeological collections in storage as well as boxes that had not been cataloged since their arrival from the field. The site location, region, province, area were recorded and photographed before the contents of each box were sorted. From the site data, an archaeologist at the museum was consulted to learn the time period that the material at each site was from. All identifiable camelid faunal material from the specified boxes of faunal material was included for this research.

Time Period	Approximate Year Range	Atacama Region Sites (6891m-0m elevation)	Coquimbo Region Sites (6160m-0m elevation)	Valparaiso Region Sites (6110m-0m elevation)
Archaic	7,730-400 BCE		Museo del Desierto, Museo del Desierto Conaf, Posesion Buenos Aires, Alero SP Viejo de Pichasco.	
Formative	2,000 BCE- 200 CE		Estero El Valle, El Olivar	Estero El Valle, Estero El Malle Interior Comundid La Villa
Animas	~650-~850 CE		El Olivar, Urbano Centro (Valle de Elqui), Plaza G. Mistral,	
Diaguita	~850 – 1536 CE	Calle Independencia y O' Higgins.	El Olivar, Parcela N 21, Parcela N 24, El Olivar-Loteo Brillarmar	El Olivar- Loteo Brillarmar (La Villa Estero El Mallo)

Table 3- Chronology and Sites Table

Table 3 shows a chronology table with the site names provided in association with the time period they were said to have been occupied during.

Each bone was individually measured using an osteoboard or digital calipers. The specific measurements taken on each bone were measured using digital calipers and then each included bone was photographed with a scale ruler of either 10cm or 25cm. The digital calipers were reset to zero and wiped clean after each measurement to make sure that there was as little error as possible since measurements were measured in millimeters. The only measurement not taken in millimeters was the total length measurements which were taken in centimeters for all specimens.

The skeletal elements chosen for this study were the long bones as well as phalanges and the carpals and tarsals. Vertebrae, pelvic and cranium bones were not included as the hypothesis considered the possible weight bearing of these animals as beasts of burden and focused on areas that would be most affected by that behavior. Teeth were not included in this study as they were fragmentary and I did not have the resources to identify camelid teeth from other possibly ungulates. Due to the exclusion of teeth, individual bones were determined as being juvenile or adult by the presence of epiphyses and diaphysis. Those without epiphyses were not included for statistical analysis as it would skew the results. If an unfused epiphysis was able to be matched to the bone it fit with, it would be measured and photographed together but noted as an unfused epiphysis. Craniodental remains were also not included since the majority of which included fragmentary mandibles and were unable to yield meaningful measurements. The specific measurements on the bones represent some of the scan sites for bone density from "Bone Density and Differential Survivorship of Fossil Classes" by R. Lee Lyman. These models show many possible measurement sites on a variety of ungulate bones and those that were seen to have the greatest survivorship were continued. With these measurements originally being designed for measuring density, the usage of them to observe weight bearing areas seemed appropriate because they were marked as scan sites due to the known structural variation between bones as well as the survivability of the measurement locations (Lyman 1984). I believe that the density scan locations chosen are able to be applied to areas thought to bear weight because they are locations where muscle attachments are made to the bone and a strengthening of these muscles could be evident on the bones. If bones were found to be broken and the pieces were present, they were looked at to see if the break occurred posthumously or during life. It was concluded that all broken bones that were able to be reassembled were broken after death and not the result

of butchery. A few bones did have areas cut out of them for previous sampling and these were noted as such but the information about the previous sampling was not unable to be obtained at the time of this study.

The identification of camelid remains was aided by resources that included pictures of bones as well as text descriptions (Torres et al 1986). The text descriptions include siding information as well as size information and identification for similar looking carpals and tarsals. Other resources provided comparative information for morphological differences between the different species, but these are based on remains from Peru. With the remains for this study originating in Northern Chile, the species may have different regional size variation, and thus these resources could not be unequivocally used. No available resources showed a difference in bone morphology for South American camelids for this region.

Figure 8- Chart of Measurements Used (Lyman 1984)

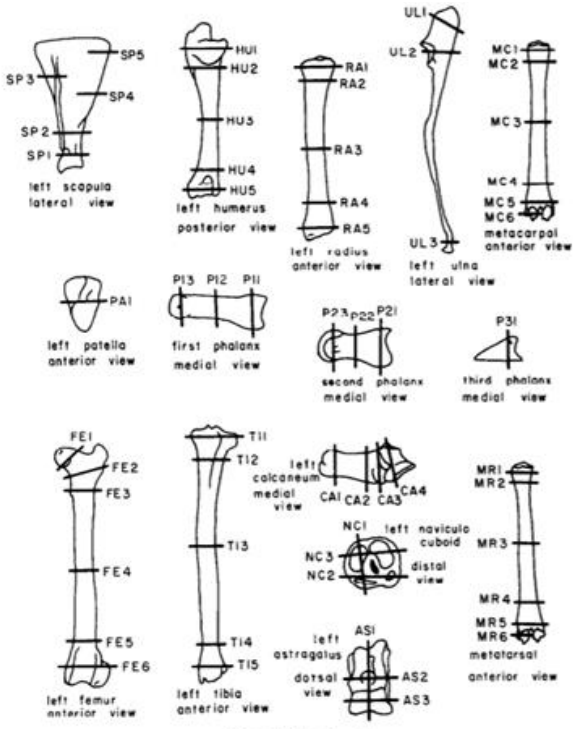


FIG. 2—*Continued.*

Identifiable bones include phalanges, femur, humeri, tibia, radii, ulna, metapodials, calcaneum, astragali, and various carpals and tarsals. The number of identified specimens (NISP) is 756 bones. Each of those bones may have anywhere from one to six measurements per bone based on how much of the bone was present and which measurements were able to be taken. The measurements were directed toward covering the facets of the bones that might exhibit change when introduced to weight-bearing behavior. Figure 8 is a

graphic from “Bone Density and Differential Survivorship of Fossil Classes” by R. Lee Lyman and shows what these measurements were based off of. Most bones were measured proximally, distally and medially in addition to the specific measurements targeting possible weight-bearing areas. Additional measurements include the bifurcation point (highlighted in Figure 9), or MC5, of the metapodials and the epicondylar gap of the femur for example (Lyman 1984). The basic proximal, medial, and lateral measurements were taken across the long bones and vertically for the phalanges to examine their robustness.

Figure 9-Photograph of Metapodial with Highlighted Bifurcation Point

The phalange measurements were chosen based on the aforementioned resource as well as the previous studies using camelid phalanges (Del Papa 2015). The chosen measurements were also used in a study that looked at the first phalanges of all four contemporary South American camelids from various sites throughout the continent (Izeta et al 2009). The proximal and distal articular surfaces were chosen because of their inclusion in previous studies, but were also marked on the density scan site studies that were being used for all of the other bones to maintain uniformity. The measurement locations were decided on prior to knowing the exact quality or quantity of faunal remains that were going to be present in the museum collections, as there was no record of how many camelid bones were present in the mixed faunal remains collections.

Each bone was given a minimum of two measurements and a maximum of six. The bones were sided if possible and identified as unfused, partial, sampled or noted for wear. If the

element was partial, it would be identified as being the distal or proximal end of the bone should distinctive features be present. The carpals and tarsals, which included cuboid, lunate, unciform, navicular, scaphoid, pisiform, and magnum, were measured for total length and width. With two of the bones, cuboid and navicular, having 19 specimens each and the rest being less than that, they were not used for statistical analyses after graphing the raw data. Raw data was graphed on a scatterplot to find variation in each measurement for each bone. The long bones have specific measurements that vary greatly between elements due to the features on the bones. The measurements for the femur include the epicondylar gap, the shaft, the proximal shaft, the femoral neck and a measurement from the first to second trochanter. The humerus measurements were distal condylar width, distal shaft, medial shaft, neck and head width. Measurements of the tibia were taken across the proximal end, across the tibial tuberosity, the shaft and the malleolus.

Results

Minimum number of individuals (MNI) was calculated for eight different bones. Every bone had an MNI calculated for the time period they were from. This is all shown in Table 4.

Table 4- Minimum Number of Individuals Calculated for Each Time Period

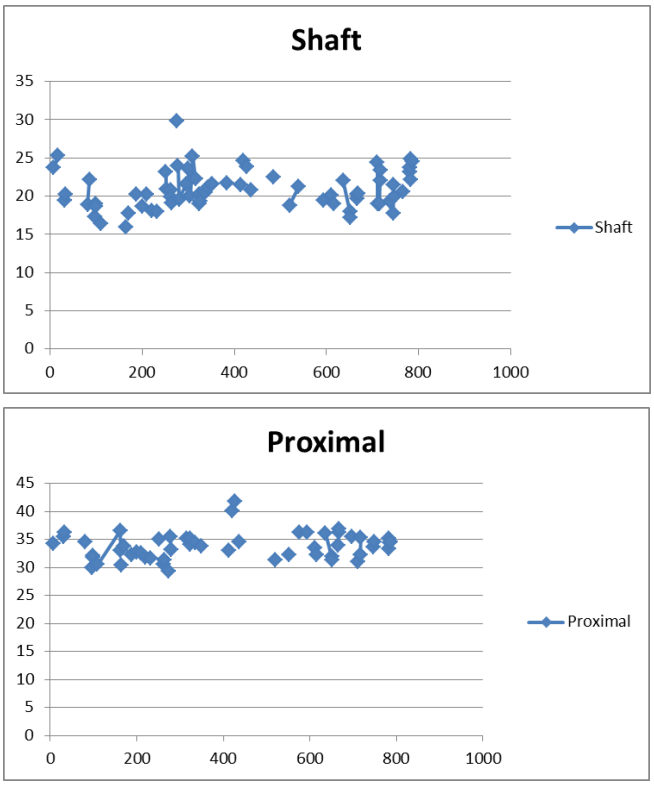
MNI by Time Period	Archaic (7,730-400 BCE)	Formative (2000 BCE- 200 CE)	Animas (~650-~850 CE)	Diaguita (~850-1536 CE)
Bone				
1st Phalanx	4	1	9	10
2nd Phalanx	3	----	3	6
Humerus	2	----	6	**13**
Tibia	2	**5**	9	10
Femur	2	3	8	10
Metapodial	**5**	2	**13**	12
Calcaneus	2	2	4	8
Talus	2	2	5	12

There are two blank cells in the table as there are no samples for second phalanges and humerii from the Formative period. The bolded values are the largest MNI for the corresponding time period. The most abundant elements overall were the first and second phalanges. The data

contains 187 first phalanges and 94 second phalanges with most being complete specimens. The first and second phalanges were measured with a vertical length at the distal head, in the middle of the shaft and at the proximal end. The raw data scatterplots showed some variation on each measurement for the first phalanx as well as two out of the three for the second phalanx. The distal head variation for the first phalanges varied from ~8mm to just above 16mm. This group of measurements does not seem to have any outliers, unlike the first phalanx shaft measurements which have only one specimen below 8mm and only one above 18mm. These outliers were reexamined via the individual photographs to determine if they were a different species that was initially mis-identified in the lab. If they were determined to be outliers, they were excluded from the statistical analysis. The proximal and distal measurements of the first phalanx were compared to a published data set on contemporary South American camelids including all four extant species (Izeta et al 2009). When comparing the two data, the measurements done by this study are similar for the proximal articular surface, but smaller on average for the distal articular surface. The third phalanges were only measured for proximal height and total length but there are nowhere near the numbers of specimens as the other phalanges.

There were 32 measurements on femur specimens that were distal shaft and condyles, making them the most numerous measurements for that element. The amount of variation in the size of the epicondylar gap measurement was one of the largest, ranging from ~35mm to ~65mm in width. Only the medial shaft and distal condylar width were represented in large enough numbers to see a reasonable distribution on the data scatterplots. The other three measurements had less than ten bones that had those facets available to them for measuring. The distal condylar width has an extremely low outlier at only ~20mm while most are sitting between 40mm and 50mm. This specimen was only a distal condyle with a total vertical length of 4.28 centimeters.

