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Shape evolution and sexual dimorphism in the mandible of the dire wolf, Canis Dirus, at Rancho la Brea

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SHAPE EVOLUTION AND SEXUAL DIMORPHISM IN THE MANDIBLE OF THE DIRE WOLF, *CANIS DIRUS*, AT RANCHO LA BREA

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ABSTRACT

The Rancho La Brea tar pits are a classic fossil lagerstätten, famous for the deposition of episodic accumulations of large numbers of fossils over short intervals in the late Pleistocene. I analyzed 157 *Canis dirus* (dire wolf) hemi-mandibles from Rancho La Brea through a 2D landmark-based morphometric analysis to test for size and shape changes through time. I scored 16 landmarks on each mandible gathered from four pits of different ages: 61/67 (~13-14 thousand years ago [ka]), 13 (~17-18 ka), 2051 (~26 ka), and 91 (~28 ka). Analyses indicate size does change through time, and shares a broad correlation with climate change. A principal components analysis revealed shape variables also fluctuated from pit to pit. Other environmental effects, such as competition, nutritional stress, and prey-preference, may also vary through time. These effects, along with climate, must be considered in determining the causalities of the size and shape changes we see in the dire wolf jaws. In addition, some sexually dimorphic signals are also distinguishable among the mandibles, and are similar to those seen in the extant gray wolf (*Canis lupus*).

CONTENTS

CHAPTER 1

INTRODUCTION

Background

The end of the Pleistocene epoch (2.6-0.01 Ma) saw numerous, extreme fluctuations in global climate, as well as the demise of many genera of large mammals (Barnosky et al., 2003; Rahmstorf, 2003; Barnosky et al., 2004; Koch and Barnosky, 2006). The causality of these global extinctions are contentious, but some combination of climate change and overkill by humans is the current consensus (Koch and Barnosky, 2006; Gill et al., 2009; MacDonald et al., 2012; Guthrie, 2006; Nogues-Bravo et al., 2008). Analyzing the structure of the fossil communities leading up to the end Pleistocene megafaunal extinctions may allow for clearer interpretations of the causalities of these extinctions.

The Rancho La Brea tar pits are located in Los Angeles, California. They are famous for the deposition of episodic accumulations of large numbers of fossils during the terminal Pleistocene (Stock and Harris, 1992). These asphaltic seeps range in age from ~50,000-10,000 years ago (O'Keefe et al., 2009). The pits formed when Paleogene oil deposits migrated to the surface and formed open pools where plants and animals became entrapped. The open seeps were then covered by alluvial sediments (Quinn, 1992; Frisca et al., 2008; O'Keefe et al., 2009). Radiocarbon dating has provided depositional time frames for each pit, and the foundation of a climate correlation to these times of deposition. The La Brea tar pits are exceptional and offer an important opportunity to study fossil communities through dramatically varying Pleistocene climates (Stock and Harris, 1992; Meachen et al., 2014; O'Keefe et al., 2014).

Carnivores are found in high proportions in the pits at Rancho La Brea; a ratio of 10 carnivores for every 1 herbivore, the opposite of what is seen in nature and at most fossil sites

(Stock and Harris, 1992; Binder and Van Valkenburgh, 2010). This disparity is due to the method of entrapment at the tar pits, where one herbivore became mired in the tar and attracted a large number of carnivores, which then became mired themselves. Carbone et al. (2009) suggested a carcass domination scenario, where large, social carnivores were more likely to become entrapped due to greater attraction to the sights and sounds of easy prey and the willingness to challenge other predators for this opportunity. A recent study supported this hypothesis by reporting significantly higher social carnivoran abundance at Rancho La Brea in comparison to the fauna of Southern California and North America as a whole (McHorse et al, 2012). The most common species at Rancho La Brea is the dire wolf, *Canis dirus* (Leidy, 1854), an extinct wolf species endemic to North and South America (Dundas, 1999). The dire wolf comprises over 50 % of the relative abundance of carnivorans at Rancho La Brea (McHorse et al., 2012). Because of the large numbers of dire wolf fossils, and the radiocarbon dating of each pit, *C. dirus* is an excellent species for the examination of shape over time at Rancho La Brea. The dire wolf is classified as a carnivoran within the family Canidae (Tedford et al., 2009), and it will be the focus species of this project.

The Origin of Dogs. The order Carnivora appeared in the early Paleocene (65-60 Ma) and encompasses a great diversity of mammalian lineages, including 11 extant families (Van Valkenburgh, 2007). The first true carnivorans, diagnosed by the presence of derived teeth called carnassials, reside in the extinct family Viverravidae, and spread throughout most of the world during the early Tertiary. Determining this lineage as a progenitor for later carnivorans, including the families Felidae and Hyaenidae, has remained controversial (Polly et al., 2006; Wang and Tedford, 2008). Fossil remains of viverravids are rare, and gaps in the fossil record complicate reconstructions of phylogenetic relationships. Evidence of plesiomorphic characteristics within the auditory bulla of *Viverravus acutus* place viverravids outside of crown-group Carnivora, indicating this family probably did not give rise to the extant members of this order. The family Miacidae, another ancient lineage of early carnivorans, is thought to be the ancestor of many, if not all, modern families within Carnivora (Polly et al., 2006; Heinrich et al., 2008). The earliest known miacids of North America have been excavated from northwestern Wyoming basins and are of early Eocene in age, while coeval miacid remains have also been found in Europe (Heinrich et al., 2008; Smith and Smith, 2010). Miacids also possessed carnassial teeth, indicating their inclusion in Carnivora, but their dental adaptations were more generalized than those of viverravids (Wang and Tedford, 2008). The family Miacidae gave rise to species classified with the family Canidae, which also has North American origins (Wang and Tedford, 2008).

<u>*The Family Canidae.*</u> The family Canidae is composed of three subfamilies-Hesperocyoninae, Borophaginae, and Caninae. Hesperocyoninae and Borophaginae are completely comprised of extinct species, while Caninae is the only canid subfamily with modern members, as well as extinct taxa. Hesperocyonines are the most ancient of all canids, first appearing in the late Eocene (~36 Ma). The oldest member of this subfamily is *Prohesperocyon wilsoni*, and retains features of both miacids and canids; characteristics of the basicranium, including the presence of the tympanic bulla, indicate that this transitional species is a member of Canidae (Wang, 1994; Wang and Tedford, 2008; Lyras, 2009). *P. wilsoni* is only known from one skull and lower jaw and is interpreted as the earliest canid from which the entire family may be derived. Hesperocyonine diversity was at its highest during the Oligocene epoch (Figure 1). The genus *Hesperocyon* is particularly important, since later members separately gave rise to the other two

subfamilies of Canidae (Figure 2). This lineage persisted into the early Miocene, with *Ectopocynus simplicidens* as the terminal species.

Borophagines are often termed "hyaenoid dogs" because some species possess adaptations to bone crushing (durophagy) that evolved convergently with those of hyenas (Tseng and Wang, 2011). However, not all borophagines were specialized for durophagy; hypocarnivores, mesocarnivores, and hypercarnivores are all included within this clade (Van Valkenburgh et al., 2003). The borophagines were confined to the North American continent and contain 66 species-the largest of all Canidae subfamilies (Wang et al., 1999; Van Valkenburgh et al., 2003). The first borophagines appeared in in the middle Oligocene and were small in size. This lineage persisted until ~ 2 Ma (Wang and Tedford, 2008), reaching their highest diversity ~16 Ma when 16 species roamed North America (Figure 1; Van Valkenburgh et al., 2003). A tendency towards a larger body size and increased hypercarnivory (and eventually durophagy) evolved within the lineage through time. As hesperocyonines, the top predators of the time, became extinct, more carnivorous niches became available to borophagines; early borophagines appear more omnivorous during the reign of the previous subfamily (Wang et al., 1999; Van Valkenburgh et al., 2003). The largest canid to have ever lived, *Epicyon*, lived throughout western North America during the Miocene (Figure 3). *Epicyon* had an enlarged lower forth premolar, indicating bone cracking abilities. This feature is also seen in its descendant, the terminal genus of this subfamily, *Borophagus*. *Borophagus* also had other adaptations to assist in bone cracking, including a domed forehead and short snout (Tseng and Wang, 2010; Wang and Tedford, 2008; Anyonge and Baker, 2006).

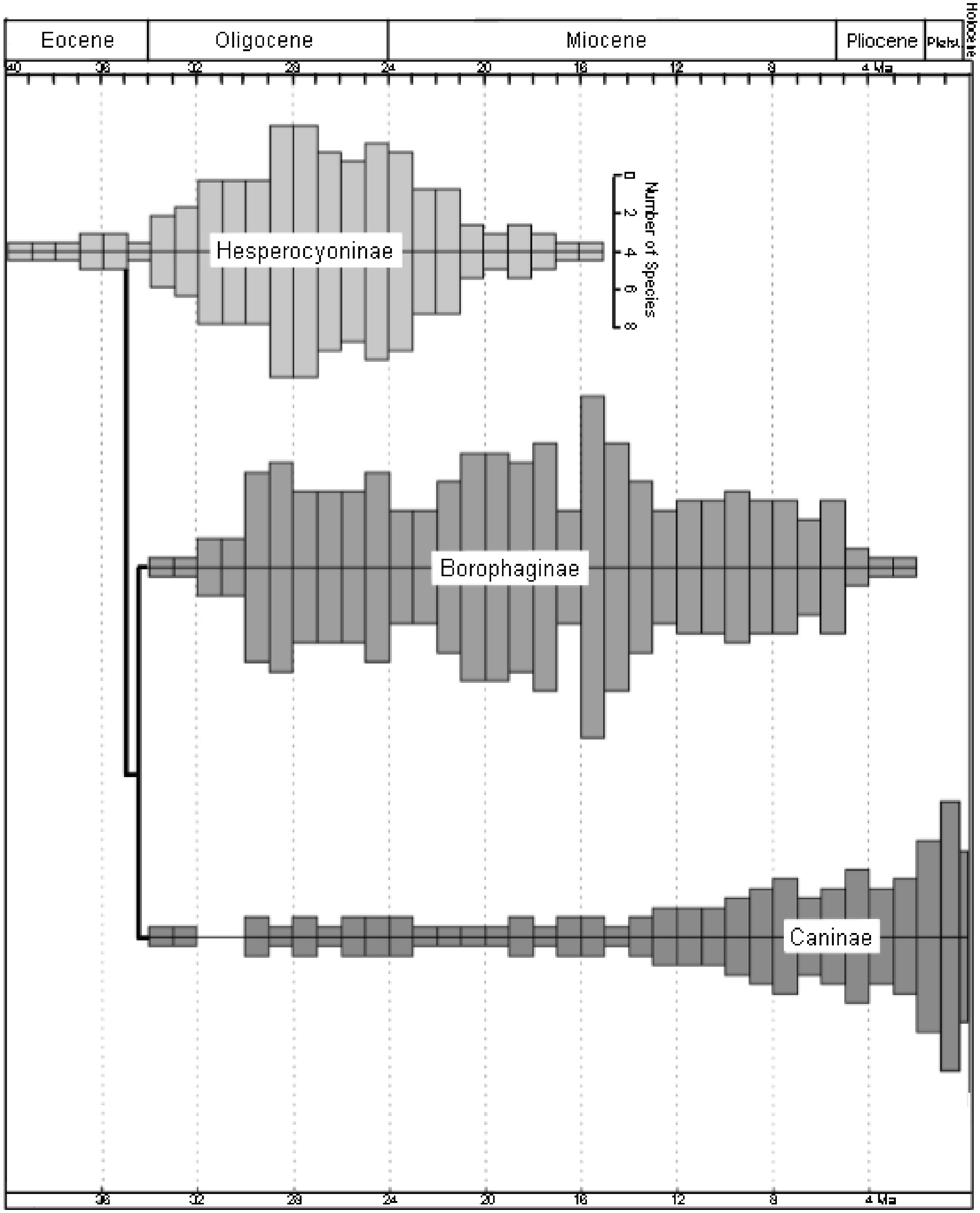


Figure 1. Diversity of the three subfamilies of Canidae at the species level per unit of time (1 Ma). Only North American taxa are included for Caninae. The expansion of diversity in succeeding subfamilies near the extinction of preceding clades is evident. Modified from Tedford et al. (2009).