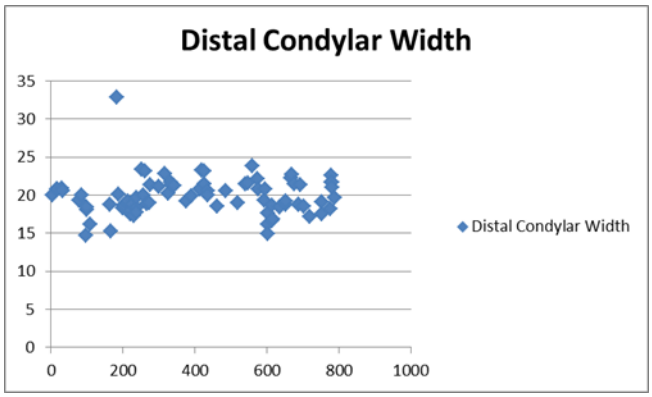
Figure 10- Metapodial Shaft and Proximal Scatterplots

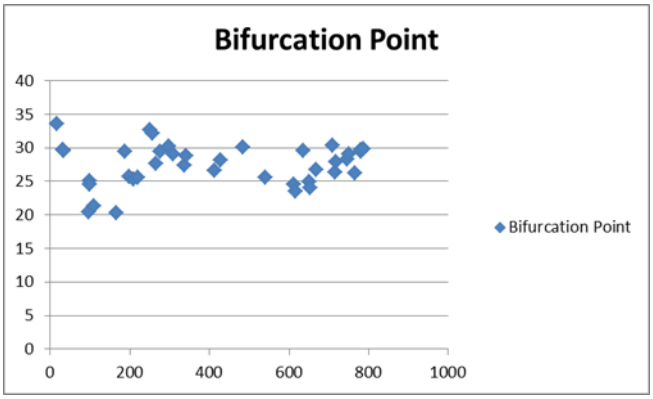


The tibia measurements were all well represented and experienced a fair amount of variation based on the raw data. There are two individual tibia that could be listed as outliers as one has a proximal measurement below 30mm with no others below ~45mm. The other measurement that could be an outlier is one malleolus measurement that exceeds 60mm while the majority are between 40mm and 50mm.When measuring the ulna or radius, most were partial bones due to the fragile nature of ulnas and a lack of radii. Distal end, distal shaft, medial shaft, proximal shaft and proximal end were the chosen measurements for the radius but there were only 17 identified specimens. There was a greater number of ulna available, but besides the olecranon and trochler notch measurements, many were not well represented. Many of the ulna only had those features present but some had the radius connected to it. These were measured but not included in statistical analyses due to the extremely fragmentary nature of the element. Possible the most important bones were the metapodials. They were identified, when possible, as either a metacarpal or metatarsal but were analyzed together along with the unidentified metapodials. The measurements taken on the metapodials include condylar width, the bifurcation point (MC5), shaft, and the proximal head. Besides an

obvious outlier in the measurements for condylar width, all measurements were distributed consistently with some variation. The bifurcation point has 15cm of variation between its highest and lowest samples, with those not being outliers. Figures 10 and 11 show the scatterplot graphs associated with the raw data for the metapodial measurements. The X-axis of the graphs is the picture number, or identification number given to each element while the Y-axis is the measurement lengths. The variation along the Y-axis is what needed to be observed in order to continue with statistical analyses so the X-axis is a null variable used just for identification and creating a horizontal spread. This proved useful in identifying outliers and referring to the original data to observe if it was a different species.

Figure 11- Metapodial Distal Condylar Width and Bifurcation Point Scatterplots





The final two elements that had more than two measurements were the calcaneus and the astragalus. Being dense, there was a fair amount of representation, but many of the calcanei were partial. The measurements done on the calcanei were a proximal width, a shaft width and a distal width. Measurements on the astragalus were length, proximal width and distal width. The distribution of the raw data on scatterplots had most of them being grouped with little variation,

while there was one astragalus as an outlier for width measurements, being ~10mm larger than the next largest.

Statistical Results

Long bones and phalanges were measured because of the presence of variation in the raw data scatterplots. The statistical test used was the Tukey test, a single step multiple comparison test. It is able to be used on the raw data to compare multiple sets to each other. A Tukey test was used to compare the bones from one time period to all of the others to see if the variation was significant. This test was chosen because a small sample size does not affect the Tukey test as much as other tests. It is still true that a larger sample would provide a more accurate result, but the test is still relevant due to it comparing the bones based on the time period they are from. Total length measurements were excluded from the statistical analyses as they were taken for all bones, partial or whole, and that would not be consistent. Data was entered into the program "R" and set to run with the Tukey multiple comparisons of means formula. The Tukey tests were run with a 95% confidence interval. The Tukey test compared the measurements from a chosen time period to each other time period. For example, the bifurcation point of the metapodials from the Archaic period was compared against those measurements from the Formative, Animas and Diaguita period. This resulted in a maximum of six sets of results for each measurement depending on if there was representation of a measurement in each time period. The results that came out of the program include the P adjunct value, the differences between MS standard and MS population, and the lower and upper limits of test values. P adjunct values were determined on the 95% confidence level for each measurement of the chosen bones.

Table 5- Statistical Analysis P-Values

	Arc/Ani	Dia/Ani	Form/Ani	Dia/Arc	Form/Arc	Form/Dia
Distal	**0.0175869**	0.5452863	0.2245032	0.1934711	0.9682500	0.4726534
Shaft	0.8677058	0.4682687	0.9988350	0.9955939	0.9963769	0.9857038
Proximal	0.7335766	0.6478551	0.9997667	0.2602149	0.9396730	0.9854252

	Arc/Ani	Dia/Ani	Dia/Arc
Distal	0.3845395	0.1331496	0.9475109
Shaft	0.1398728	0.8059254	**0.0241834**
Proximal	0.9990644	0.5452383	0.6065738

	Arc/Ani	Dia/Ani	Form/Ani	Dia/Arc	Form/Arc	Form/Dia
Shaft	0.7871161	0.6298945	0.5483806	0.9998659	0.1982382	**0.0675029**
Epi Gap	**0.0324297**	**0.0001746**	0.9884379	0.9971930	0.1063503	**0.0074910**

	Arc/Ani	Dia/Ani	Form/Ani	Dia/Arc	Form/Arc	Form/Dia
Cond Width	**0.0435335**	0.0844369	0.9987728	0.8888944	0.2804936	0.4593358
Bifurc Point	0.1775570	**0.0001919**	0.7374365	0.8064330	0.9996716	0.9340841
Shaft	0.1226805	**0.0470239**	0.1659925	0.9452770	0.9960518	0.9902625
Proximal	0.5385075	0.9999999	0.4075797	0.5371709	0.1111045	0.4007863

	Arc/Ani	Dia/Ani	Form/Ani	Dia/Arc	Form/Arc	Form/Dia
Proximal	0.9921992	0.8802140	0.4367425	0.8762078	0.8526498	0.1092634
Tuberosity	0.9970272	0.4491297	0.7366762	0.6311783	0.9466311	**0.0752765**
Shaft	0.4145809	0.1052692	0.7047430	0.9999141	0.1566863	**0.0340619**
Malleolus	0.9999848	0.9997520	0.8752658	0.9997128	0.9504634	0.8262658

Table 5 displays all of the measurements that were put through statistical analyses and displays their P-adjunct value. The bolded values are those that exhibited statistical significance when under a 95% confidence interval. Starting with the first phalanx, the P adjunct value for the distal measurement between archaic and animas was found to be significant with a value of 0.0175869. This value displays that there is the possibility of significance between the

measurements of these two time periods. While some of these are in consecutive time periods, others are separated by a larger period of time. For example, the shaft measurements on the second phalanges were found to be significant when comparing bones from the Diaguita time period to the archaic time period with a P-adjunct value of 0.0241834. These time periods are the furthest apart in this sample, but with the available sample, there is significance in the sizes of the shaft measurements of the second phalange. An example of a measurement with statistical significance in consecutive time periods would be the shaft of the femur between the animas time period and the Diaguita time period. The P-adjunct value for this data set is 0.0001746, representing a high level of significance. When reviewing the measurement data, the femur shaft measurements from the Diaguita time period are smaller on average than that of the Animas time period. The same is true of the statistical significance of the bifurcation point of the metapodials for the same consecutive time periods. This data set also has the measurements from the Diaguita time period as smaller on average than those from the animas time period.

Discussion

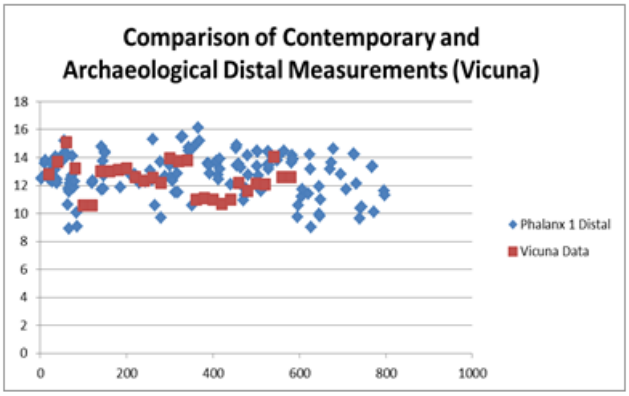
This project offers new information to the methods of identifying domesticated camelid through osteometric techniques. There have been other studies that look at differentiating species via skeletal morphology for the South American camelids, but they have been focused on other areas of the continent or focused on pathologies. The ability to find evidence of the domestication of South American camelids requires the species identification criteria to be known prior so that wild guanaco or vicuña are not mistaken for a domesticated individual. While size can be used as a main determinant between guanaco and llama due to the former's larger stature, this varies with regional size variation. Without these criteria, the ability to identify the species based on the remains became an impossible task. Due to this obstacle, the

statistical analysis is used to look at the potential size differential of similar measurements between different time periods.

As previously mentioned, there were some measurements that were found to be statistically significant in consecutive time periods while others were in the furthest possible time periods. It is interesting to have high levels of statistical significance in consecutive time periods, suggesting a large amount of change between them. Those measurements that were significant between the Animas and Diaguita time periods had a larger average size in the former, which is also the earlier time period. It could be determined that these specimens were different species with further testing such as DNA analysis. Another viewpoint could be that the individuals from the Animas time period were domesticated or not and the same for the Diaguita time period. The significance of these measurements is greater than those that are from non-consecutive time periods. The gap between the overlapping Late Archaic and Formative and the later Animas and Diaguita time periods was what I believed to be an important gap that should have showed a large amount of statistical significance of bones from each group of time periods. One statistic of note was the proximal metapodial measurements from the consecutive Animas and Diaguita time periods having a level of significance of 0.9999999. When the raw measurement data were consulted for these, there does not seem to be a much smaller sample size than that of other measurements, but the averages seem to be very similar as the measurements vary without a trend of one being larger or smaller on average.