Canines, comprising all members of the subfamily Caninae, arose in the early Oligocene alongside Borophaginae in North America (Figure 3). The *Hesperocyon* lineage within Hesperocyonidae gave rise to the first primitive, fox-sized canine species, *Leptocyon* (Figure 2). While Borophaginae and Caninae both possess carnassials with bicuspid talonid basins, *Leptocyon* differed from borophagines by having longer jaws with premolars separated by gaps (borophagine premolars are large without gaps). This initial canine genus has a suite of pleisomorphic characteristics, especially within dental features, when compared to later canines (Tedford et al., 1995; Wang and Tedford, 2008). All later canines evolved from *Leptocyon*, including the vulpine (fox) lineage. An important member of the Caninae line is *Eucyon*-the middle Miocene canid that gave rise to the genus *Canis*. *Eucyon*, along with *Canis* and later derived genera, are separate from the South America subtribe of Cerdocyonia and create the subtribe Canina (both subtribes are within the tribe Canini); Cerdocyonia phylogenetically stands between the subtribe Canina and the vulpine tribe, Vulpini. The subtribe Canina is morphologically distinct from its close relatives in South America in sharing two particular features: a strongly arched zygomatic arch and a second posterior cusp on the lower forth premolar (Tedford et al., 2009).

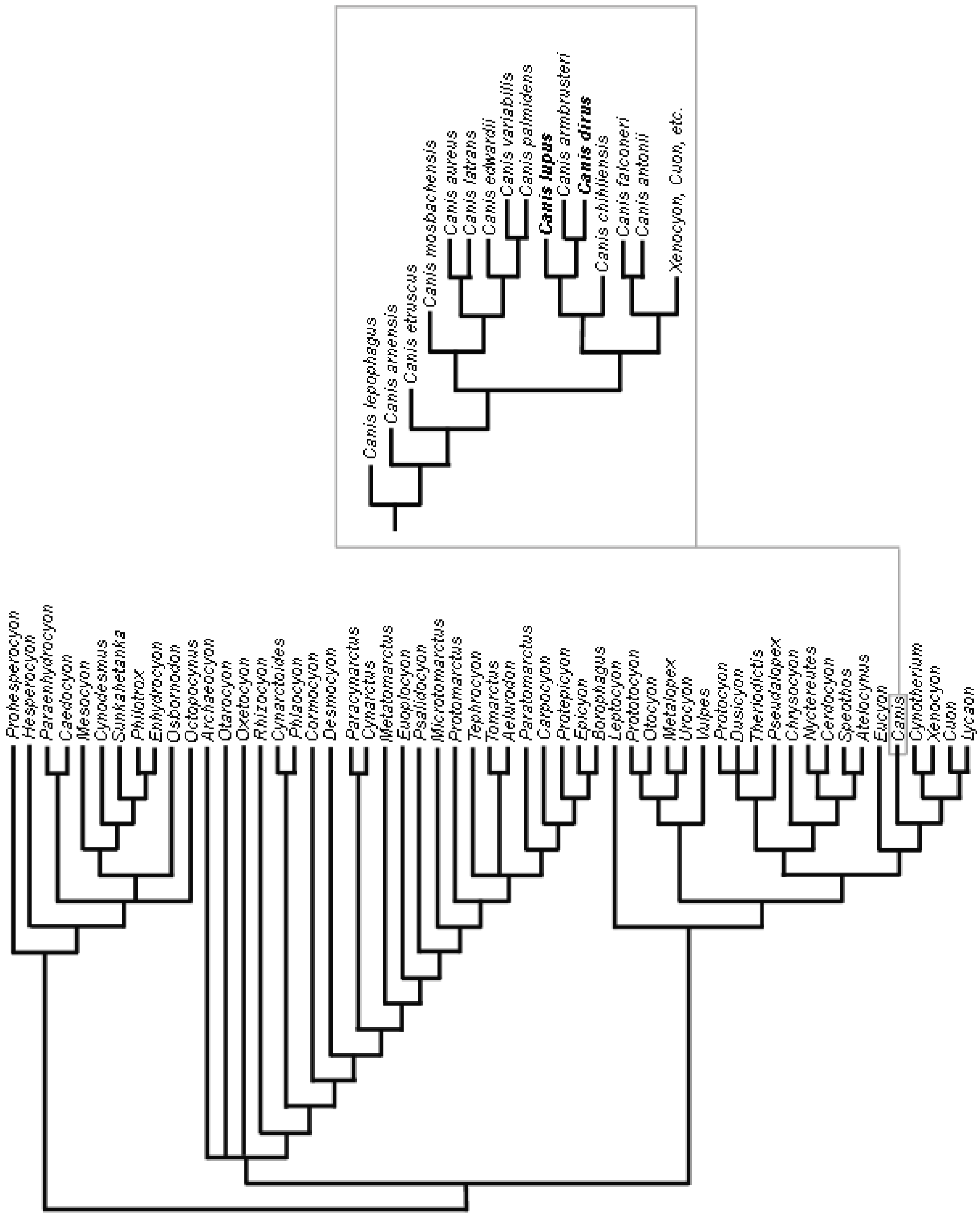


Figure 2. Cladogram of Canidae. The gray box displays a more detailed cladogram of the genus *Canis*. Modified from Tseng and Wang (2011) and Tedford et al. (2009). Data for the cladogramss are from Wang (1994), Wang et al. (1999), and Tedford et al (2009).

Eucyon davisi appeared in North America ~7 Ma (late Miocene), and expanded its range into Eurasia ~6-5 Ma through the use of the Beringian land bridge. *Eucyon* disappeared in North

America in the early Pliocene (~5 Ma), but persisted in Asia until ~3 Ma. *Eucyon* in Eurasia expanded in Africa and radiated into other Eurasian species (Figure 3). The genus *Canis* arose from North American *Eucyon* ~6 Ma, about the same time *Eucyon* radiated across the world (Wang and Tedford, 2008). It took almost 2 million years for *Canis* to invade Asia; the first immigrant to arrive was *C. chihliensis*. From this initial stock of species that migrated into the Old World, *Canis* continued to expand its range, radiate within the genus, and give rise to other genera (*Xenocyon*, which then gave rise to *Cuon* [dhole] and *Lycaon* [African hunting dog]) (Tedford et al., 1995; Tedford et al., 2009; Wang and Tedford, 2008).

Of particular importance to *Canis dirus* evolution is *Canis armbrusteri*. Although *C. armbrusteri* fossils have been found only in North America and appear suddenly on this continent in the early Pleistocene (~1.5 Ma), it has been suggested that this wolf immigrated from Asia. This wolf is of a large size compared with contemporaneous species of *Canis*, and predates the appearance of wolf-sized canines in Europe; it is also the first wolf-sized species within the subtribe Canina to appear in North America. However, *C. chihliensis* is a large canine of the late Pliocene found in China and is a sister taxon to the Holartic and North American *Canis lupus* (the gray wolf, European origin; Figure 2). Because there are a number of similarities among *C. armbrusteri*, *C. lupus*, and *C. dirus* (the dire wolf, endemic to North and South America), extensive research on the phylogenetic relationships between these three species has been performed (Tedford et al., 2009). It has been suggested that *C. armbrusteri* is a descendant of the *C. chihliensis* lineage, while the dire wolf arose from *C. armbrusteri* after its immigration into the New World (Figures 2 and 3; Tedford et al., 2009; Wang and Tedford, 2008).

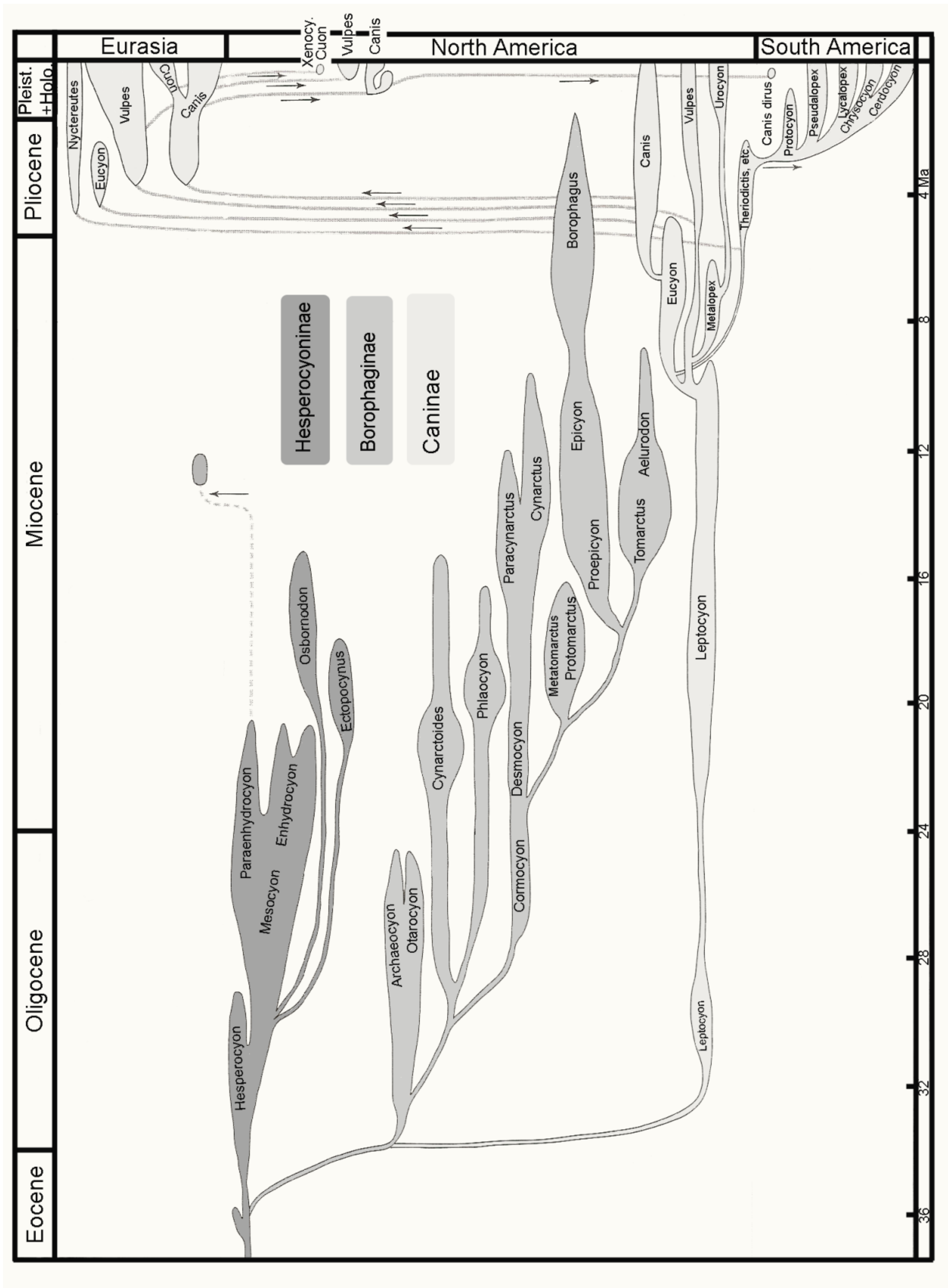


Figure 3. The phylogenetic relationship between the three subfamilies, as well as some selected genera. Migration directions are also displayed by the arrows. The widths of the clades roughly correlate to the diversity of the clade through time. Modified from Wang and Tedford (2008).