The comparison to a prior data set collected from contemporary South American camelids can lead to a few conclusions (Izeta et al 2009). While the proximal articular surface measurements were similar, the distal surface measurements were smaller in the archaeological material when comparing three of the four species. The distal measurements for the contemporary vicuña are

Figure 12- Scatterplots Comparing Contemporary Vicuña and Archaeological Phalange Measurements (Izeta et al 2009)



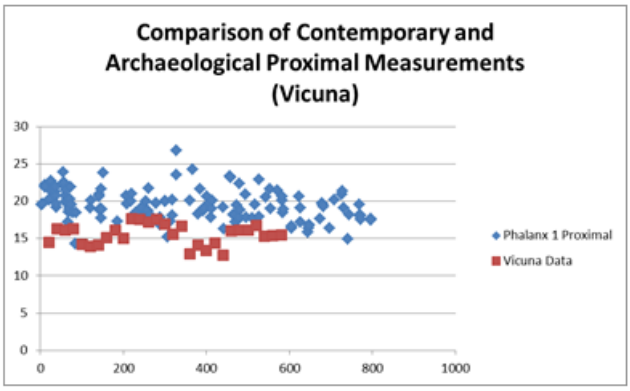
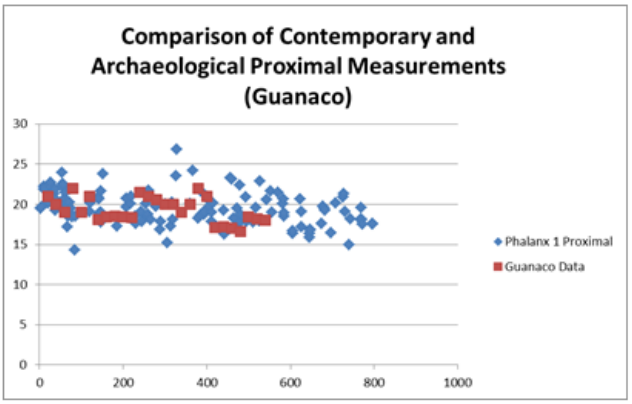
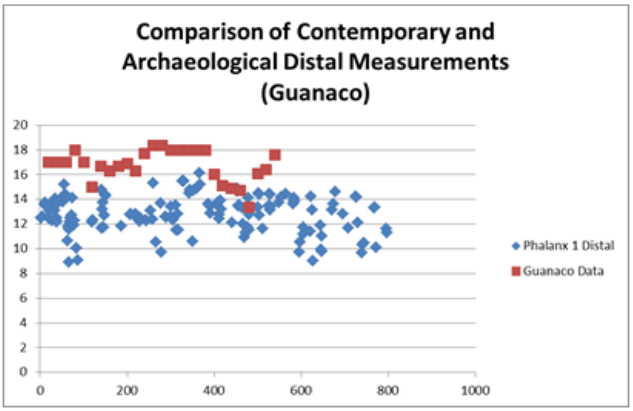


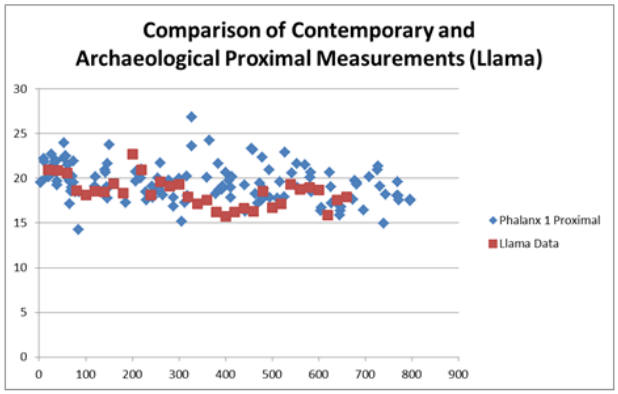
Figure 13- Scatterplots Comparing Contemporary Guanaco and Archaeological Phalange Measurements (Izeta et al 2009)





similar in size, but the proximal measurements are smaller on average than the archaeological material. Figure 12 shows multivariate scatterplots with the contemporary vicuña measurements from the Izeta article and the measurement data for the first phalanges from this study to show these differences in size. As vicuñas are a wild species, this comparison looks at how the archaeological material compares to a modern wild population to determine if the species present in the collection were wild or domesticated. Figure 13 looks at the same measurements when compared to the guanaco data from the same study as guanaco is the larger wild species that is difficult to distinguish from llama by skeletal morphology alone. The trends for the guanaco and vicuña are opposite as the archaeological material and contemporary guanaco

Figure 14- Scatterplots Comparing Contemporary Llama and Archaeological Phalange Measurements (Izeta et al 2009)



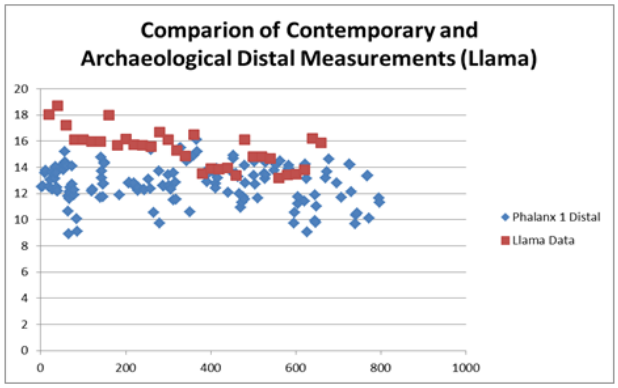
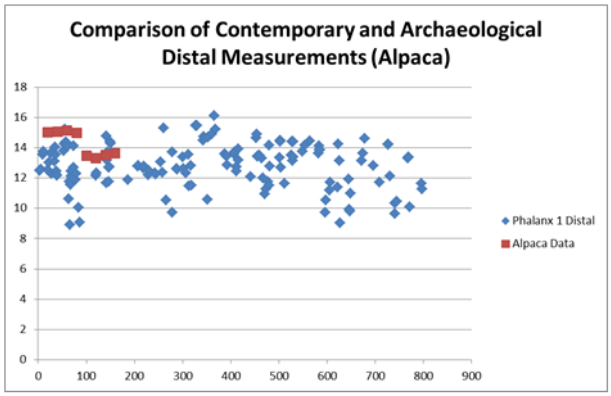
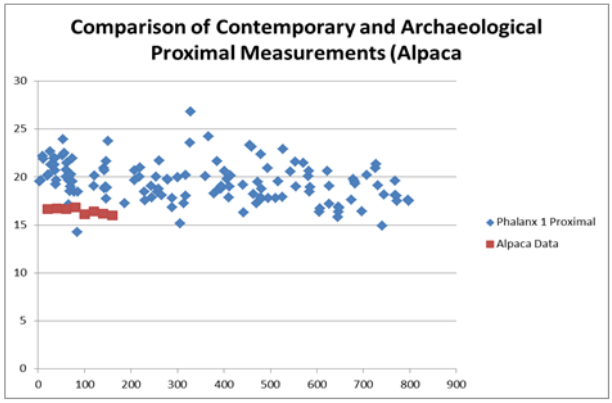


Figure 15- Scatterplots Comparing Contemporary Alpaca and Archaeological Phalange Measurements (Izeta et al 2009)





measurements are similar for the proximal while the distal measurements have the guanaco being larger that the archaeological material on average. These two wild species both have one similar measurement and one differing measurement to the archaeological material studied. The other two species, the alpaca and llama, are the domesticated species for the South American camelids but they do show similar trends to the wild species they are related to when compared to the archaeological data. The comparison for contemporary llamas data is shown in Figure 14 and the comparison for alpaca data is shown in Figure 15. With only 8 measurements for the alpaca, it is not as strong of a trend as the other three species, but it still shows that proximal measurements are smaller than the archaeological material and the distal measurements are similar. The llama had the most data available and followed the same trends that the guanaco had with the distal

measurements being larger on average and the proximal measurements being similar to those of the archaeological collection. These comparisons display that the archaeological material measured cannot be directly compared to any single modern species as it has similarities and differences with each genus. A specified study on the proximal phalanx including the full suite of prior measurements would be required in order to fully conclude which of the South American camelids the archaeological material is comparable to (Izeta et al 2009).

All of the time periods from this study are from after the first known domestication of camelids as they all occur post-7000 BP. This complicates determining if an assemblage associated with human activity contains domesticated or wild camelids when looking at the time period alone. The inclusion of DNA analysis would aid in this as it could be used to first determine the species of the bones, and possibly compare to known domesticated DNA sequences. This was not able to be done for this study as the funds, equipment and ability to sample bones were not available at this time. Beyond DNA analysis, the teeth of camelids would be useful in determining the age of death. If the individual died at a younger age or at prime age, it could be assumed that they were used as a food source while those who died at an older age could have been assumed to be kept around for their secondary resources. Having tooth samples of camelids would be able to further this research through the above mentioned means as well as the possibility of having other isotopic analysis such as strontium and carbon. Being able to date the bones with radiocarbon dating techniques as well as using strontium analysis to aid in pinpointing the location that the animal resided in when alive could offer information into if the animal was wild or domesticated. While other bones could also be sampled for the isotope analysis, the carbon signatures deposited during tooth formation can be used to identify the carbon pathways of consumed food at younger ages. The carbon pathways, C3 and C4, could be

examined to determine the types of foods eaten by the camelids and aid in the identification of wild and domesticated species due to diet composition.

As exploratory research on the camelids in this area of Chile, there is a lot that can be built upon and improved. An obvious improvement upon this study is to have a larger sample size. A larger sample size will allow for greater statistical results and the ability to discern differences between species. The current collections used allowed for the testing of methods for the measurement and analysis to be done on a larger scale in the future. A large problem that remains is the ability to identify the different species based on their skeletal morphology in this region. Due to the region size variation, resources that do display differences in skeletal morphology to determine species, usually in the form of bone size, may not be of use for this area of Chile. If the ability to discern size variation in species for that area of Chile is able to be obtained, then it aides this research in its main goal of finding a morphological signal for the domestication of South American camelids. This can also be accomplished with information that shows morphological differences on bones between the species, allowing for identification of those that overlap in size range may also yield more information into the topic. This research contributes to the archaeology of northern Chile by addressing the question of camelid domestication. The evidence from this analysis shows that the structure of the first phalanx should be focused on because it seems to correspond to the degree of load-bearing hence the suggestion of their use for transportation of goods. The trends shown in the comparative graphs are intriguing since the proximal measurements were similar to those from the *Lama* species while the distal were similar to those from the *Vicugna* species. Since the archaeological material was not able to be identified to genus level, there is the possibility that it is a large mixture, but then the other comparative graphs should have shown similar trends to the previous ones. With

the distal measurements for the *Lama* species being larger on average and the proximal measurements for the *Vicugna* species being smaller on average, they only overlap with a small portion of the archaeological material. This study solidifies the importance of osteometrics for the first phalanx when identifying the species of South American camelids based on post-cranial faunal remains in northern Chile.

Conclusion

The hypothesis of this study could not be tested, because the methods used and materials available were not able to discern domesticated South American camelids through skeletal morphology. However, the measurements proved to be successful, and statistical significance was found for measurements on the first phalanx, second phalanx, femur, metapodial and tibia. The statistical significance was found in four of the six possible time period comparisons; Archaic/Animas, Diaguita/Animas, Diaguita/Archaic, and Formative/Diaguita. These methods could be improved upon with a larger sample size to be able to have more precise statistical tests. The statistical test chosen that compared bone measurements from different time periods worked well with this study as it demonstrated that camelids do change morphologically between time periods. Given the relative climatological stability over this time period, these observed morphological changes must be related to artificial selection. Due to this selection pressure, if the pathway to domestication was purely on the prey pathway, traits pertaining to improving the meat and coats of the camelids would be the focus. The findings of mummified camelids showed that the fibers were selectively bred for based on the ritualistic use or textile use of the animals and their coats (Wheeler et al 1995).

Future work

A different method that could be used in future research includes DNA analysis to determine species as the regional size variation in this area of Chile overlaps between different species. Isotopic analysis can also be used to determine the diet of the animal and age based on the isotopes studied. These would require the permission of the Museo Arqueológico de La Serena as well as a facility to test the samples. Other future research would include the identification of camelid teeth and the aging of the samples at their death. These results will be able to be compared with my current measurement data to help determine if there is a morphological difference between domesticated individuals and non-domesticates. The age of death may allow for animals at sites to be determined as a food source or those used for their secondary goods as those consistently killed at a prime age will be those used for meat. There is the possibility of variation, as hunting will not only target prime age individuals, but any the hunters can catch. Animals used for their secondary goods would likely be older on average since they were kept alive until they could not provide the good or service any longer. The results from this study do show the aforementioned possibility of morphological change due to the pressures of becoming a beast of burden, but these results are also the first for this area of South America. In Peru, these types of studies have been done due to the visible size variation in camelids in that region. The ability to identify domesticated South American camelids via skeletal morphology in the semiarid north of Chile does seem to be a possibility, but first it is necessary to identify the species of the remains to be able to exclude the wild species and use them for comparisons.