The Dire Wolf

The dire wolf was one of the last Pleistocene species to disappear during the megafaunal extinctions, with radiocarbon dates of Rancho La Brea specimens dating as late as 9850 ± 550 BP (Marcus and Berger, 1984). Furthermore, specimens from other sites date as recently as 8,200 ± 260 BP (Hester, 1960). The oldest record of dire wolf fossils are from the Sheridan Beds of Sheridan County, Nebraska and are late Irvington in age (~ 1 Ma). There are other late Irvington sites in Nebraska and California that contain dire wolf material, however, the Sheridan beds are considered to predate the others (Tedford et al., 2009). There are a number of autapomorphies distinguishing this species from other canines, with the majority being dental characteristics indicating a hypercarnivorous diet (Tedford et al., 2009). The dire wolf is largely of Rancholabrean age, and went extinct during the terminal Pleistocene (~10 Ka) along with many other megafaunal species (Tedford et al., 2009; Wang and Tedford, 2008; Dundas, 1999). *Canis dirus* is documented from over 120 sites in North and South America. Although suggestions of a South American origin have been proposed (Dundas, 1999), most researchers agree that the dire wolf arose in North America due to the abundance of northern localities and synapomorphies shared with *C. armbrusteri* (Tedford et al., 2009). Most fossil localities are located within the lower 48 states of the USA, but a few sites have been found to contain dire wolf material in southern Alberta, Canada and the north and west coasts of South America (Dundas, 1999; Tedford et al., 2009).

The dire wolf is the largest canine (extant and extinct) known within the genus *Canis*. While Van Valkenburgh and Koepfli (1993) estimated the mass of the dire wolf to be 50 kg from regressions of skull length and head-body length against body weight for extant carnivores, a more recent study by Anyonge and Roman (2006) estimated a heavier mass based on leastsquares and reduced-major-axis regression models for five measurements of the femur; they estimated an average body mass of 60kg for western dire wolves (those specimens studied from localities in California and Mexico; synonymous with *Canis dirus guildayi* [Kúrten 1984]) and 68kg for the eastern dire wolf (those specimens studied from localities in Texas, Florida, and Missouri; synonymous with *Canis dirus dirus* [Kúrten 1984]). Probably the most well-known fossils of western Pleistocene dire wolves are the exceptional remains from the Rancho La Brea tar pits in Los Angeles, CA (Stock and Harris, 1992).

Canis dirus and Canis lupus. The closest extant relative of the dire wolf is the gray wolf, *Canis lupus*. The gray wolf appeared in Eurasia ~1 million years ago and migrated to North America ~750,000 years ago; migrations to North America have occurred at least three times based on morphological data and biogeographical reconstruction. *C. lupus* and *C. dirus* cohabitated in North America for ~400,000 years (Figure 3; Paquet and Carbyn, 2003; Chambers et al., 2012). However, *C. lupus* was relatively rare in North America until the Pleistocene extinction and the demise of *C. dirus* (Dundas, 1999). The two wolf species are similar morphologically, and there is evidence for behavioral similarity, making *C. lupus* an excellent model for the dire wolf (Anyonge and Baker, 2006). For example, *C. dirus* and *C. lupus* share four specific synapomorphies in cranial and dental structures, including frontal sinuses that extend to the frontoparietal suture (Tedford et al., 2009). Previous studies on craniofacial measurements suggest that the two species are not significantly different in most indices related to cranial proportions and jaw musculature, indicating similar feeding and killing behavior between the gray wolf and dire wolf (Van Valkenburgh, 2007; Anyonge and Baker, 2006; Biknevicius and Van Valkenburgh, 1996). However, *C. dirus* has a larger dentition, including a more massive carnassial blade (Anyonge and Baker, 2006). *C. dirus* also has broader zygomatic arches and relatively longer temporal fossae which suggest a slightly larger bite force from more massive temporalis muscles (Biknevicius and Van Valkenburgh, 1996; Anyonge and Baker, 2006). This, in addition to larger, rounded canines, reveals that the dire wolf may have been able to resist the struggling of larger prey (Van Valkenburgh and Ruff, 1987).

Both species probably lived in packs, and display cursorial hunting adaptations to a hypercarnivorous diet comprised primarily of ungulates (Fox-Dobbs et al., 2007). Both species have been classified as hypercarnivores specializing in large prey based on linear discriminant analysis of mandibular morphology (Meloro, 2011). Killing strategies do not include using their limbs to grapple with prey or delivering a precise, fatal kill bite, unlike felids including *Smilodon fatalis* (Van Valkenburgh and Sacco, 2002; Meachen-Samuels, 2012). Instead, wolves work in groups, with some wolves holding down the prey item, while others make the kill (Van Valkenburgh, 2007). Both species have the ability to use postcarnassial molars for crushing bone and gaining access to marrow, but are not habitual bone crushers like some hyaenids (Anyonge and Baker, 2006). Body mass estimates indicate that the dire wolf was larger than the gray wolf, but analysis of an extinct Pleistocene gray wolf ecomorph of eastern-Beringia shows possible convergence on dire wolf morphology due to the dire wolf's absence in this region, and thus decreased competition with another, larger species (Anyonge and Roman, 2006; Leonard et al., 2007). Although there are some differences between *C. dirus* and *C. lupus*, the gray wolf remains the best modern analog for interpreting behavior and morphological variation in *Canis dirus*.

<u>Morphological Variation and the Environment</u>. A recent study has demonstrated significant geographic variation in shape and size in gray wolves (O'Keefe et al, 2013). Gray wolves follow Bergmann's Rule, an ecological trend stating that body size increases with increasing latitude and decreasing temperature (Jolicoeur, 1959; Skeel and Carbyn, 1977; Blackburn et al., 1999;

O'Keefe et al., 2013). However, recent work has suggested that size differences in gray wolves are related to resource availability rather than surface to volume ratio, as was originally suggested by Bergmann's rule (Geist, 1987; McNab, 2010). Although Bergmann's rule is predominantly seen as a latitudinal trend, this pattern has also been applied temporally (Gardner, 2011).

While climate may influence overall body size, other environmental effects may also impact the size and shape of canid mandibles. Because canids rely almost solely on their crania in prey aquisition (Slater et al., 2009), mandibles should reflect functional changes in prey capture. Functional changes may be induced by competition, prey availability, and prey-preference change through time. Previous studies on dire wolf tooth breakage and wear show fluctuations between high and low breakage and wear frequencies (Binder et al., 2002; Binder and Van Valkenburgh, 2010; O'Keefe et al., 2014). High levels of breakage and wear have been proposed to indicate increased inter- and intra-specific competition and/or nutrient stress (decreased food availability) (O'Keefe et al., 2014; Binder et al., 2002; DeSantis et al. 2012). Because breakage and wear data reflect environmental effects, it is worth testing whether mandible shape also changes during times of food stress.

Increased nutrient stress may have an ontogenetic effect on growing wolves, resulting in neotenic (more juvenile) characteristics. In mandibles, this would result in proportionally larger teeth in comparison to the bony jaw (O' Keefe et al., 2014). Examination of gray wolf morphological variation reveals an identifiable late-stage ontogenetic axis and indicates that dire wolf morphology may have a similar response (O' Keefe et al., 2013; O' Keefe et al., 2014). Evolutionary impacts are also possible with increased nutrient stress. If episodes of stress were long enough, mandibular morphology might adapt to increase bone-cracking and carcass utilization abilities. These changes may include a shortening of the jaw and a deepening of the corpus for a greater buttressing effect, as seen in hyenas (Tseng and Wang, 2010; Biknevicius and Ruff, 1992). A combination of both ontogenetic and evolutionary effects is also possible if periods of increased food stress were long.

In addition to size patterns, sexual dimorphism is detectable in gray wolf skulls. Although levels of sexual dimorphism in canids are low, distinct characteristics are found in association with size variation among the sexes of *C. lupus* (Van Valkenburgh and Sacco, 2002). Females are smaller than males and have proportionally larger molars, whereas males have relatively larger coronoid processes (O'Keefe et al., 2013; Milenkovic et al., 2010; O'Keefe et al., 2014; Jolicoeur, 1975). These features should be identifiable in the dire wolf mandibles if these ancient wolves displayed the same type of sexual dimorphism. In carnivores, larger species usually display increased amounts of sexual dimorphism; it is possible that the dire wolf shared the same sexually dimorphic characteristics as the gray wolf, but at an increased level (Meachen-Samuels and Binder, 2010).

Study Design

The Rancho La Brea tar pits are an excellent locality for examining late Pleistocene fossil communities. Each pit can be considered as a distinct depositional episode in the larger time range of ~50,000-10,000 years ago. However, strictly constraining the range of deposition for each pit has proven to be a challenge. O'Keefe et al. (2009) has provided a compilation of calibrated ages for 10 pits from previous studies, as well as new radiocarbon dates. All radiocarbon dates were generated from decalcified bone collagen taken from a variety of animal species, or from woody plant species. Unfortunately, the number of dates available for most pits is low, creating large spans of deposition for each pit (O'Keefe et al., 2009). The production of more radiocarbon dates for each pit will allow for tighter constraints and more precise average ages. For now, only broad interpretations of climate conditions for each pit may be made.

It is known, however, from North American climate records (North Greenland Ice Core Project [NGRIP], 2004) that climate changes between glacial and interglacial periods are cyclic, and they span time periods of different pit depositions; abrupt onsets of large amplitude warming events, named Dansgaard-Oeschger (D-O) events, were followed by more gradual cooling events (Figure 4; Rahmstorf, 2003). These D-O events are on the order of 10 degrees C and can change environments from glacial to interglacial in decades (Rahmstorf, 2003). At La Brea, both temperature and aridity would increase rapidly during D-O events and effect plant and herbivore communities. These effects would cascade up to carnivore groups (Meachen et al., 2014; O' Keefe et al, 2014). Due to the radiocarbon dates that are available for the pits, it is known that depositions include the Bølling-Allerød warming event, the Oldest Dryas cold interval, and the Younger Dryas cool interval (Rahmstorf, 2003; O' Keefe et al., 2009). The calibrated age of pit 61/67 (13-14 ka) is associated with the Bølling-Allerød warming event and is immediately prior to extinctions coincident with the Younger Dryas event, making it a vital pit to study (O' Keefe et al., 2009; Koch and Barnosky, 2006; Kennett et al., 2008; O' Keefe et al., 2014; Meachen et al., 2014). Although pit depositions may span multiple climatic events, the shifts in climate are important to consider when looking at changes within the fossil communities.