Appendix

1st Phalanx

Region	Province	Area	Site	Sector	Box #	Picture #	Measurement 1	Measurement 2	Measurement 3	Total Length	Notes
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1	Distal	Shaft	Proximal			
						3 12.50 mm	15.38mm	19.53mm	7.05cm		
						6 12.58 mm	12.96mm	19.69mm	7.12cm		
						10 13.57 mm	14.25mm	22.21mm	7.02 cm		
						11 13.77 mm	13.44mm	21.87mm	7.12 cm		
						20 12.52 mm	14.45mm	20.15mm	6.88 cm		
						22 13.02 mm	13.47mm	20.25mm	7.02 cm		
						26 13.64 mm	14.83mm	22.69mm	7.89 cm		
						27 12.30 mm	11.79mm	21.31mm	6.29 cm		
						34 13.12 mm	13.94mm	21.97mm	7.71 cm		
						35 14.06 mm	14.73mm	21.28mm	7.89 cm		
						36 12.28 mm	12.76mm	20.71mm	6.77 cm		
						37 13.55 mm	15.53mm	21.93mm	7.96 cm		
						38 12.47 mm	12.78mm	19.22mm	6.96 cm		
						39 12.18 mm	12.72mm	19.64mm	6.75 cm		
					2						
						53 13.81mm	15.26m	22.24mm	7.41cm		
						54 14.25mm	16.26mm	23.92mm	7.33cm		
						56 15.22mm	14.45mm	22.51mm	7.28cm		
						57 14.38mm	15.23mm	22.46mm	7.50cm		
						60 14.32mm	15.02mm	20.76mm	7.80cm		
						61	10.98mm	20.03mm	7.14cm	Partial	
						62 14.11mm	14.44mm	21.49mm	7.14cm		
						64 10.63mm	12.40mm	70.40mm	6.82cm		
						65 11.77mm	11.82mm	19.69mm	6.97cm		
						66 8.99mm	10.59mm	17.16mm	6.06cm	Worn	
						67 11.58mm	11.23mm	19.67mm	6.38cm		
						68 12.15mm	11.26mm	18.54mm	6.16cm		
						69 12.47mm	10.79mm	18.98mm	6.96cm		
						71 11.99mm	14.43mm	20.24mm	7.42cm		
						73 12.69mm	14.18mm	21.99mm	7.21cm		
						74 14.12mm	13.23mm	19.52mm	7.15cm		
						78 11.88mm	10.93mm	18.46mm	6.50cm		
						79 12.29mm	11.74mm		5.22cm	Partial	
						84 10.05mm	7.58mm	14.26mm	5.65cm	Partial	Wear
						86 9.09mm	10.67mm	18.47mm	5.79cm	Partial	
IV de Coquimbo	Elqui	Borde Costero	Parcela N. 24	Penuelas	4						
						120 12.16mm	12.06mm	19.08mm	6.34cm		
						121 12.34mm	12.22mm	20.15mm	6.23cm		
						141 11.70mm	14.76mm	20.92mm	6.81cm	Partial	
						142 14.78mm	13.44mm	20.67mm	6.93cm		
						143 13.20mm	12.19mm	18.83mm	6.82cm		
						144 13.72mm	13.35mm		6.51cm	Partial	
						145	11.59mm	19.02mm	5.86cm	Partial	
						146 11.75mm	11.20mm	17.77mm	6.24cm		
						147 12.69mm	11.89mm	21.64mm	7.42cm		
						148 12.74mm	11.99mm	18.90mm	6.83cm		

						149	14.40mm	12.03mm		6.27cm	Partial	
						150	14.31mm	12.96mm		6.27cm	Partial	
						151		18.82mm	23.77mm	5.73cm	Partial	
IV de Coquimbo	Elqui	Interior	Camite Allegados	Panuelas/Guana	6							
						186	11.87mm	10.74mm	17.29mm	6.27cm		
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8							
						207	12.79mm	12.16mm	20.70mm	6.52cm	Unfused	
						208	12.84mm	11.95mm	19.67mm	6.63cm	Unfused	
						218	12.66mm	11.52mm	20.04mm	6.64cm	Unfused	
						219	12.80mm	11.96mm	21.00mm	6.55cm	Unfused	
						229	12.21mm	11.00mm	18.48mm	5.83cm	Unfused	
						230	12.48mm	10.39mm	17.58mm	5.88cm	Unfused	
						243	12.33mm	11.11mm	19.09mm	5.83cm	Unfused	
						244	12.27mm	10.41mm	17.84mm	5.88cm	Unfused	
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	9							
						254	13.07mm	14.56mm	20.05mm	7.16cm	Partial	
						257		12.85mm	18.49mm	5.33cm	Partial	
						258*	12.38mm	11.08mm		2.39cm	Partial	
						259		12.53mm	18.78mm	5.80cm	Partial	
						260	15.32mm	13.25mm	21.70mm	6.29cm	Partial	
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10							
						266	10.56mm	12.72mm	18.13mm	6.39cm	Partial	Worn
						278	13.71mm	13.92mm	19.76mm	6.69cm		
						279	9.71mm	13.90mm	19.73mm	6.89cm	Partial	
						281		11.96mm		4.32cm	Partial	
						288	12.63mm	11.61mm	16.83mm	6.17cm	Partial	
						289	12.56mm	11.57mm	17.82mm	6.30cm	Partial	
						300	13.41mm	13.40mm	19.98mm	7.03cm		
						301	12.62mm	13.49mm	19.97mm	6.95cm		
						306	12.33mm	11.59mm	15.17mm	6.00cm	Partial	
						312	13.55mm	12.02mm		4.80cm	Partial	
						313	11.50mm	13.50mm	17.28mm	6.83cm		
						317	12.84mm	12.58mm	20.23mm	6.29cm	Wear	
						318	11.53mm	13.05mm	18.07mm	6.77cm	Partial	Wear
IV de Coquimbo	Elqui		Posesion Buenos Aires	Comunidad Caldera	11							
						327	15.46mm	13.65mm	23.58mm	8.20cm	Partial	
						328			26.82mm	2.72cm	Partial	
						330	15.49mm			4.74cm	Partial	
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	14							
						343	14.49mm	11.28mm		5.94cm	Partial	
						344	14.75mm	12.66mm		3.76cm	Partial	
						351	10.60mm			2.40cm	Partial	
						353	14.70mm			3.49cm	Partial	
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	15							
						360	14.91mm	14.23mm	20.06mm	7.60cm		
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	16/17							
						366	16.13mm	16.70mm	24.24mm	8.08cm	Partial	???
						368	15.21mm	12.68mm		4.76cm	Partial	
						379		13.29mm	18.27mm	3.88cm	Partial	

IV de Coquimbo	Limari	Valle Rio Hurtado	Alero SP Viejo Pichasca	Pichasca	20							
						385		14.56mm	21.65mm	5.66cm	Partial	
						386			18.66mm	1.94cm	Partial	
						387	13.61mm			4.39cm	Partial	
						390	13.51mm	10.77mm		5.47cm	Partial	
						391	13.42mm	12.15mm		5.26cm	Partial	
						392	12.88mm			3.65cm	Partial	
						393			18.75mm	5.54cm	Partial	
						394		13.92mm	19.08mm	4.42cm	Partial	
						401			20.63mm	3.29cm	Partial	
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21							
						407	13.60mm	13.96mm	19.76mm	7.54cm		
						408	13.74mm	13.87mm		7.02cm	Partial	
						411	12.75mm	10.95mm	17.86mm	6.68cm		
						412	12.44mm	11.18mm	18.98mm	6.64cm		
						414			20.13mm	2.24cm	Partial	
						415	13.92mm	12.48mm		6.01cm	Partial	
						416	13.18mm	11.73mm		4.83cm	Partial	
						441	12.09mm	11.29mm	19.21mm	6.49cm		
						442			16.30mm	3.45cm	Partial	
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22							
						453	14.65mm	12.65mm		4.02cm	Partial	
						454	14.90mm	11.99mm		3.57cm	Partial	
						455	13.45mm	13.54mm		5.48cm	Partial	
						456		15.52mm	23.32mm	3.96cm	Partial	
						459	13.51mm	12.91mm	23.16mm	6.19cm		
						464	13.30mm	12.18mm	18.23mm	6.71cm		
						467	12.00mm	10.66mm		5.25cm	Partial	
						470	10.95mm	10.28mm	17.24mm	6.19cm		
						473	11.29mm	11.85mm	19.48mm	7.31cm		
						477	11.76mm	11.61mm	17.56mm	6.48cm	Worn	
						479	14.15mm	15.35mm	22.36mm	7.70cm	???	
						480	11.54mm	10.58mm	17.85mm	6.14cm		
						481	12.78mm	10.65mm	18.79mm	5.97cm		
III	Huasco		Calle Independencia	Choapa IV	252							
						494			20.92mm		Partial	
						495			17.81mm		Partial	
						498		13.92mm			Partial	
						501	13.36mm			3.15cm	Partial	
						502	14.48mm			2.25cm	Partial	
						503	14.42mm			2.94cm	Partial	
						504	12.69mm				Partial	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24							
						511	11.64mm	11.57mm	17.78mm	5.96cm	Unfused	
						517		13.06mm	19.57mm	3.78cm	Partial	
						526	13.50mm	12.12mm	17.93mm	6.91cm		
						527	14.43mm	14.98mm	22.92mm	7.89cm		
						528	13.15mm	12.33mm		5.02cm	Partial	
						529	14.40mm			3.58cm	Partial	
						530	13.41mm			3.65cm	Partial	

						543			20.59mm		Partial		
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	25								
						549	13.77mm	12.41mm		5.50cm	Partial		
						553		16.89mm	21.61mm	4.71cm	Partial		
						554	14.17mm	14.24mm		6.07cm	Partial		
						555			18.98mm	5.51cm	Partial		
						563				4.19cm	Partial		
						564	14.46mm			5.63cm	Partial		
						571			21.46mm	3.90cm	Partial		
IV and V Valpo	Choapa-Petorca			La Villa Estero	199								
						582	13.62mm	12.85mm	20.09mm	6.73cm			
						583	14.14mm	13.97mm	20.62mm	7.15cm			
						584	13.90mm	11.23mm	18.47mm	6.90cm			
						585	13.83mm	12.21mm	18.95mm	7.03cm			
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26								
						596	9.73mm	9.82mm		5.35cm	Juvenile	Worn	
						597	10.56mm	11.72mm		6.11cm	Juvenile	Worn	
						598		10.81mm		5.93cm	Juvenile	Worn	Partial
						604		8.26mm		5.30cm	Juvenile	E. Worn	
						605	11.21mm	10.30mm	16.36mm	5.55cm	Juvenile	Worn	
						606	11.73mm	10.19mm	16.69mm	5.48cm	Juvenile	Worn	Partial
						621	11.40mm	11.65mm		6.12cm	Juvenile	Worn	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27								
						623	14.23mm	13.44mm	20.62mm	7.78cm			
						626	13.16mm	13.48mm	19.06mm	7.82cm			
						627	9.04mm	11.29mm	17.19mm	7.37cm	Worn		
						645	11.91mm	10.89mm	15.84mm	6.07cm			
						646	9.93mm	9.12mm	16.34mm	6.16cm	Worn		
						647	9.79mm	8.92mm	16.88mm	6.27cm	Worn		
						648	11.01mm	8.03mm	16.77mm	5.99cm	Worn		
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar		28								
						671	13.17mm			1.92cm	Partial		
						674	13.65mm	12.23mm	17.61mm	7.10cm			
						678	14.60mm	15.10mm	19.77mm	7.74cm			
						681		12.77mm	19.52mm	5.83cm	Partial		
						682			19.28mm	3.09cm	Partial		
						696	12.81mm	11.82mm		5.92cm	Partial		
						697			16.42mm	3.45cm	Partial		
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	208								
						707		12.26mm		5.85cm	Partial		

IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174	708	11.71mm	13.22mm	20.18mm	6.97cm		Partial	
						714		10.14mm		5.19cm		Partial	
						726	14.26mm	14.92mm	20.93mm	7.35cm			
						727	14.20mm	14.42mm	21.35mm	7.46cm			
						730		12.24mm		6.36cm		Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	189	731	12.14mm	11.68mm	19.12mm	6.94cm		Partial	
						740	9.66mm	11.10mm	14.93mm	5.72cm			
						741	10.35mm	11.09mm		5.19cm		Partial	
						742		10.25mm		5.93cm		Partial	
						743		11.69mm		5.42cm		Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*	744	10.48mm	12.38mm	18.18mm	6.93cm			
						768	13.31mm	13.11mm	18.08mm	7.16cm			
						769	13.39mm	13.43mm	19.58mm	7.09cm			
						771		11.84mm	18.07mm	6.39cm		Partial	
						772	10.10mm	10.94mm	17.53mm	6.49cm			
IV de Coquimbo	Elqui	Borde Costero	Parcela N24	Penuelas	424	796	11.64mm	10.43mm	17.63mm	5.67cm		Unfused	
						797	11.29mm	10.15mm	17.48mm	5.83cm		Unfused	
						798		11.24mm		4.56cm		Worn	

2nd Phalanx

Region	Province	Area	Site	Sector	Box #	Picture #	Measurement 1	Measurement 2	Measurement 3	Total Length	Notes
							Distal	Shaft	Proximal		
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1	13	6.18 mm	10.62 mm	13.78 mm	3.08 cm	
						21	9.53 mm	11.39 mm	14.43 mm	3.37 cm	
						43	12.50 mm	11.43 mm	15.63 mm	3.78 cm	
						44	12.05 mm	11.29 mm	16.76 mm	3.96 cm	
						45	11.28 mm	11.45 mm	14.58 mm	3.54 cm	
					2						
						55	12.12mm	11.82mm	16.59mm	3.63cm	
						59	12.71mm	12.25mm	17.34mm	3.99cm	
						63	11.70mm	11.26mm	15.30mm	3.47cm	
						70	11.58mm	10.27mm	15.31mm	3.69cm	
						75	10.75mm	10.59mm	14.58mm	3.35cm	
						76	12.11mm	12.69mm	14.96mm	3.50cm	
						87	10.82mm	10.63mm	15.13mm	3.37cm	
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4						
						111	12.88mm	13.35mm	18.70mm	4.49cm	
						122	11.20mm	11.64mm	13.25mm	3.17cm	
						123	10.48mm	10.41mm	13.55mm	3.31cm	
						152	11.71mm	11.20mm	14.61mm	3.17cm	
						153	11.54mm	11.96mm	16.53mm	4.11cm	
						154	12.97mm	11.75mm	14.95mm	3.68cm	
						155	11.43mm	10.69mm	14.02mm	3.35cm	
						156	15.58mm	13.32mm	17.41mm	4.20cm	
						157	14.02mm	12.17mm	16.28mm	4.40cm	
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8						
						205	10.01mm	9.59mm	13.62mm	2.49cm	Unfused
						206	10.10mm	10.04mm	13.21mm	2.58cm	Unfused
						216	10.17mm	9.29mm	13.68mm	2.49cm	Unfused
						217	10.51mm	9.96mm	13.31mm	2.55cm	Unfused
						228	11.46mm	9.99mm	12.51mm	2.76cm	Unfused
						241	11.00mm	9.41mm	12.92mm	2.82cm	Unfused
						242	11.48mm	9.90mm	15.22mm	2.75cm	Unfused
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	9						
						255	11.20mm	10.90mm	14.42mm	3.10cm	
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10						
						272	9.92mm	11.43mm	14.66mm	3.26cm	
						290		10.42mm	13.91mm	3.39cm	Partial
						291	10.40mm	10.39mm	13.70mm	3.52cm	
						302	10.53mm	11.18mm	15.35mm	3.47cm	
						314	10.19mm	10.48mm	15.34mm	3.30cm	Partial
IV de Coquimbo	Elqui		Posesion Buenos Aires	Comunidad Caldera	11						
						331	12.60mm	11.63mm	15.97mm	3.82cm	Burnt
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	14						
						345	12.43mm	11.73mm	16.20mm	3.59cm	
						354	12.53mm	11.30mm	15.87mm	4.05cm	
						356	13.05mm	10.56mm	16.33mm	4.09cm	
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	15						

						362	11.88mm	10.53mm	14.81mm	3.29cm		
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	16/17							
						365*	9.62mm	10.39mm	15.64mm	3.75cm	Seal?	
						370	13.13mm	12.08mm	17.04mm	4.47cm		
						372*	9.01mm	9.73mm	14.07mm	3.42mm	Seal?	
IV de Coquimbo	Limari	Valle Rio Hurtado	Alero SP Viejo Pichasca	Pichasca	20							
						388	11.20mm			2.48cm	Partial	
						395			16.87mm	3.30cm	Partial	
						396	13.24mm	11.32mm	16.51mm	3.70cm		
						397			15.29mm	3.13cm	Partial	
						398	12.13mm	11.72mm	15.69mm	3.59cm		
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21							
						405	10.40mm	11.11mm	15.30mm	3.51cm		
						406	11.61mm	11.68mm	15.04mm	3.53cm		
						417	10.90mm	11.10mm	14.73mm	3.39cm		
						418	10.76mm	11.55mm	15.04mm	3.56cm		
						443	11.66mm			2.60cm	Partial	
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22							
						463	8.46mm	9.91mm	12.79mm	3.69cm	Worn	
						466	12.69mm	12.00mm	16.79mm	4.00cm		
						471	10.51mm	10.41mm	13.99mm	3.21cm		
						474	10.36mm	10.02mm	13.52mm	3.22cm		
						476	11.84mm	10.82mm	14.85mm	3.60cm		
						482	10.66mm	10.82mm	14.79mm	3.55cm		
						483	12.70mm	11.59mm	17.04mm	3.82cm		
III	Huasco		Calle Independencia	Choapa IV	252							
						496			17.18mm		Partial	
						505	11.41mm	10.36mm	13.90mm	3.25cm	Unfused	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24							
						512	12.46mm	11.24mm	16.83mm	4.15cm		
						518	11.42mm	11.46mm	16.52mm	3.74cm		
						531	11.92mm	11.10mm	15.90mm	3.44cm		
						532			17.31mm	3.02cm	Partial	
						533	11.33mm			2.84cm	Partial	
						544			13.50mm	2.66cm	Partial	
						545	9.73mm			3.60cm	Partial	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	25							
						556			16.04mm		Partial	
						557	11.93mm	10.58mm	15.50mm	4.02cm		
						565	12.69mm	12.31mm	16.51mm	3.79cm		
						572	12.93mm	11.19mm	15.55mm	3.70cm		
						573	11.74mm	10.59mm	15.04mm	4.09cm		
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27							
						628	11.82mm	10.63mm	15.86mm	3.40cm		
						629	10.60mm	11.14mm	16.16mm	3.61cm		
						649	7.84mm	8.43mm	13.05mm	2.87cm		
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar		28							
						675	12.77mm	12.17mm	15.07mm	3.16cm	Unfused	
						680	12.59mm	11.76mm	17.28mm	4.40cm		
						685	12.07mm	11.49mm	15.39mm	3.30cm		

						686	12.17mm	11.67mm	16.69mm	3.87cm		
						689	12.46mm	11.74mm	15.86mm	3.78cm		
						690	11.81mm	10.53mm	14.90mm	3.67cm		
						694	9.86mm	10.50mm	13.87mm	3.11cm		
						695	8.28mm	10.31mm		3.46cm	Partial	Unfused
						699	12.08mm			2.88cm	Partial	
						700			12.61mm	4.46cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174							
						724	10.96mm	10.77mm		3.33cm	Partial	
						725	10.89mm	11.47mm	15.78mm	3.47cm	Partial	
						729	9.80mm	10.64mm	15.07mm	3.19cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*							
						770	10.14mm	11.04mm	13.11mm	3.30cm		
IV de Coquimbo	Elqui	Borde Costero	Parcela N24	Penuelas	424							
						799	11.01mm	9.93mm	13.61mm	2.84cm	Unfused	

Humerus

Region	Province	Area	Site	Sector	Box #	Picture #	Measurement 1	Measurement 2	Measurement 3	Measurement 4	Measurement 5	Total Length	Notes
							Distal Condyl-ar Width	Distal Shaft	Head Width	Median Shaft	Neck		
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1	5	47.63 mm	34.98 mm	53.62 mm	25.03 mm		23.60cm	
						18	20.82 mm	25.12 mm	59.78 mm	27.57 mm		4.28 cm	DISTAL ONLY
						19	N/A					22.40cm	NO DISTAL
					2	72	31.65mm	28.76mm	58.90mm	28.80mm	38.86mm	25.60cm	Broken
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Peruelas	4	113	46.14mm	21.36mm		18.92mm	29.56mm	20.10cm	Unfused
						114	45.76mm	22.27mm		17.88mm	44.43mm	20.20mm	Unfused
						161	44.97mm	24.65mm				11.24cm	Distal/Right
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Centro	5	184	50.44mm					3.79cm	Distal/Right
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Bajo de Peruelas	7	191	46.75mm					11.24cm	Distal/Left
						192	46.08mm			20.00mm	28.09mm	18.95cm	Right
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10	297				18.78mm			
IV de Coquimbo	Elqui		Posesion Buenos Aires	Comunidad Caldera	11	309		28.32mm		30.92mm		17.06cm	Partial
IV de Coquimbo	Elqui	Peruelas	Museo del Desierto	Todos	18							14.73cm	Partial
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21	376	47.45mm					5.59cm	Partial
						452	47.82mm			25.02mm			
						448	51.54mm			24.00mm	38.98mm	12.91cm	Partial
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	D	23	486				17.02mm		20.60cm	Left
						489	43.94mm	26.76mm		17.49mm		12.72cm	Juvenile
III	Huasco		Calle Independencia	Choapa IV	252	508	45.87mm					18.20cm	Right/Juvenile
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	E	24	510	42.42mm					5.42cm	Left/Partial
						513	46.31mm						
						514				24.68mm		4.97cm	Left/Partial
						534	46.59mm			21.91mm		13.20cm	Partial
						535	47.20mm			22.41mm		14.67cm	Left/Partial
						536	45.22mm					11.28cm	Right/Partial
						537				19.06mm		6.87cm	Right/Partial
						541				21.03mm		11.52cm	Partial
						542				25.19mm		10.53cm	Partial
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	E	25	550	52.90mm					13.54cm	Partial
						560	45.45mm					15.30cm	Partial
						566	47.25mm					11.02cm	Right/Partial
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	D	26	617	45.85mm			18.89mm	34.78mm	6.12cm	Right/Partial
						618	41.05mm			18.44mm	34.88mm	19.50cm	Left/Partial
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	D	27	654	45.71mm			21.80mm	31.08mm	21.70cm	Right/Partial
						655						20.90cm	Partial
						650			64.10mm			8.09cm	Partial
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174					22.18mm	31.62mm	17.90cm	Partial
						752	42.44mm						
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	207	753	45.75mm			24.72mm		19.55cm	Right/Partial
						755	41.48mm					10.92cm	Left/Partial
						757				23.87mm		18.00cm	Partial
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	188								
						762	41.78mm			26.82mm		23.40cm	Right/Partial
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	208*								
						790				22.99mm	33.61mm	17.90cm	

3rd Phalanx								
Region	Province	Area	Site	Sector	Box #	Picture #	Measurement 1	Total Length
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4		Proximal Height	
						124	10.56mm	1.86cm
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8			
						204	9.99mm	1.76cm
						214	9.10mm	1.71cm
						215	9.84mm	1.76cm
						226	12.07mm	1.85cm
						227	11.80mm	1.95cm
						239	13.05mm	1.90cm
						240	12.08mm	1.85cm
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10			
						273	10.72mm	1.77cm
IV de Coquimbo	Limari	Valle Rio Hurtado	Alero SP Viejo Pichasca	Pichasca	20			
						399	13.85mm	2.17cm
						400	14.66mm	2.27cm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21			
						444	13.08mm	2.05cm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22			
						472	12.91mm	1.68cm
						475	10.64mm	1.63cm
III	Huasco		Calle Independencia	Choapa IV	252			
						506	12.09mm	1.80cm
						507	11.64mm	1.77cm
IV de Coquimbo	Elqui	Borde Costero	Parcela N24	Penuelas	424			
						800	13.64mm	1.82cm