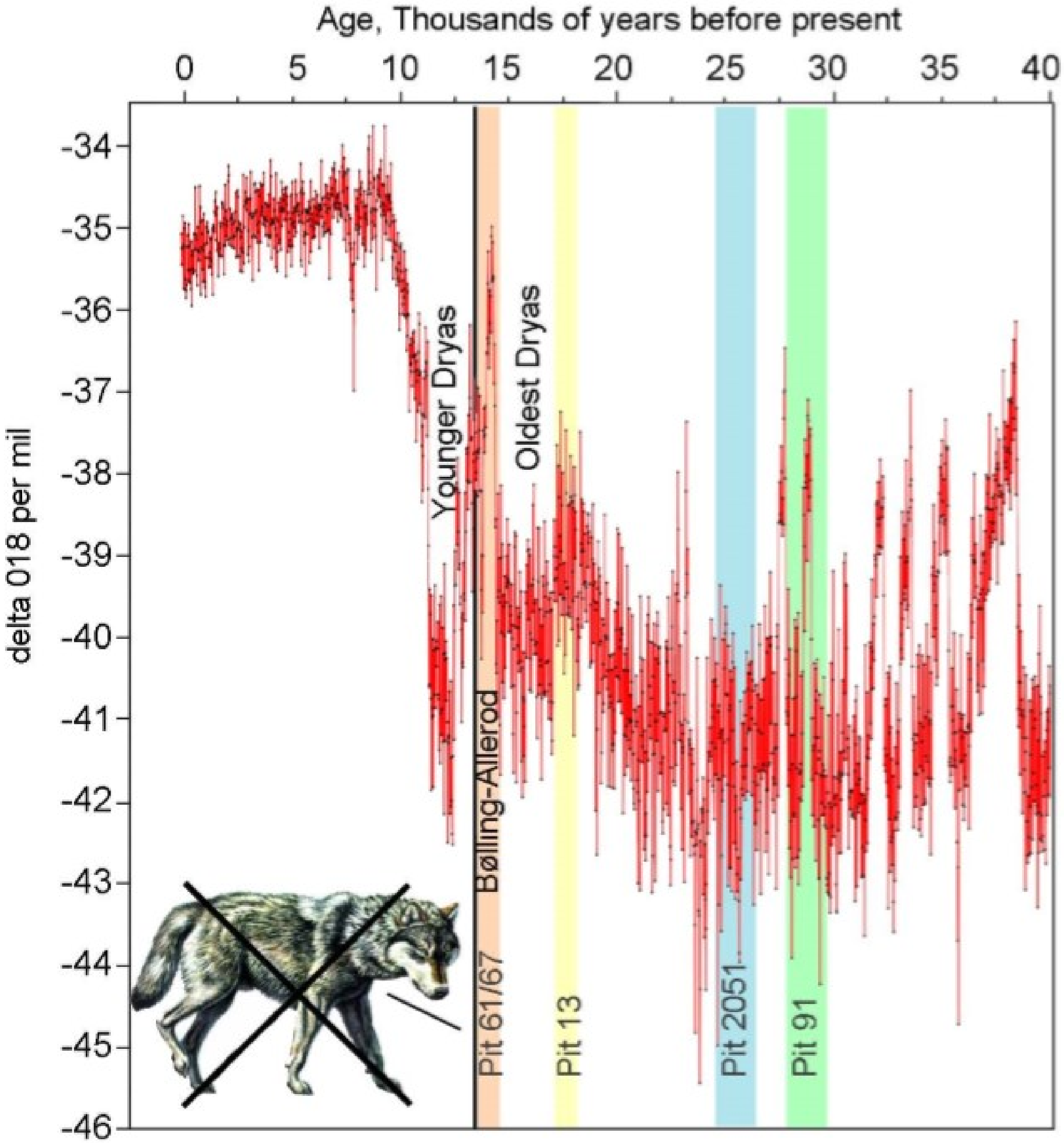


Figure 4. Climate data from NGRIP (2004). Depositions of pits in this study are highlighted, as well as climatic events. Modified from O'Keefe et al. (2014).

This project focuses on analyzing dire wolf mandibles to determine if shape and size remained static over time at Rancho La Brea. To test for change over time, shape and size in *Canis dirus* hemi-mandibles from Rancho La Brea were analyzed in a 2D landmark-based morphometric analysis. Mandibles gathered from four pits of different ages were included: 61/67 (~13-14 thousand years ago [ka]), 13 (~17-18 ka), 2051 (~26 ka), and 91 (~28 ka) (Meachen et al., 2014). Size comparisons among pits are completed through an analysis of variance on centroid size, while a principal components analysis is used to test if shape variables fluctuated from pit to pit. If size change does occur, I will examine these fluctuations in relation to Bergmann's rule on a temporal scale. If dire wolves follow a temporal version of Bergmann's Rule, than we would expect to see the largest *C. dirus* specimens from pits with the coldest climates. In addition to climate, other environmental effects, such as competition, nutritional stress, and prey-preference, may also vary through time. These effects must be considered in determining the causalities of changes we see in the dire wolf jaws.

Shape variations among pits will also be assessed. Using known morphological changes in the gray wolf, *Canis lupus*, and their correlations to environmental factors may shed light to possible causalities of changes seen in the dire wolf (O'Keefe et al., 2013). Sexually dimorphic characteristics will also be evaluated while examining shape. Assuming that sexual dimorphism does not vary over time, these signals should not segregate among pits. By examining how morphology varies in this carnivore, insight into fluctuations in their paleoecology leading up to its extinction and its responses to environmental pressures can be gained and may help decipher possible causes for the dire wolf's demise.

CHAPTER 2

LANDMARK-BASED SIZE AND SHAPE ANALYSES

Methods and Materials

Two-dimensional geometric morphometrics were used to analyze jaws of *Canis dirus*. I analyzed 157 complete, adult *C. dirus* hemi-mandibles. Digital photographs were taken of the labial side of specimens from pits 91(n = 22), 13 (n =36), and 61/67 (n = 83) from the George C. Page Museum Hancock Collection (LACMHC), and pit 2051 (n = 16) from the University of California Museum of Paleontology at Berkeley (UCMP) (Table 1). Photos for pit 2051 were taken by FRO and JAM, while photos for the 3other pits were taken by ALB and JAM. I analyzed left hemi-mandibles only for all pits, except pit 2051, where only right hemi-mandibles were examined. Only right hemi-mandibles were analyzed for pit 2051 due to higher sample size for this side of the jaw in this pit. Specimens from pit 2051 were horizontally inverted, using Adobe Photoshop CS2 v.9.0, before analysis. All specimens were laid flat and photographed with a tripod-mounted Cannon EOS 30D 8.20-megapixel camera with a 5 cm scale-bar. While camera angle and distance were held constant while photographing LACMHC specimens, scale-bars present in photographs were used to properly size UCMP specimen images to LACMHC specimen images in Adobe Photoshop CS2 v.9.0 before landmark digitization.

Table 1. Summary of the *Canis dirus* hemi-mandible material used in this study. Pit dates are in radiocarbon years before present and are condensed from O'Keefe et al., 2009. See O'Keefe et al. (2009) and Meachen et al. (2014) for calibration information. The pit ages here are mean ages in the windows of deposition.

Pit	Date (Kybp)	Number of Specimens (n)
91	≈ 23-28 calibrated kybp, majority of dates 27-28 kybp	22
2051	≈ 21-30 calibrated kybp, mean	16

	26 Kybp;	
13	≈17-18 calibrated kybp	36
61/67	≈13-14 calibrated kybp	83

Sixteen homologous landmarks were digitized on each specimen using the program tpsDig2 (Rohlf, 2013). Positions of landmarks were chosen to give a general outline of the mandible and capture information of functional relevance (Meachen et al., 2014;Table 2, Figure 1). Landmarks on the tooth row were placed on alveolus so specimens with missing teeth could be included in our dataset. However, presence of the lower carnassial tooth was required in order to obtain landmark 5. Landmark 5 properly distinguishes the trigonid basin from the talonid basin of this tooth. The alveolus of the carnassial does not accurately differentiate between these basins, so the tooth itself must be present.

Table 2. Descriptions of the 16 homologous landmarks placed on *Canis dirus* hemi-mandibles; See Fig.1

1. Anterior edge of the canine at the alveolus.
2. Posterior edge of the canine at the alveolus. Together landmarks 1 & 2 will give the anteroposterior width of the canine.
3. Anterior edge of p1 at the alveolus.
4. Posterior edge of the p4 at the alveolus. Together 3 & 4 will give the length of the premolar arcade.
5. Point on alveolus directly below anterior edge of the talonid basin of the m1. Together landmarks 4 & 5 will give the length of the shearing area of m1.
6. Alveolus of the posterior edge of m1. Together landmarks 5 & 6 will give the length of the grinding area of m1.
7. Posterior edge of m2 at the alveolus. Together landmarks 5 &7 will give an estimate for the grinding area
8. Anterior edge of the masseteric fossa. Disregard landmark movement in the coronal plane and focus only movement in the anteroposterior plane.
9. Top edge of the coronoid process.
10. Point where the coronoid process meets the condyloid process. Together landmarks 8 & 10 give the total width of the masseteric fossa.
11. Posterior edge of the condyloid process. Together landmarks 1 & 11 give an estimate of the total jaw length.
12. Posterior edge of the angular process.

13. Point where the ramus of the jaw moves from a horizontal plane to a vertical plane to the angle of the jaw. Together landmarks 9 & 13 will give the height of the coronoid process.
14. Inferior edge of mandible, directly below landmark #6. When taken with landmark 6, gives the height of the jaw in the coronal plane post m1 (Corpus Depth 3).
15. Inferior edge of mandible, directly below landmark #4. When taken with landmark 4, gives the height of the jaw in the coronal plane post p4 (Corpus Depth 2).
16. Inferior edge of mandible, directly below landmark #3. When taken with landmark 3, gives the height of the jaw in the coronal plane at the beginning of the premolar arcade (Corpus Depth 1).

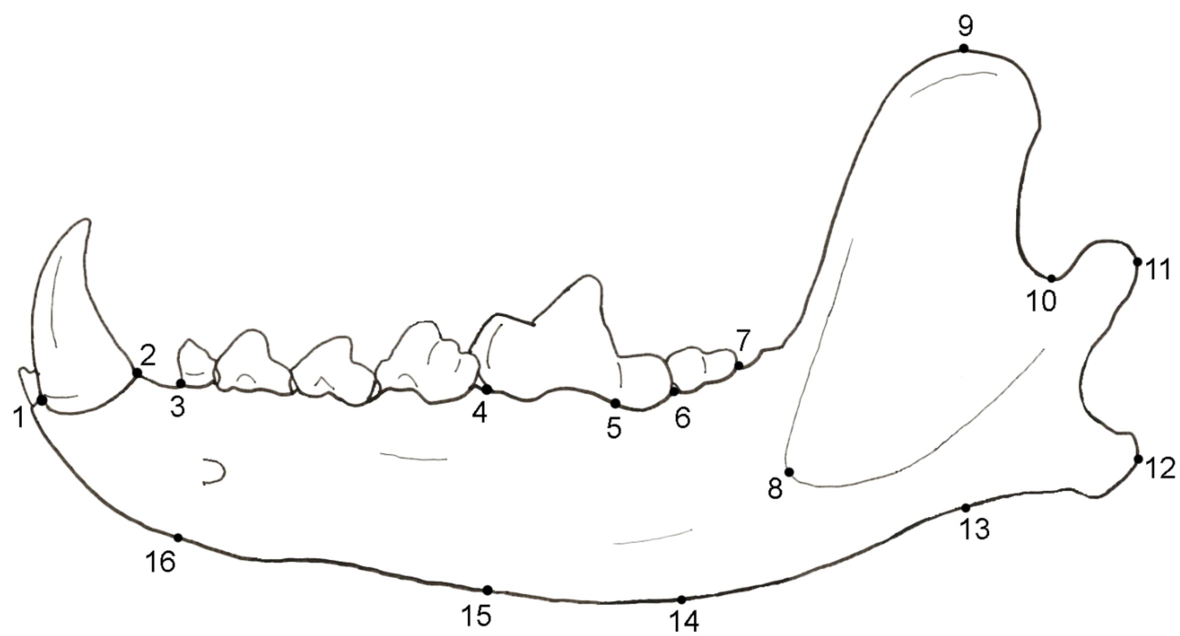


Figure 1.Generic *Canis dirus* hemi-mandible in labial view. Locations of 16 landmarks are also shown. See Table 2 for corresponding list and descriptions for landmark placement.

A Procrustes superimposition was performed on raw landmark x-y coordinates in Morphologika. A set of new x-y coordinates, with rotation and translation between specimens removed, was then used in further analyses (Zelditch et al., 2004). In order to determine if the large sample size in pit 61/67 effected the resulting Procrustes coordinates, 30 specimens from pit 61/67 (total of 104 specimens) were randomly selected using Microsoft EXCEL and subjected to a Procrustes superimposition. This process was replicated 3 times. No significant difference between the replicates and the original sample was detected; further analyses were conducted using the original sample of all 157 total specimens. Centroid size, a scaling variable, was also calculated, and provided a relative representation of mandible size for each specimen. Since mandible size and overall body size in carnivorans have been shown to be highly correlated (Figueirido et al., 2011), centroid size is used as a proxy for overall body size. Differences in size between pit samples were determined through an analysis of variance (ANOVA) on centroid size. Pairwise comparisons of centroid size means among pits were conducted by Student's T tests (Table 3).

A principal component analysis (PCA) was conducted on the Procrustes coordinates in order to investigate jaw shape variation within and among the pits sampled (Zelditch et al., 2004). The PCA was run in pcagen7_14a (Sheets, 2005), as well as the program JMP. Principal components were calculated from the covariance matrix of partial warp scores generated in pcagen7_14a and JMP. PC axes were used as shape variables to describe variance in shape among the specimens. Specimens were then identified by pit along each PC axis to evaluate mandibular shape. Both a set of ANOVAs and Student's T tests on the first four principal component scores were used to determine significant shape differences among the pits.

Shape changes along PC axes were visualized as vectors of mean landmark positions differences by 0.1 units in the positive direction (unless described otherwise). Pcagen7_14a was used to create the landmark vectors. The vectors showed the relative direction and magnitude of landmark displacement, allowing for a clearer interpretation of shape change along each PC axis.

Results

The ANOVA of centroid size showed that overall jaw size varied among the pits (Figure 2). Pit 61/67 displayed the largest size, but was only significantly larger than pit 2051 and 13.

The smallest jaw size was from pit 13, which was significantly smaller than all of the other pits. Pit 91 did not differ from either pit 2051 or pit 61/67 (Table 3).

Table 3. Centroid size pairwise comparisons. Significance of pairwise comparisons was determined by Student's T tests, and is delineated by stars. See Figure 2.

Comparison	**61/67-2051**	**61/67-13**	**61/67-91**	**13-91**	**2051-91**	**2051-13**
Size	p<0.0412*	p<0.0001*	p<0.7950	p<0.0001*	p<0.01304	p<0.0062*

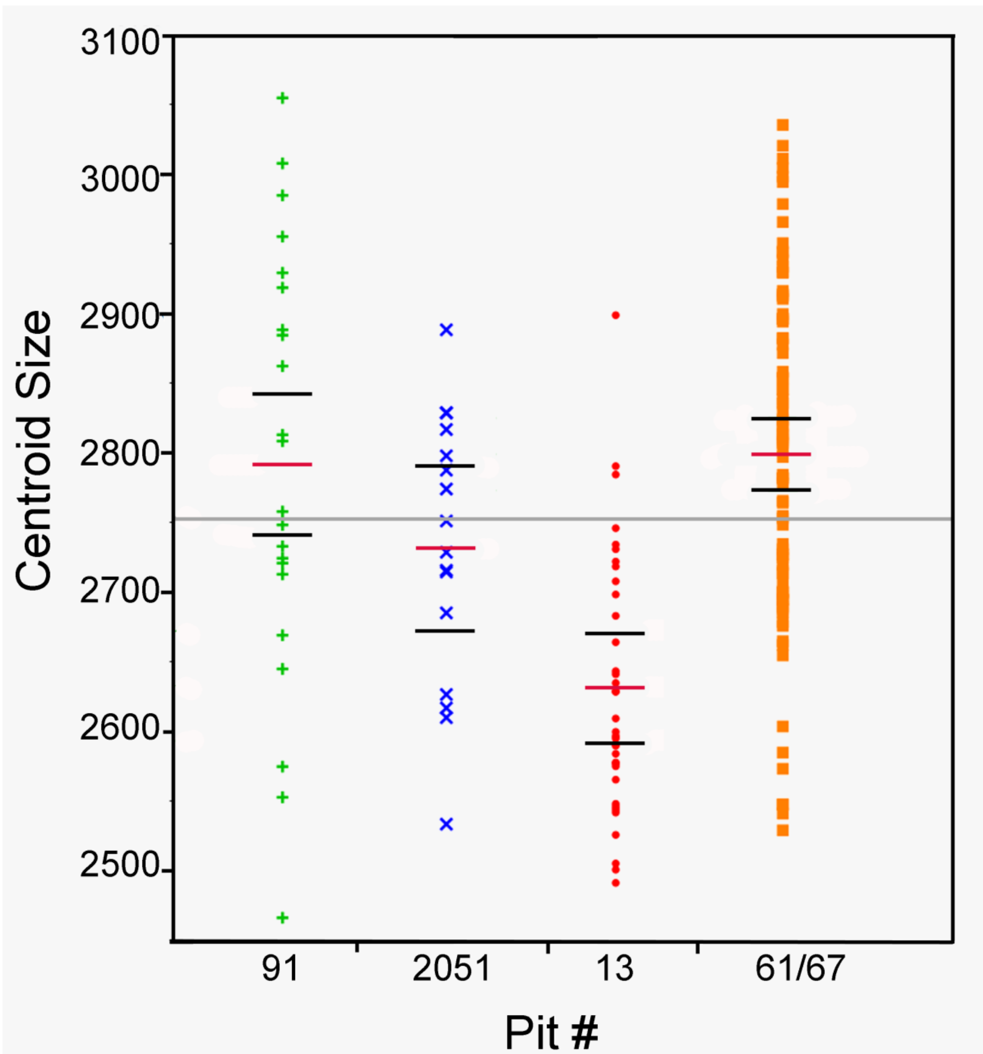


Figure 2. Plot of ANOVA of centroid size among pits. The red lines represent estimates of the mean for each pit. Black lines indicate 95% confidence intervals. Pit 13 has a significantly smaller overall body size in comparison to the other three pits. Pits are arranged in chronological order, from oldest (left) to youngest (right).

Thirty-two principal components resulted from the PCA, with PCs 1-6 explaining 67.2% of the variance (Table 4). While performing a PCA on the Procrustes coordinates should minimize the effect of size on shape variables due to the removal of centroid size, size significantly varied among the pits and should be taken into account when examining shape. For example, knowing the correlation between size and a PC axis may alter the interpretation of that axis and indicate a specific allometric relationship on that PC. The first and fourth principal components are positively correlated with centroid size ($p<0.001$, $R^2=0.099$ and $p<0.0001$, $R^2=0.090$, respectively), while PC 3 is negatively correlated with centroid size ($p<0.0335$, $R^2=0.0288$; Table 4). Principal component 2 is not correlated with centroid size.

Table 3. One-way ANOVAs of principal components by pit. The first four PCs are shown and account for 52.8% of the variance. Regressions against centroid size are also shown

PC	**Percent Explained**	**One-way ANOVA, by pit**	**Means, T 61/67-2051**	**61/67-13**	**61/67-91**	**13-91**	**2051-91**	**2051-13**	**Regression, Centroid Size**
PC I	17.91	F ratio 10.9195 p<0.0001*	0.0157*	0.7741	<0.0001*	0.0001*	<0.0001*	0.0171*	F ratio 17.1757 p<0.0001*
PC II	13.02	F ratio 6.8112 p<0.0002*	<0.0001*	0.0194*	0.3131	0.3995	0.0055*	0.0216*	F ratio 1.6429 p<0.2018
P	11.92	F ratio	0.9019	0.1412	0.2246	0.9920	0.4323	0.3856	F ratio

C II I		1.0209 p<0.3852							4.6030 p<0.0335*
PC IV	9.92	F ratio 5.8212 p<0.0009*	0.0533	0.0145*	0.0366*	0.0003*	0.0019*	0.8991	F ratio 15.3336 p<0.0001*

Principal component 1 (PC1) explains 17.9% of variance and is interpreted to represent posterior jaw size increase. PC1 is also correlated with size. Dire wolves scoring high on the PC1 axis have a larger bony jaw, largely represented by vectors from landmarks 8-13, in relation to the size of their teeth, represented by vectors from landmarks 1-7 (Figure 3). Negative values on the PC1 axis indicate animals with small jaws relative to tooth size. Significant differences among pits on PC1 were identified. Pit 91 significantly segregated from all other pits, as did pit 2051. Pits 13 and 61/67 were not different on PC1.

The second principal component (PC2) represents significant reorientation of the jaw. PC2 explains 13% of the variance and also displays segregation among the pits. Negative loading on PC2 is associated with two shape changes: 1) the coronoid process and posterior portion of the jaw shifting both anteriorly and ventrally, in a counter-clockwise fashion, and 2) the anterior portion of the jaw near the canine shifting posteriorly and dorsally in a clockwise rotation (Figure 3). Positive loadings are associated with the anterior and posterior portions of the jaw rotating away from each other. Pit 2051 differed of all other pits, displaying the highest degree of the anterior and posterior portions of the jaw rotating in towards each other (most negative PC 2 values). Pit 61/67 differentiated from pit 13 as well, with pit 13 displaying more reorientation of the anterior and posterior portions of the jaw towards each other than 61/67. However, pit 13 did not differ significantly from pit 91. A plot of the scores of the first two principal components can be seen in Figure 3.