Femur

Region	Province	Area	Site	Sector	Box #	Picture #	Measurement 1	Measurement 2	Measurement 3	Measurement 4	Measurement 5	Total Length	Notes
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1		Epicon/VarGap	Shaft	Proximal Shaft	Femoral Neck	Cross Trochanters		
						2	60.02 mm	26.23 mm	38.82 mm	30.54 mm	73.15 mm	32.50 cm	Right
						24	64.18 mm	28.34 mm	46.35 mm	34.14 mm	75.15 mm	33.50 cm	Left
IV de Coquimbo	Elqui	Borde Costero	Parcela N.21	Penuelas	3	28	60.64 mm	28.70 mm				11.95 cm/Partial	DISTAL ONLY
						89	56.50mm	24.71mm	23.78mm		68.14mm	30.10cm	Left Unfused/Sampled
						92	54.85mm	19.20mm	45.13mm			23.40cm	Right Unfused
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4	93	54.58mm	19.32mm	49.53mm			23.35cm	Left Unfused
						105	42.23mm	19.04mm		29.41mm	55.91mm	25.50cm	Right Unfused
						106	42.18mm	18.75mm		25.74mm	55.43mm	25.48cm	Left Unfused
						115	35.29mm	16.82mm		27.77mm	58.90mm	27.00cm	Right Unfused
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Centro	5	167		25.65mm		26.64mm	69.58mm	26.95cm	Left Partial
						168				26.52mm	70.73mm	19.30cm	Left Partial
						169	58.59mm					7.76cm	Right Partial
						177		30.87mm				16.20cm	Partial
IV de Coquimbo	Elqui	Interior	Camilo Allegados	Penuelas, Guana	6								
						188	40.54mm	25.02mm				28.60cm	Left Unfused/Partial
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Bajo de Penuelas	7	193	53.69mm	20.92mm	26.99mm		56.15mm	27.65cm	Left Unfused/Broken
						197	55.11mm	21.23mm	26.83mm			27.30cm	Right Unfused/Partial
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10								
						267	48.36mm					3.03cm	Distal Partial
						268		27.13mm	34.54mm			15.13cm	Partial
						275		29.75mm				13.40cm	Partial
						292	42.88mm					6.26cm	Partial Worn
						293		25.50mm				13.83cm	Partial
						311		31.49mm				8.85cm	Partial
IV and V Valpo			Estero El Valle	Choapa IV R	190								
						320	60.15mm					8.82cm	Right/Partial
						321	63.62mm	29.02mm				15.10cm	
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	16/17								
						371	53.15mm					3.30cm	Left/Partial
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar	F	21								
						430	60.15mm	25.40mm				14.22cm	Left/Partial
						431			25.45mm			11.53cm	Left/Partial
						445	59.27mm	27.19mm				17.20cm	Right/Partial
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22								
						468	55.69mm					8.86cm	Left/Partial
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar	D	23								
						487		17.39mm				20.92cm	Juvenile
					487*			17.32mm				18.53cm	Juvenile
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar	E	24								
						515	61.82mm					6.18cm	Right/Partial
IV and V Valpo	Choapa-Petorca				199								
						578	65.93mm					7.49cm	Left/Partial

IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26									
						599	48.69mm						Left/Partial	Juv/Wom
						600	52.35mm						Right/Partial	Juv/Wom
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27									
						655	60.03mm	22.93mm	26.30mm		66.68mm	32.00cm	Left	
						656	60.62mm	21.03mm	26.89mm		66.17mm	31.90cm	Right	
IV and V Valpo	Choapa-Petorca			La Villa Estero	200									
						662		28.77mm	32.59mm		76.54mm	33.40cm	Left/Partial	
						663	61.35mm	26.91mm				27.30cm	Left/Partial	
						664		27.07mm	30.96mm			25.30cm	Right/Partial	
						665	59.64mm	24.99mm	31.59mm			28.40cm	Right/Partial	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar		28									
						670		26.01mm	32.66mm		63.80mm	16.20cm	Right/Partial	
						673	55.95mm						Partial	
						679	55.14mm						Left/Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*									
						777		24.15mm				25.45cm	Partial	
						789	54.18mm						Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	169			28.60mm				13.57cm	Partial	

Radius											
Site	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**	**Measurement 3**	**Measurement 4**	**Measurement 5**	**Total Length**	**Notes**	
El Olivar	Compania Baja	1		Distal End	Shaft (D)	Shaft (M)	Shaft (P)	Proximal End			
			9	43.61mm	33.67mm	30.94mm			18.80cm	Partial	
			12	46.97mm	34.73mm				23.90cm	Partial	
		2									
			52				22.56mm	36.02mm	9.48cm	Partial/Prox/Unfused	
			82	43.20mm		27.46mm			9.79cm	Partial	
			83	47.32mm		34.43mm					
Plaza de Armas	Urbano Centro	5									
			171				16.37mm	27.36mm	18.20cm	Partial/Prox	Wear
			183				25.25mm	40.63mm	5.71cm	Partial/Prox	
Plaza G Mistral	Urbano Centro	10									
			310		28.84mm		27.88mm		22.90cm	Partial	
Museo del Desierto	Todos	14									
			348				16.44mm	31.42mm	6.05cm	Partial/Prox	
			355					29.85mm	6.90cm	Partial/Prox	
Museo del Desierto	Todos	15									
			358				16.38mm	33.87mm	14.12cm	Partial	
El Olivar-Lateo Brillmar	F	21									
			447	46.77mm		32.95mm	29.88mm		25.60cm	Right/Partial	
El Oliver-Lateo Brillmar		28									
			693	48.46mm					9.49cm	Partial	
Plaza G. Mistral	Aldunate	174									
			716	37.29mm	28.32mm				18.15cm	Partial	
			733	42.43mm	29.05mm				17.30cm	Partial	
			737	42.92mm	31.07mm				16.05cm	Partial	
Plaza G. Mistral	Aldunate	182									
			792			30.93mm			29.80cm	Partial	

Ulna														
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**	**Measurement 3**	**Measurement 4**	**Measurement 5**	**Total Length**	**Notes**	
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1		Olecranon	Trochler notch	Shaft	Distal	Proximal			
						8	22.57mm	17.46mm	18.30mm			20.20cm	Partial	
						15	34.60mm	28.64mm				9.77cm	Partial	
					2									
						51		20.88mm				9.06cm	Partial	
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4									
						112	33.16mm	21.86mm		25.86mm**		28.70cm	Right	Unfused
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Bajo de Panuelas	7									
				Ulna/Radius		190	32.65mm	24.45mm	23.90mm	39.92mm	40.90mm	27.50cm	Left	
				Ulna/Radius		196		23.90mm	23.23mm	41.26mm	40.88mm	27.90cm	Right	Unfused
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas/Coquimbo	12									
				Ulna/Radius		337	33.31mm	22.97mm	21.37mm	36.42mm		28.40cm	Right	
				Ulna/Radius		338		21.56mm	20.62mm	37.13mm		25.20cm	Right	Partial
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	15									
						359		29.15mm				9.40cm	Partial	
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	18									
						377		22.57mm				7.84cm	Partial	
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21									
				Ulna/Radius		449	31.57mm	30.85mm	32.42mm	48.16mm	28.24mm	31.20cm		
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22									
						469	36.81mm	28.77mm	27.33mm			19.10cm	Partial	
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	D	23									
				Ulna/Radius		490		24.77mm	22.76mm			24.60cm	Juvenile	Partial
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24									
						538		28.90mm				9.03cm	Partial	
						539		24.98mm				6.35cm	Partial	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26									
				Ulna/Radius		609			23.04mm	38.68mm	39.65mm	25.50cm	Partial	Juv/Worn
				Ulna/Radius		615			22.72mm	38.28mm	37.58mm	24.50cm	Partial	Juv/Worn
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27									
				Ulna/Radius		624	39.85mm	27.46mm	29.63mm	47.49mm	45.41mm	33.20cm		
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	208									
				Ulna/Radius		712			26.81mm	35.51mm	42.75mm	28.10cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174									
				Ulna/Radius		734		28.32mm			38.60mm	13.60cm	Partial	
				Ulna/Radius		735		26.69mm			35.11mm	11.75cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	207									
						756		28.26mm			42.16mm	8.87cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	188									
				Ulna/Radius		761	34.59mm	30.19mm	30.15mm		41.96mm	31.10cm	Partial	
				Ulna/Radius		763			28.56mm			15.75cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*									
						788	36.78mm	25.73mm				13.90cm	Partial	

Tibia														
Region	Province	Area	Site	Sector	Box #	Picture #	Measurement 1	Measurement 2	Measurement 3	Measurement 4	Total Length	Notes		
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1		Proximal	Tuberosity	Shaft	Malleolus				
						25	69.01mm	35.85mm	30.96mm	46.52mm	32.50cm	Right		
						32			29.12mm	47.69mm	22.30cm	Partial/Distal		
						42	68.59mm				9.87cm	Partial/Prox		
					2									
						58		22.72mm	21.82mm		16.00cm	Partial		
IV de Coquimbo	Elqui	Borde Costero	Parcela N. 21	Penuelas	3									
						90	61.96mm	32.05mm	25.68mm	41.63mm	28.30cm	Left		
						91	61.93mm	32.14mm	25.68mm	43.67mm	28.10cm	Right		
						94	47.98mm	26.38mm	22.40mm	31.68mm	23.10cm	Right		
						95	47.34mm	27.60mm	22.37mm	32.52mm	23.00cm	Left	Unfused/Sampled	
						100	28.58mm	17.94mm	15.92mm	26.73mm	15.15cm	Unfused		
IV de Coquimbo	Elqui	Borde Costero	Parcela N. 24	Penuelas	4									
						104	57.22mm	21.30mm	25.19mm	36.59mm	28.40cm	Unfused		
						110	52.26mm	21.86mm	26.27mm	35.65mm	27.55cm	Left/Unfused		
						158				47.50mm	7.64cm	Distal/Right	Partial	
						159				51.93mm	6.86cm	Distal/Left	Partial	
						160				65.39mm	8.90cm	Distal/Right	Partial	
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Centro	5									
						174	47.57mm				6.04cm	Right	Partial	
						175			23.64mm	42.33mm	24.50cm	Left	Partial	
						176			25.48mm	40.24mm	20.00cm	Right	Partial	
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	7									
						194	60.64mm	34.05mm	23.82mm	42.75mm	28.40cm	Right	Unfused	
						195	61.49mm	30.80mm	23.82mm	37.99mm	27.40cm	Left	Unfused	
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8									
						253			25.53mm	45.60mm	17.10cm	Distal/Right	Partial	
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10									
						269	48.15mm					Partial		
						270		34.48mm	29.03mm		14.19mm	Right	Partial	
						271			27.08mm	38.23mm	13.04cm	Left	Partial	
						294			27.74mm	38.64mm	11.38mm	Distal/Right	Partial	
						296			27.84mm		22.40cm	Partial		
						307			25.30mm	41.90mm	11.43cm	Distal/Right	Partial	
						315	61.04mm		28.80mm	39.40mm		Partial	Extreme Wear	
IV and V Valpo			Estero El Valle	Choapa IV R	190									
						322	62.50mm				3.76cm	Partial		
IV de Coquimbo	Elqui	Borde Costero	Parcela N. 24	Penuelas Coquimbo	12									
						339	66.20mm	35.07mm	28.90mm	39.10mm	32.50cm	Left	Sampled	
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21									
						437	64.46mm	29.08mm	26.78mm	43.05mm	31.00cm	Left		
						446	65.16mm	32.65mm	27.39mm	46.39mm	31.10cm	Right		
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22									
						458				42.02mm	7.53cm	Distal/Right		
						461				44.16mm	10.44cm	Distal/Left		
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	25									
						548				71.34mm	9.04cm	Partial		

IV and V Valpo	Choapa-Petorca			La Villa Estero	199									
						579	68.08mm				6.95cm	Right/Partial		
						580	67.62mm				8.73cm	Left/Partial		
						581	72.07mm				5.99cm	Left/Partial		
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26									
						607	46.21mm					Partial	Juv/Worn	
						608	53.59mm					Partial	Juv/Worn	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27									
						653	65.75mm	30.92mm	24.08mm	40.42mm	31.50cm	Left		
						654	64.02mm	30.48mm	23.36mm	41.01mm	31.42cm	Right		
IV and V Valpo	Choapa-Petorca			La Villa Estero	200									
						658	65.65mm	32.84mm	28.01mm	44.84mm	31.60cm	Right		
						659		33.05mm	27.59mm	43.84mm	25.50cm	Right/Partial		
						660		36.45mm	30.45mm	42.02mm	29.30cm	Right/Partial		
						661		32.02mm	26.75mm	44.54mm	27.30cm	Left/Partial		
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	207									
						754	60.38mm	30.04mm			12.31cm	Left/Partial		
IV and V Valpo			Estero El Valle		206									
						759		38.45mm	31.41mm	48.18mm	31.40cm	Partial		
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*									
						767		34.52mm			11.69cm	Partial		
						775				41.26mm	5.00cm	Partial		
						785	58.43mm					Partial		
						786		32.33mm	29.92mm	43.42mm	26.60cm	Partial		

Metapodials

Region	Province	Area	Site	Sector	Box #	Type	Picture #	Measurement 1	Measurement 2	Measurement 3	Measurement 4	Measurement 5	Total Length	Notes	
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1			Condylar Width	Bifurcation Point	Shaft	Proximal	Shaft (P)			
						Distal	4	20.02mm					5.67cm	Partial	
						MC	7			23.75mm	34.22mm	25.49mm	16.31cm	Par/Pro	Left
						Distal	16	20.82mm	33.56mm	25.35mm			8.97cm	Partial	
						Distal	17	20.82mm					6.42cm	Partial	
						MT	31	20.91mm	29.75mm	19.50mm	35.52mm		23.90cm	Right	
						MT	33	20.54mm	29.60mm	20.20mm	36.24mm		24.00cm	Left	
					2										
							77	19.29mm					4.74cm	Partial	
						MT	81			18.90mm	34.52mm	21.51mm	10.34cm	Par/Pro	Right
							85	19.96mm		22.11mm			11.62cm	Partial	
IV de Coquimbo	Elqui	Borde Costero	Parcela N.21	Penuelas	3										
						MT	97	14.66mm	20.39mm	17.35mm	29.90mm		18.53cm	Right	Unfused
						MT	98	18.06mm	25.03mm	19.02mm	32.18mm		21.67cm	Left	
						MT	99	18.48mm	24.56mm	18.65mm	31.76mm		21.72cm	Right	
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4										
						MT	109	16.16mm	21.31mm	16.35mm	30.55mm		21.40cm	Right	Unfused
						MC	162				36.55mm		8.71cm	Left/Pro	Partial
						MT	163				33.01mm	18.75mm	13.71cm	Left/Pro	Partial
							164	18.75mm					8.27cm	Partial	
						MT	165	15.24mm	20.25mm	16.00mm	30.46mm		20.90cm	Left	Unfused
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Centro	5										
						MT	170			17.80mm	33.73mm		17.57cm	Partial	
							182*	32.84mm					9.46cm	Distal	Partial
IV de Coquimbo	Elqui	Interior	Camite Allegados	Paneulas, Guana	6										
						MT	187	20.14mm	29.45mm	20.25mm	32.23mm		22.50cm	Right	
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Penuelas	8										
						MC	199	18.28mm	25.73mm	18.65mm	32.80mm		20.00cm	Left	Unfused
							202	18.60mm					2.41cm		
							203	18.65mm					2.47cm		
						MC	209	19.00mm	25.30mm	20.26mm	32.58mm		20.20cm	Right	Unfused
							212	18.96mm					2.50cm		
							213	19.27mm					2.50cm		
						MT	220	17.50mm	25.58mm	18.05mm	31.77mm		20.95cm	Left	Unfused
							224	17.98mm					2.25cm		
							225	18.79mm					2.28cm		
						MT	231	17.29mm		17.99mm	31.63mm		20.80cm	Right	Unfused
							236	18.32mm					2.20cm		
							237	17.71mm					2.26cm		
							238	19.71mm					4.55cm		
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	9										
							251	23.35mm	32.66mm	23.17mm			18.50cm	Distal	Partial
						MT	252			20.91mm	34.98mm		8.08cm	Left/Prox	Partial
							256	20.03mm	32.17mm					Distal	Partial
							261	23.16mm		20.85mm			18.70cm	Distal	Partial
						MT	262			19.98mm	30.56mm		11.56cm	Left/Prox	Partial

IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10										
							264			19.08mm	31.39mm		14.37cm	Partial	
							265	18.90mm	27.60mm				8.50cm	Partial	
							274	18.98mm		29.84mm	29.40mm		26.30cm	Partial	Worn
							276	21.33mm	29.49mm				6.83cm	Partial	
						MC	277			23.99mm	35.53mm		10.00cm	Right/Prox	Partial
							280			19.60mm	33.11cm		19.90cm	Partial	
							295			21.54mm			20.10cm	Partial	
							298	21.16mm	30.24mm				8.04cm	Partial	
							299			23.67mm			13.25cm	Partial	
							303			19.96mm			9.06cm	Partial	
							309		29.10mm	25.16mm			21.20cm	Partial	
						MC	316	22.85mm		22.22mm	35.23mm		21.00cm~	Left	Partial
IV and V Valpo			Estero El Valle	Choapa IV R	190										
						MC	323			20.26mm	34.17mm		18.80cm	Partial	
						MT	324			18.97mm	35.20mm		11.52cm	Left	Partial
							325	20.26mm		19.36mm			14.65cm	Partial	
IV de Coquimbo	Elqui		Posesion Buenos Aires	Comunidad Caldera	11										
							332	21.74mm					3.63cm	Partial	
IV de Coquimbo	Elqui	Borde Costero	Parcela N. 24	Penuelas Coquimbo	12										
						MC	336	21.31mm	27.36mm	20.42mm	34.44mm		22.95cm	Right	
							342	21.24mm	28.74mm	21.18mm			11.51cm	Partial	
						MC	350			21.52mm	33.76mm		8.22cm	Partial	
							352			21.57mm			11.88cm	Partial	
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	18										
							376	19.26mm					2.15cm	Partial	
IV de Coquimbo	Limari	Valle Rio Hurtado	Alero SP Viejo Pichasca	Pichasca	20										
							384			21.68mm			15.32cm	Partial	
							389	19.92mm					2.24cm	Partial	
IV de Coquimbo	Elqui			F	21										
						MT	413	20.81mm	26.58mm	21.43mm	33.04mm		22.20cm	Left	
							419	23.23mm					7.91cm	Partial	
						MC	420			24.59mm	40.14mm		15.20cm	Left	Partial
							425	21.44mm					2.63cm	Partial	
							426	23.15mm					2.87cm	Partial	
						MC	427		28.12mm	23.90mm	41.78mm		20.48cm	Right	Partial
							434	20.59mm					3.43cm	Partial	
							435	20.06mm					3.08cm	Partial	
						MT	436			20.79mm	34.57mm		20.90cm	Left	Partial
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22										
							462	18.53mm						Partial	
							484	20.57mm					2.26cm	Partial	
							485		30.03mm	22.53mm			8.18cm	Partial	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24										
							519	18.98mm					5.78cm	Partial	
						MT	520			18.78mm	31.41mm		18.20cm	Left	Partial
							540	21.43mm	25.55mm	21.29mm			13.25cm	Partial	
							546	21.62mm					5.41cm	Partial	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	25										
							552				32.22mm		2.93cm	Partial	
							559	23.83mm					11.02cm	Partial	

							574 22.13mm					5.25cm	Partial	
							575 20.81mm					5.23cm	Partial	
							576			36.26mm		3.31cm	Partial	
IV and V Valpo	Choapa-Petorca			La Villa Estero	199									
							593 19.31mm					4.85cm	Partial	
						MT	594 20.83mm		19.46mm	36.25mm		23.10cm	Right	Partial
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26									
							601 16.22mm						Partial	Juv/Worn
							602 17.64mm						Partial	Juv/Worn
							603 14.98mm						Partial	Juv/Worn
							611	24.49mm	20.13mm	33.45mm		20.20cm	Partial	Juv/Worn
							613 18.61mm						Partial	Juv/Worn
							614 16.58mm						Partial	Juv/Worn
							616 16.82mm	23.55mm	19.02mm	32.24mm		20.40cm	Left/Partial	Juv/Worn
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27									
						MC	636 18.46mm	29.55mm	22.06mm	36.08mm		21.52cm	Right	
						MT	651 18.80mm	24.95mm	17.94mm	31.91mm		22.80cm	Left	
						MT	652 19.18mm	24.07mm	17.14mm	31.29mm		22.40cm	Right	
IV and V Valpo	Choapa-Petorca			La Villa Estero	200									
						MT	666		20.28mm	33.95mm		19.60cm	Left/Partial	
						MT	667 22.23mm		19.70mm	36.20mm		24.30cm	Right/Partial	
						MT	668 22.70mm	26.78mm	20.36mm	36.84mm		24.30cm	Left	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar		28									
							676 21.52mm					2.52cm	Partial	
							687 18.82mm					6.58cm	Partial	
							688 18.74mm					6.07cm	Partial	
							692 21.37mm					2.25cm	Partial	
						MC?	698			35.52mm		4.96cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	208									
							702 18.55mm						Partial	
							709	30.32mm				4.78cm	Partial	
							710		24.41mm			11.13cm	Partial	
							711		19.04mm	31.02mm		18.50cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174									
							715	26.38mm	18.94mm			9.39cm	Partial	
							717		22.00mm	32.23mm		8.09cm	Partial	
							718	27.95mm	23.44mm	35.39mm		20.95cm	Partial	
							719 17.19mm					3.42cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	189									
							739		19.36mm			16.70cm	Partial	
							745		17.79mm			6.95cm	Partial	
						MC	746	28.23mm	21.48mm	33.72mm		20.05cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	207									
						MT	748		19.94mm	34.57mm		16.25cm	Partial	
							750	29.08mm				7.96cm	Partial	
							751 19.14mm						Partial	
							752 17.50mm					2.81cm	Partial	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*									
							766	26.24mm	20.53mm			17.02cm	Partial	
							776 18.20mm					2.77cm	Partial	
							778 22.63mm					4.53cm	Partial	
							779 21.73mm					6.24cm	Partial	
							780 21.74mm	29.42mm				7.18cm	Partial	
							781 20.99mm	29.76mm	23.22mm			10.05cm	Partial	
						MC	782		23.70mm	35.22mm		13.46cm	Partial	
						MT	783		22.11mm	33.35mm		11.67cm	Right/Partial	
						MT	784		24.90mm	34.41mm		15.43cm	Partial	
						MC	787 19.67mm	29.83mm	24.50mm	34.52mm		20.20cm	Partial	

Calcaneus												
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**	**Measurement 3**	**Total Length**	**Notes**	
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1		Proximal	Shaft	Distal			
						14	26.73mm	20.45mm	27.17mm	8.63cm	Left	
						29	29.35mm	28.78mm	38.31mm	9.82cm		
						30	29.20mm	28.28mm	40.72mm	9.74cm		
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4							
						107	20.33mm	22.70mm	28.78mm	7.67cm	Right	Unfused
						108	21.17mm	23.32mm	29.73mm	7.59cm	Right	Unfused
						116	20.89mm	24.16mm	31.55mm	8.13cm	Right	Unfused
						117	21.29mm	25.55mm	32.71mm	8.19cm	Left	Unfused
						130	26.34mm	24.38mm	30.31mm	8.65cm	Right	
						137	26.40mm	28.05mm	31.98mm	8.91cm	Left	
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Centro	5							
						172	24.76mm	26.01mm	32.44mm	8.64cm	Left	
						179	27.37mm	31.40mm	21.55mm	7.47cm	Left	
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8							
						222	22.12mm	23.67mm	32.16mm	7.88cm	Left	Unfused
						235	20.54mm	22.72mm	32.05mm	7.87cm	Right	Unfused
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10							
						282	21.75mm	24.92mm		6.34cm	Partial	
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	14							
						349	20.82mm	21.67mm		5.01cm	Partial	Burnt
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21							
						404	24.71mm	25.58mm	33.61mm	8.80cm	Left	
						439	26.60mm	26.28mm	35.42mm	9.11cm	Right	
III	Huasco		Calle Independencia	Choapa IV	252							
						499	25.75mm	25.23mm	35.45mm	9.67cm	Right	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	25							
						551	28.15mm	28.96mm	35.74mm	8.49cm	Right	Partial
						558	26.45mm		31.25mm	9.14cm	Right	Partial
IV and V Valpo	Choapa-Petorca			La Villa Estero	199							
						586	29.50mm	30.44mm	36.91mm	10.26cm	Right	
						587	27.34mm	26.76mm	34.95mm	9.42cm	Right	
						588	25.60mm	27.10mm	34.49mm	9.41cm	Left	
						589	29.62mm	30.42mm	36.53mm	10.00cm	Left	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27							
						641	22.86mm	24.87mm	32.08mm	8.38cm	Left	
						642	22.77mm	24.39mm	32.32mm	8.68cm	Right	
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar		28							
						672		21.75mm		7.26cm	Right	Partial
						683	21.69mm	24.57mm	30.32mm	8.33cm	Left	
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*							
						773	25.07mm	27.72mm		7.55cm	Right	Partial