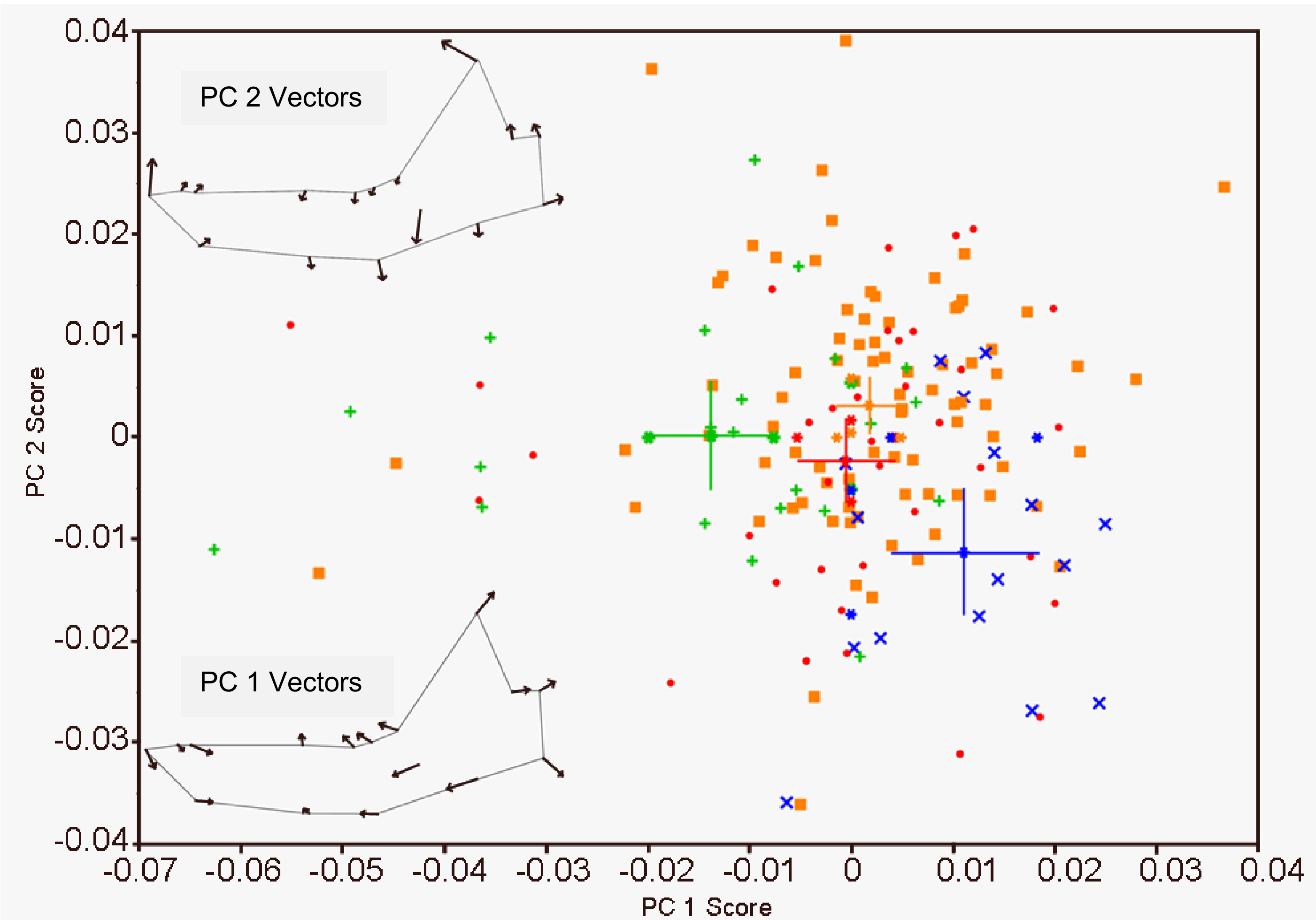


Figure 3. Plot of PC1 vs. PC2 scores. Crosses represent the mean pit score (center) and 95% confidence intervals. PC1 vector, shown on a landmark wireframe, are from the centroid in a positive direction, while PC2 vectors are from the centroid in a negative direction. Colors associated with pit numbers are as follows: orange-61/67, red-13, blue-2051, and green-91.

Principal component 3 (PC3) explains 11.9% of the variance and shows no significant differences among pits. Negative loadings on PC3 are associated with increases in canine size and length of the tooth row relative to the bony jaw. Molars shift together posteriorly, with a slight decrease in size of the second molar. Positive loading are associated with decreases in canine size and overall tooth row length (Figure 4).

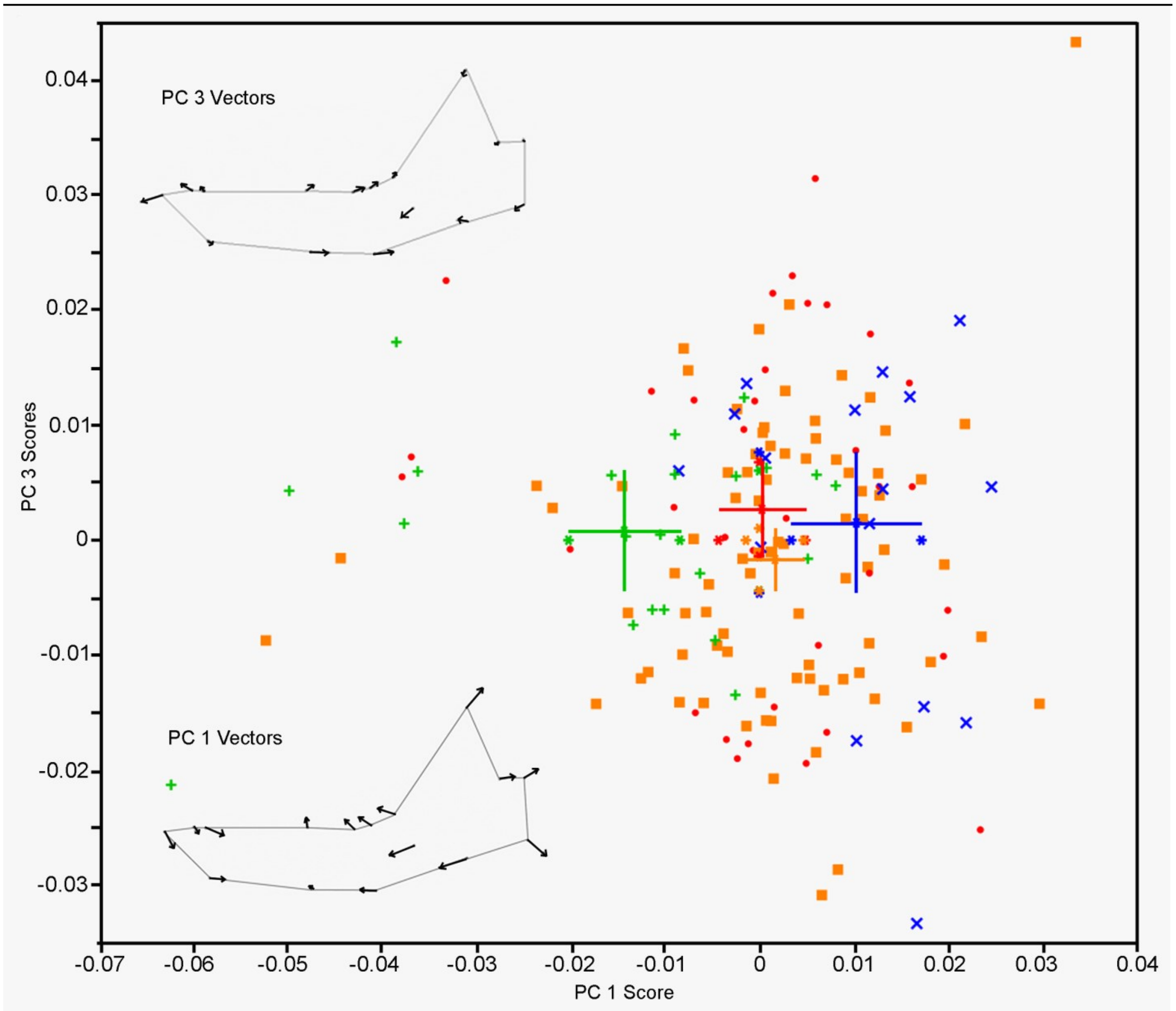


Figure 4. Plot of PC1 vs. PC3 scores. Crosses represent the mean pit score (center) and 95% confidence intervals. PC1 vector, shown on a landmark wireframe, are from the centroid in a positive direction, while PC3 vectors are from the centroid in a negative direction. Colors associated with pit numbers are as follows: orange-61/67, red-13, blue-2051, and green-91.

Principal component 4 (PC4) explains 9.9% of the variance and is correlated with size. Positive values on PC4 are associated with slight increases in jaw and tooth row length. Negative values are associated with a decrease in jaw size, especially the coronoid height, and a shift of the molar arcade forward. On this axis, wolves from pit 91 are distinct from all other pits. Pit

61/67 differs from pit 13, but not 2051. Pit 13 and 2051 are not distinct. It is important to note that the landmark 13 vector dominates this PC axis; this is relevant because the variance of this landmark in the x-dimension regarding the Procrustes coordinates is a magnitude greater than any other landmarks' variance in the x or y dimension. The placement of landmark 13 is more subjective, in the x-dimension, than any other landmark. However, landmark 13 still contributes to size decrease with negative values on the x-axis. The variance of landmark 13 in the y-dimension was similar to that of the other landmarks; this is important because the main purpose of the landmark 13 was to acquire coronoid height in conjunction with landmark 9.

Discussion

Both size and shape in *C. dirus* change through time at Rancho La Brea, clearly showing that some evolution is occurring. Mean jaw size, and therefore body size, averages vary from pit to pit; the largest average body size occurs in pit 61/67, while wolves from pit 91 are only marginally smaller than those from 61/67. Significantly smaller wolves are found in pit 13. By examining NGRIP and GRIP climate records, we can begin to evaluate size and climate relationships, such as a temporal Bergmann's Rule (NGRIP, 2004). Pit 61/67 had the warmest climate, overlapping in deposition with the Bølling-Allerød warm interval, while pit 13 was deposited during a relatively cool interval near the last glacial maximum. According to NGRIP data, pit 2051 represents the coldest interval of this sequence, while pit 91 is thought to be associated with rapid warming events, labeled Dansgaard-Oeschger events. Specifically, pit 91 is associated with D-O event 3 (Meachen et al., 2014; O'Keefe et al., 2014; Rahmstorf, 2003). However, more precise dating of all of these pits, especially pits 61/67 and 13, will solidify these correlations.

Bergmann's rule, originally correlated with latitude, predicts mean body size to be larger in areas of colder climates, while areas of warmer climates will have smaller mean body sizes (Bergmann, 1874; O'Keefe et al., 2013). From the size changes seen here, it appears dire wolves did not follow a temporal Bergmann's rule. Instead, body size in relation to climate is opposite to what Bergmann's rule would have predicted; the colder pits (2051 and 13) display smaller body sizes and the warmer pits (91 and 61/67) show larger body sizes. This is particularly interesting because the gray wolf, our model species for the dire wolf, follows Bergmann's rule (O'Keefe et al., 2013). Many carnivores do not follow Bergmann's rule, including some canids, such as coyotes (Meiri and Dayan, 2003; Meachen and Samuels, 2012). This is thought to be related to levels of primary productivity, competition, and food availability rather than climate (McNab, 2010; Huston and Wolverton, 2011; Yom-Tov and Geffen, 2011). Huston and Wolverton (2011) suggest that carnivores may be indirectly affected by the amount of ecological and evolutionary net primary productivity (eNPP) during a given period of time. Higher outputs of eNPP, possibly due to warmer climatic conditions, may increase food availability for primary producers. With an increase of food for primary producers, larger populations of herbivores can be supported which increases food availability for carnivores and allow for body size increases. Changing levels of primary productivity due to climate would have a cascading effect on carnivores, such as the dire wolf (Meachen et al., 2014).

Mandible shape also varies significantly from pit to pit. Fluctuating environmental pressures, such as changing nutrient stress, are a leading cause in changing the appearance and/or rate of development, or heterochrony, within a population (McNamara, 1990). Neoteny, decreased somatic growth relative to sexual maturation, in canids is recognizable through the identification of proportionally shorter snouts, larger teeth, and a more steeply rising forehead region in comparison to the ancestral population (O'Keefe et al., 2014; Gould, S. J., 1977; Paquet and Carbyn, 2003). The largest amount of variance in shape is shown along PC1, representative of an allometric size vector, and this axis displays evidence of neoteny in the dire wolf. A recent study on dire wolf cranial morphometrics found higher incidences of tooth breakage and wear (indicative of increased nutritional stress), along with neotenic characteristics in wolves of pit 13. These specimens were also significantly smaller than those of other pits (O'Keefe et al, 2014). Results presented here agree with this study; animals examined here are smallest in pit 13. However, wolves of pit 91 also had high tooth breakage and wear frequencies, but were relatively large using the centroid size of the entire skull as a metric (O'Keefe et al., 2014). These authors suggest nutrient stress for pit 91 wolves was less severe than that for pit 13 wolves or began after dental maturity was reached. Although wolves from pit 91 were the second largest in this study, PC1 scores from this study suggest that pit 91 wolves also show neotenic characteristics; these wolves have the smallest jaws relative to the size of their teeth. Since modern wolves reach dental maturity before they reach full bony growth, it can be inferred that pit 91 wolves experienced late-stage growth truncation (O'Keefe et al., 2014; Kreeger, 2003). This pattern was subtle but identifiable in the skull data, but is more marked here.

Both the jaw and skulls show allometic impacts in wolves of pits 91 and 13 (O'Keefe et al., 2014). However, the impacts are slightly different between pits. Pit 91 displays late stage growth truncation, as seen in the relative size of the bony jaw in comparison to tooth size. These wolves are stunted along the ontogenetic allometry axis. Pit 13 wolves are not only stunted along the ontogenetic allometry axis, but have also been pushed down the static allometry axis. Comparing the size of their bony jaw size and teeth shows a ratio similar to that of 61/67 (Figure 3), but their teeth are relatively small. Because wolves of pit 13 have a small body size, small teeth, and a bony jaw/tooth ratio indicative of isolated late stage growth truncation (like pit 91), they are interpreted to have experienced stunting on both the static allometry and ontogenetic allometry axes. The dire wolf skull data agree with these interpretations of allometric stunting in pits 91 and13 (O'Keefe et al., 2014).

The shape changes along PC1 primarily show allometric jaw growth, but it is plausible it may contain some evolutionary effects as well. Pit positions along PC1 may also be in response to competition and prey availability. Taller coronoid processes allow increased area for the attachment of the temporalis muscle, which increases the speed and force of jaw closure (Wang and Tedford, 2008; Anyonge and Baker, 2006). Wolves of pits 61/67 and 2051 have the largest jaws, including the coronoid process, relative to their teeth. Increased coronoid height suggests that these wolves are catching larger, faster prey and tooth breakage and wear indicate that they are not under nutrient stress (O'Keefe et al., 2014). It follows that these wolves may have mechanical advantage in shearing when tooth breakage and wear indicates that they are not under nutrient stress. Wolves of pit 91 and 13 have the relatively smallest bony jaws in comparison, including their coronoid processes. Having shorter coronoid processes decreases the mechanical advantage of the temporalis muscles in relation to the masseter muscle. Additionally, shorter, broader jaws produce larger bite forces. These wolves are more masseter dominated, which is active in crushing at the molars. It follows that these wolves are probably consuming more bone, making crushing abilities necessary, or prey preference was different in comparison to pits 61/67 and 2051. This explanation is plausible, but relies more on adaptation than allometric axes to rectify the differences among the pits.

In terms of shape, pit 2051 wolves are interesting in that they discretely segregate from the other pits on the first two principal component axes (Figure 3). Pit 2051 wolves have anteroventrally oriented coronoid processes, while the anterior portion of the jaw orients posteriorly and dorsally. In addition, these wolves do not display signs of neoteny, having the largest bony jaws relative to their teeth. Wolves of pit 13 score closest to pit 2051 on the PC2 axis, which demonstrates reorientation of both ends of the jaw. Evidence of neoteny is present in pit 13; further directional change of pit 13 wolves towards the shape seen in 2051 may have been hindered by nutritional stress or other factors. Because pit 13 and pit 2051 were deposited during relatively colder climates than the other pits, it is possible that this anterior rotation of the terminal ends of the jaw may have been an adaptation for living in cold climates. The ecological drivers of the shape difference displayed in pit 2051 are not clear, but my PCA analysis determined that shape evolution did occur.

Although PC 3 explains ~12% of the shape variance, it is important to note the shape changes along this axis. Principal component 3 is interpreted as capturing sexual dimorphism. There are no significant differences among the pits on this axis, which is expected since sexual dimorphism should remain constant through time (Figure 4). Negative loadings would be associated with male dire wolves- canine size increases, overall tooth row lengthens, and the size of the second molar decreases with more negative values. A recent study on the morphology of extant gray wolves reveals that male wolves are generally larger than female wolves and have relatively smaller molars (O'Keefe et al., 2013). The lengthening of the tooth row may be explained by an increase in overall size and moving up the static allometry axis. It would also follow that the second molar size decreases in putative male wolves. Canine size has also been shown to be sexually dimorphic in dire wolves, with male dire wolves' canines estimated to be 11-12% larger than female canines (Van Valkenburgh and Sacco, 2002). In contrast, positive loadings are associated with overall smaller female dire wolves that have relatively larger second molars and smaller canines. Previously determined characters that differentiate the sexes in both dire wolves and gray wolves agree with the shape changes along PC 3 (See Chapter 3).

In summary, *Canis dirus* mandible size and shape, and therefore overall body size, do not remain constant throughout time. Jaw size comparisons reveal that dire wolves were largest in pits with warmer climates and smaller in cooler pits, the opposite of what a temporal Bergmann's rule would have predicted. Because the dire wolf does not seem to follow climate correlations similar to the gray wolf, its extant counterpart, it is appropriate to explore other environmental factors as possible causalities by examining shape change. Overall mandible shape shows certain microevolution, and nutrient stress and adaptations relating to food availability and competition are also influential factors. Because Pleistocene climate records reveal extreme variability, more precise dating of the La Brea tar pits would help more accurately define the existing environmental conditions of each deposit. Exploring the variation of size and shape throughout time is important in determining paleoecologic changes the dire wolf was experiencing. One aspect of morphology that was not extensively investigated here is sexually dimorphic characteristics. Determining the level and extent of sexual dimorphism in the dire wolf can help tease out causalities of intraspecific morphological variation, as well as better inform us of their overall lifestyle. Sexual dimorphism of the dire wolf will be examined more thoroughly in Chapter 3.

CHAPTER 3

TESTING EVOLUTIONARY RESPONSES IN THE MANDIBULAR CORPUS AND ASSESSING SEXUALLY DIMORPHIC CHARACTERS THROUGHOUT THE JAW

Introduction

Corpus Depth Evolution. The analyses in this chapter have three main objectives. The first objective is to see if dire wolves of both pits 91 and 13 had evolved hyena-like jaw corpora. Pit 91 and pit 13 wolves have higher incidences of tooth breakage and wear, possibly indicating increased levels of competition or nutrient stress during these depositions (O' Keefe et al., 2014). Jaw morphology may therefore have been driven towards adaptations of bone-cracking, increased carcass utilization, and stronger bite forces. Durophagous adaptations might include vaulted, dome-like foreheads, simplified but robust dentition, shortened snouts, and prominent sagittal crests among others (Tseng and Binder, 2010; Tanner et al., 2008; Wang and Tedford, 2008; Van Valkenburgh 2007; Binder and Van Valkenburgh, 2000; Biknevicius and Ruff, 1992). In mandibular morphology specifically, corpus depth should relatively increase to create a greater buttressing effect if there is an adaptive response to increased mechanical stress in the bone of the corpus (Biknevicius and Ruff, 1992).

Hyaenids and canids use different teeth to crack bones, however. Hyenas utilize their robust premolars to process bone. By using their premolars, gape is increased and larger bones can be processed; the loss of bite force due to this long lever arm is counteracted by hypertrophied masticatory muscles in hyaenids (Biknevicius and Ruff, 1992; Binder and Van Valkenburgh, 2000; Van Valkenburgh, 2007; Tanner et al., 2010). Canids, unlike hyaenids, are not specialized for a durophagous diet. Greater occlusal forces are generated in the molars than in premolars and cortical bone thickness is greater posterior to the lower first molar, indicating molars, not premolars, are used to crack bone in canids (Biknevicius and Ruff, 1992; Van Valkenburgh, 2007). Because bone thickness, and thus strength in bending, is greatest posterior to the teeth used in bone processing in both hyaenids and canids (Biknevicius and Ruff, 1992), I focused on differences in corpus depths, especially Corpus Depth 3 (Table 1, Figure 1), among the four pits to determine if the corpus evolved to become deeper in times of increased nutrient stress.

Sexual Dimorphism in Corpus Depth. The second objective was to determine whether corpus depth could be distinguished as sexually dimorphic. It has been hypothesized that female gray wolves have relatively larger molars to more completely process carcasses due to increased nutrient needs during lactation and/or enable them to be even with males while feeding if they fall short in prey apprehension (O'Keefe et al., 2013). If females are more prone to increased carcass utilization, it is possible females may have thicker corpora to increase their bone cracking ability. Because extant gray wolves (*C. lupus*) are the closest analog to the dire wolf, I modeled my hypotheses of sexual dimorphism in the corpus based on known molar dimorphism, and interpreted behavior for this morphology, in the gray wolf (See Chapter 1). Here, greater values of centroid size represent males, while lower values represent females, since gray wolves are male-biased size dimorphic (males are larger than females; Fairbairn, 1997; O'Keefe et al., 2013; Milenkovic et al., 2010).

Sexual Dimorphism in Other Measurements. Finally, the last objective was to determine if other linear measurements on dire wolf jaws could be classified as sexual dimorphism, allometric, or both (Table 1, Figure 1). Difficulties determining sexually dimorphic characters arise from not knowing the sex of each fossil specimen *a priori*. It is also difficult to decipher whether positive trends are due to sexual dimorphism or static allometry, since much of dimorphism is contained on the static allometry axis. It is essential to keep in mind that all linear measurements were calculated from Procrustes coordinates, meaning that all measurements are relative to one another and do not factor in size. All regressions in this section were calculated using 61/67 specimens only.