Calcaneus

Region	Province	Area	Site	Sector	Box #	Picture #	Measurement 1	Measurement 2	Measurement 3	Total Length	Notes
							Proximal	Shaft	Distal		
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1	14	26.73mm	20.45mm	27.17mm	8.63cm	Left
						29	29.35mm	28.78mm	38.31mm	9.82cm	
						30	29.20mm	28.28mm	40.72mm	9.74cm	
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4	107	20.33mm	22.70mm	28.78mm	7.67cm	Right Unfused
						108	21.17mm	23.32mm	29.73mm	7.59cm	Right Unfused
						116	20.89mm	24.16mm	31.55mm	8.13cm	Right Unfused
						117	21.29mm	25.55mm	32.71mm	8.19cm	Left Unfused
						130	26.34mm	24.38mm	30.31mm	8.65cm	Right
						137	26.40mm	28.05mm	31.98mm	8.91cm	Left
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Centro	5	172	24.76mm	26.01mm	32.44mm	8.64cm	Left
						179	27.37mm	31.40mm	21.55mm	7.47cm	Left
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8	222	22.12mm	23.67mm	32.16mm	7.88cm	Left Unfused
						235	20.54mm	22.72mm	32.05mm	7.87cm	Right Unfused
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10	282	21.75mm	24.92mm		6.34cm	Partial
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	14	349	20.82mm	21.67mm		5.01cm	Partial Burnt
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21	404	24.71mm	25.58mm	33.61mm	8.80cm	Left
						439	26.60mm	26.28mm	35.42mm	9.11cm	Right
III	Huasco		Calle Independencia	Choapa IV	252						
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar	E	25	499	25.75mm	25.23mm	35.45mm	9.67cm	Right
						551	28.15mm	28.96mm	35.74mm	8.49cm	Right Partial
						558	26.45mm		31.25mm	9.14cm	Right Partial
IV and V Valpo	Choapa-Petorca			La Villa Estero	199						
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar	D	27	586	29.50mm	30.44mm	36.91mm	10.26cm	Right
						587	27.34mm	26.76mm	34.95mm	9.42cm	Right
						588	25.60mm	27.10mm	34.49mm	9.41cm	Left
						589	29.62mm	30.42mm	36.53mm	10.00cm	Left
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar			641	22.86mm	24.87mm	32.08mm	8.38cm	Left
						642	22.77mm	24.39mm	32.32mm	8.68cm	Right
IV de Coquimbo	Elqui	Barrio la Compania	El Olivar-Lateo Brillmar		28						
						672		21.75mm		7.26cm	Right Partial
						683	21.69mm	24.57mm	30.32mm	8.33cm	Left
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*						
						773	25.07mm	27.72mm		7.55cm	Right Partial

Talus									
Area	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**	**Measurement 3**	**Notes**	
Borde Costero	El Olivar	Compania Baja	1		Length	Proximal Width	Distal Width		
				40	36.21mm	25.90mm	29.65mm	Left	
				41	36.26mm	24.89mm	29.03mm	Right	
			2						
				80	34.30mm	26.27mm	27.27mm	Right	
Borde Costero	Parcela N.21	Penuelas	3						
				96	29.19mm	24.80mm	25.02mm	Left	
Borde Costero	Parcela N.24	Penuelas	4						
				118	33.65mm	27.65mm	27.85mm	Right	
				119	33.62mm	27.92mm	28.77mm	Left	
				127	32.71mm	23.71mm	22.10mm	Left	
				128	29.95mm	23.09mm	22.56mm	Left	
				129	30.53mm	22.17mm	22.46mm	Right	
				131	29.68mm	26.17mm	24.73mm	Right	
				134	32.24mm	24.35mm	24.45mm	Right	
				138	34.04mm	26.64mm	26.96mm	Left	
				139	33.94mm	25.63mm	24.70mm	Right	
				140	34.13mm	27.41mm	28.49mm	Right	
Interior	Plaza de Armas	Urbano Centro	5						
				173	36.08mm	24.56mm	23.81mm	Left	
				178	37.67mm	37.48mm	40.09mm	Left	
Interior	Museo del Desierto	Baja de Panuelas	8						
				221	33.04mm	26.91mm	26.84mm	Left	
				234	32.98mm	25.99mm	27.19mm	Right	
Interior	Plaza G Mistral	Urbano Centro	10						
				283	31.86mm	25.32mm	26.36mm	Right	
				286	29.90mm	26.36mm	26.55mm	Left	
				305	30.67mm	23.70mm	25.34mm	Left	
Penuelas	Museo del Desierto	Todos	15						
				361	32.78mm	27.21mm	26.50mm	Left	
Penuelas	Museo del Desierto	Todos	16/17						
				369	32.13mm	26.09mm	24.58mm	Worn	
Penuelas	Museo del Desierto	Todos	18						
				374	34.64mm	27.48mm	24.58mm	Left	
Barrio La Compania	El Olivar-Lateo Brillmar	F	21						
				403	34.69mm	27.78mm	27.45mm	Left	
				440	33.56mm	29.79mm	26.38mm	Right	
Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22						
				451	33.63mm	25.16mm	27.80mm	Left	
				452	32.43mm	26.46mm	28.09mm	Right	
				465	33.49mm	26.29mm	26.61mm	Right	
	Calle Independencia	Choapa IV	252						
				500	35.53mm	27.45mm	29.65mm	Right	
Barrio la Compania	El Oliver-Lateo Brillmar	E	25						
				561	34.45mm	27.00mm	27.21mm	Left	
				562	38.54mm	28.87mm	30.50mm	Right	
				567		25.31mm		Partial	
				568		25.32mm		Left	Partial

		La Villa Estero		199						
					590	36.46mm		28.86mm	31.57mm	Left
					591	34.70mm		27.00mm	29.75mm	Right
					592	34.24mm		27.86mm	27.54mm	Right
Barrio la Compania	El Oliver-Lateo Brillmar	D		27						
					643	32.35mm		25.77mm	25.98mm	Left
					644	32.48mm		25.72mm	26.00mm	Right
Barrio la Compania	El Oliver-Lateo Brillmar			28						
					691	34.33mm		25.76mm		Left
Urbano Centro	Plaza G. Mistral	Aldunate		174						
					736	32.22mm		22.86mm	21.04mm	Right

Cuboid								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1		Length	Width
						48	33.48mm	19.16mm
						49	34.40mm	17.88mm
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4			
						125	33.80mm	17.98mm
						132	32.16mm	18.37mm
						135	26.32mm	16.93mm
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Centro	5			
						180	32.82mm	18.72mm
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8			
						223	32.18mm	14.34mm
						232	31.65mm	16.44mm
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10			
						284	31.39mm	17.93mm
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	14			
						346	33.16mm	31.39mm
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	18			
						375	34.28mm	24.96mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21			
						409	30.58mm	19.28mm
						437	34.19mm	24.15mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22			
						457	33.47mm	24.40mm
III	Huasco		Calle Independencia	Choapa IV	252			
						493	31.12mm	20.28mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	25			
						569	32.37mm	23.13mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27			
						637	31.43mm	24.06mm
						638	31.60mm	24.23mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	207			
						749	34.04mm	22.18mm

Lunate								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania Baja	1		Length	Width
						46	26.27mm	17.12mm
						47	25.56mm	17.36mm
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8			
						200	27.08mm	13.46mm
						210	27.80mm	13.56mm
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10			
						308	22.93mm	13.55mm
IV de Coquimbo	Elqui		Posesion Buenos Aires	Comunidad Caldera	11			
						334	27.40mm	18.22mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21			
						423	28.64mm	17.42mm
						429	22.38mm	16.73mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26			
						612	23.33mm	13.64mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27			
						631	25.53mm	14.45mm
						632	26.09mm	14.33mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar		28			
						684	23.34mm	14.68mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	208			
						703	24.71mm	16.70mm
						705	23.80mm	15.97mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174			
						720	24.07mm	12.97mm
						721	25.60mm	13.42mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	188			
						764	23.04mm	13.48mm

Unciform								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	18		Length	Width
						380	29.84mm	21.61mm
IV de Coquimbo	Limari	Valle Rio Hurtado	Alero SP Viejo Pichasca	Pichasca	20			
						383	31.96mm	21.93mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22			
						460	28.38mm	16.04mm
III	Huasco		Calle Independencia	Choapa IV	252			
						491	31.08mm	21.22mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24			
						521	31.48mm	21.08mm
						522	30.29mm	20.36mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26			
						610	27.21mm	17.14mm
						619	27.54mm	17.17mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27			
						625	28.97mm	20.67mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	208			
						706	26.02mm	18.11mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174			
						722	26.29mm	15.95mm

Navicular								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Borde Costero	Parcela N.24	Penuelas	4		Length	Width
						126	29.28mm	13.63mm
						133	25.29mm	14.50mm
						136	23.63mm	14.84mm
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Panuelas	8			
						233	25.83mm	14.24mm
IV de Coquimbo	Elqui	Interior	Plaza G Mistral	Urbano Centro	10			
						285	24.87mm	15.15mm
						287	25.41mm	16.25mm
						304	24.83mm	16.15mm
IV de Coquimbo	Elqui		Posesion Buenos Aires	Comunidad Caldera	11			
						333	27.02mm	16.96mm
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	14			
						347	28.69mm	17.78mm
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	16/17			
						367	22.49mm	11.98mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21			
						438	26.11mm	18.00mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	A,B,C,D,E,F	22			
						478	26.13mm	15.78mm
III	Huasco		Calle Independencia	Choapa IV	252			
						492	25.72mm	18.95mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24			
						525	23.94mm	13.53mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	25			
						570	29.03mm	16.47mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27			
						639	25.46mm	16.93mm
						640	25.25mm	16.81mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar		28			
						677	24.95mm	15.30mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	206*			
						774	26.18mm	14.39mm

Pisiform								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21		Length	Width
						421	28.07mm	21.60mm
						428	27.55mm	18.87mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24			
						516	26.65mm	29.22mm
						523	29.49mm	25.69mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	26			
						620	24.71mm	21.49mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27			
						630	24.59mm	23.93mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	174			
						723	26.15mm	23.47mm
						728	22.61mm	23.19mm
Scaphoid								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Interior	Plaza de Armas	Urbano Ce	5		Length	Width
						181	34.27mm	29.85mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21			
						410	22.08mm	20.61mm
						422	24.51mm	20.96mm
III	Huasco		Calle Independencia	Choapa IV	252			
						497	21.45mm	17.27mm
Magnum								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Penuelas	Museo del Desierto	Todos	16/17		Length	Width
						364	26.71mm	20.50mm
IV de Coquimbo	Elqui	Barrio La Compania	El Olivar-Lateo Brillmar	F	21			
						424	22.38mm	19.95mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	E	24			
						524	24.71mm	16.22mm
IV de Coquimbo	Elqui	Barrio la Compania	El Oliver-Lateo Brillmar	D	27			
						633	22.05mm	18.28mm
IV de Coquimbo	Elqui	Urbano Centro	Plaza G. Mistral	Aldunate	208			
						704	18.81mm	16.86mm
Unidentifiable Carpals								
Region	**Province**	**Area**	**Site**	**Sector**	**Box #**	**Picture #**	**Measurement 1**	**Measurement 2**
IV de Coquimbo	Elqui	Borde Costero	El Olivar	Compania	1		Length	Width
						23	25.79mm	12.92mm
IV de Coquimbo	Elqui	Interior	Museo del Desierto	Baja de Pa	8		Length	Width
						201	24.21mm	13.31mm
						211	24.17mm	13.80mm

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