Allometry. Allometry is variation in shape of specific elements in association with variation in size or another element, and can help describe morphology (Klingenberg, 1996). Isometry is when a trait size scales proportionally to body size. An element that is positively allometric is relatively larger, in proportion to body size, in larger individuals, whereas negative allometry indicates a character that is relatively smaller in larger individuals (Klingenberg, 1996; Bonduriansky, 2007). Although growth is a major contributing factor to resulting allometric patterns, these patterns can be also be caused by evolution within, or among, taxa and variation among individuals of a population. Because of the multiple causations to allometric trends, allometry has been classified into three types. Static allometry, as defined by Klingenberg (1996), results from variation among individuals of the same population and age group and mostly reflects size allometry. Ontogenetic allometry refers to changes in relative trait size through development/different age stages and is also referred to as growth allometry (Bonduriansky, 2007; Klingenberg, 1996). Evolutionary allometry concerns relative changes in different traits along branches of a phylogeny, either contemporaneous species sharing a common ancestor or fossil members (Klingenberg, 1996). Because I am not concerned with multiple members of a phylogeny, and my focus is one species (*Canis dirus*), the resulting effects of both the ontogenetic and static allometry axes will be emphasized, whereas the evolutionary allometry axis will not be discussed.

In order to discuss sexual dimorphism and allometry, it is first important to rule out any measurements that are not candidates for sexual dimorphism. These measurements will be isometric, or will not have significant correlations with centroid size, and thus body size. Due to the assumption that dire wolves were male-biased size dimorphic, determining morphological differences between males and females relies on a characteristic to differ with centroid size. Positively allometric components, or those that have a positive correlation with size, will be considered for possible sexual dimorphism, but the static allometry axis will also be considered for an effect. It is common for positively allometric components to be also be considered sexually dimorphic. However, the characters that are negatively allometric elements must also be examined (Bonduriansky, 2007). Elements that are negatively allometric, or have a negative correlation with centroid size, will be considered for both the ontogenetic axis and sexual dimorphism.

Materials and Methods

Corpus Depth Evolution. All specimens used in these analyses were the same as those used in Chapter 2. Processes of digitization and Procrustes superimposition were consistent with those previously described (Zelditch et al., 2004). Differences among pit samples for three separate corpus depth measurements (Corpus Depth 1, Corpus Depth 2, and Corpus Depth 3- Table 1, Figure 1) were analyzed through an analysis of variance (ANOVA). Pairwise mean comparisons between pits were completed by Student's t tests.

Sexual Dimorphism in Corpus Depth. To evaluate sexual dimorphism in the corpus, both a pooled dataset, which included all 157 specimens from the four pits (See Chapter 2), and a subsample of specimens from only pit 61/67 were used. As with assessing corpus depth evolution, the processes of digitization and Procrustes superimposition were the same as described in Chapter 2 (Zelditch et al., 2004). Distances between Procrustes coordinates for Corpus Depth 1, Corpus Depth 2, and Corpus Depth 3 were calculated (Table 1, Figure 1). These three interlandmark distances were regressed against centroid size and M2 length (which was determined to be sexually dimorphic before this analysis was complete) to establish allometric patterns of these elements in relation to overall body size, since centroid size was used as a body size indicator and has been shown to serve as a robust size variable when examining sexual size dimorphism (Hood, 2000).

Table 1. Interlandmark Distances and a list of the landmarks from which each distance was calculated. See Figure 1.

Measurements on Figure 1	Interlandmark Distance	Landmarks Distance Calculated Between
A	Corpus Depth 1	3 & 16
B	Corpus Depth 2	4 & 15
C	Corpus Depth 3	6 & 14
D	Coronoid Height	9 & 13
E	Jaw Length	1 & 11
F	Premolar Arcade	3 & 4
G	M1 Shearing (Trigonid Basin)	4 & 5
H	M1 Grinding (Talonid Basin)	5 & 6
I	M2 Length	6 & 7
J	Canine Length	1 & 2
K	Molar Arcade	4 & 7
L	Carnassial-Coronoid	5 & 9
M	Carnassial-Condyloid	5 & 11
N	Carnassial-Angular	5 & 12

O	Carnassial-Masseter Fossa	5 & 8

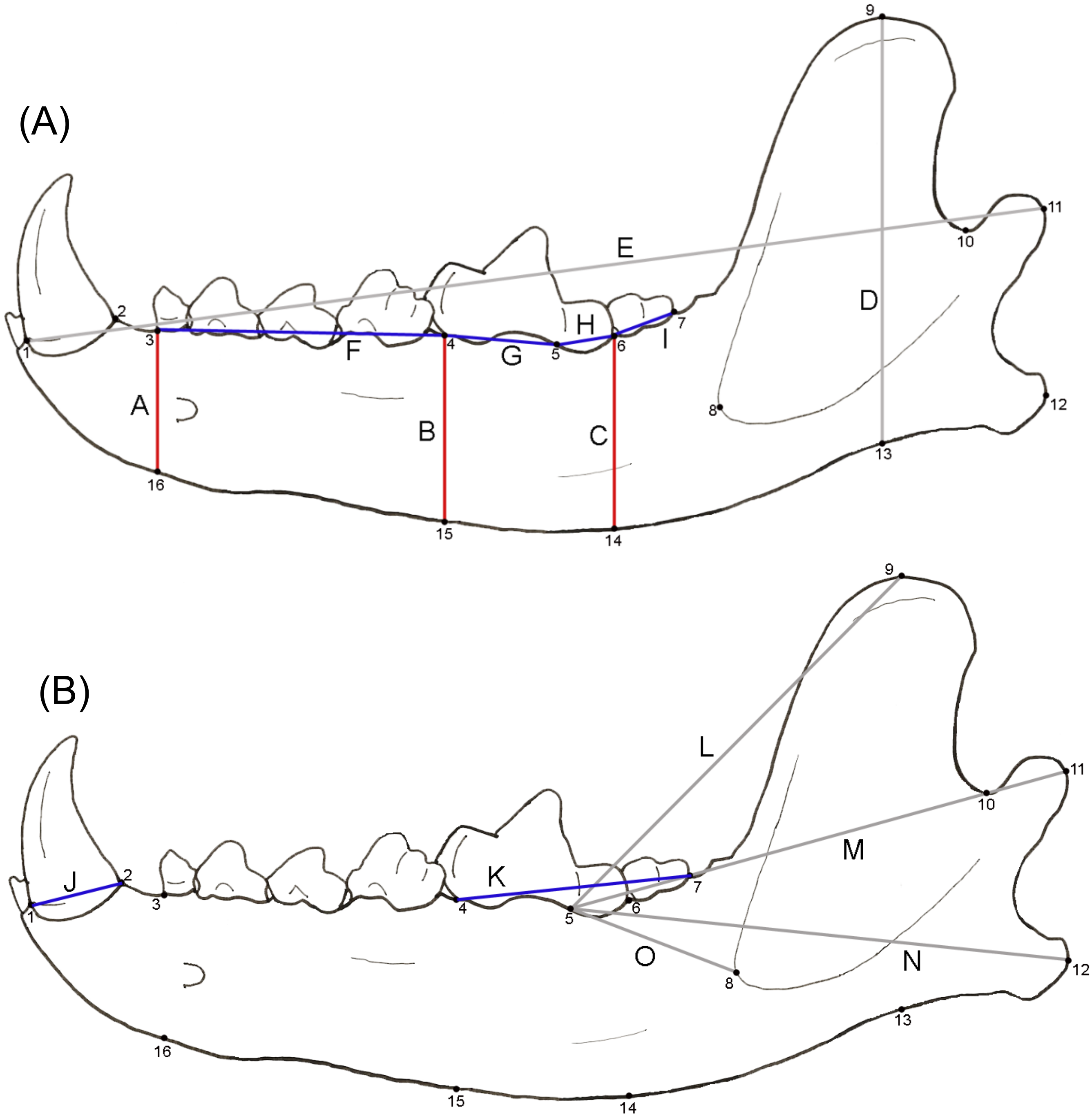


Figure 1. Linear measurements taken on mandibles. See Table 1 for description. Measurements A-I shown in part (A); measurements J-O shown in part (B). Blue lines represent measurements taken on teeth; red lines represent corpus depth measurements; gray lines represent bony jaw measurements.

Sexual Dimorphism in Other Measurements. To examine other possible sexually dimorphic characteristics, 12 other (besides corpus depths) linear measurements were taken on Procrustes coordinates of specimens from pit 61/67 only (Table 1, Figure 1). This pit was chosen because it had the largest sample size of all the pits (n = 83) and the largest range of centroid size. If sexual dimorphic characteristics are clear, they should be visible in this pit, and not observed by inter-pit variability. These measurements were then regressed against centroid size to determine allometric patterns of each element in relation to overall body size. All linear measurements were subjected to ANOVAs and Student's t tests to determine statistical differences among the pits; sexually dimorphic characteristics should not fluctuate through time.

For specific distances (coronoid height, M2 length, and the talonid basin of M1), global regressions against centroid size using the pooled dataset (157 specimens) were completed. These distances were also regressed using the complete dataset because these elements have been shown to be sexually dimorphic in the extant gray wolf, *C. lupus* (O'Keefe et al., 2013). My aim was to see if any significant regressions of these elements were also significant using the pooled dataset to partially determine if they stayed consistent through time.

Body Size Estimation: Although body size comparisons among the pits were discussed in Chapter 2, analysis of sexual dimorphism in the jaw reveals certain allometric components that may have skewed mean centroid size results. In addition, body size estimates generated from the mandible do not agree with those generated from skulls (O'Keefe et al., 2014) This indicates that centroid size may not have been the best body size indicator. Previous studies have suggested that the lower carnassial (m1) is a good predictor of body size in canids, with a 27% prediction error (Van Valkenburgh, 1990). The functional relevance and low sexual dimorphism in the carnassial suggests this tooth may be a good body size indicator. One-way ANOVAs of the length of the trigonid basin of the carnassial (m1), the length of the talonid basin of the carnassial, and the length of the upper carnassial (P4) were calculated among the pits. Data for the P4 measurement was taken from O'Keefe et al., 2014. Pairwise comparisons among the pits were calculated by Student's t tests.

Results

The ANOVA of Corpus Depth 1 showed that the corpus did not vary in depth at the beginning of the premolar arcade among the pits ($p<0.1226$). Only pit 13 differed from pit 2051; all other comparisons were not significant (Table 2). The ANOVA of Corpus Depth 3 had the same results-the corpus did not vary in depth behind the carnassial among the pits ($p<0.1258$). Only pit 61/67 differed from pit 91, but all other comparisons were not significant (Table 2). The ANOVA of Corpus Depth 2 did reveal a significant difference in depth at the beginning of the molar arcade among the pits ($p<0.0083$). Pit 13 had the greatest depth at this measure, while pit 2051 had the shallowest depth here. Pits 91 and 61/67, which were not different from one another, have values in between pits 2051 and 13 (Table 2).

Table 2. Significance of pairwise comparisons of interlandmark distances among pits based on one-way Student's T tests among means. Stars indicate significance after Bonferroni correction. For measurement descriptions, see Table 1, Figure 1.

Comparison	**61/67-2051**	**61/67-13**	**61/67-91**	**13-91**	**2051-91**	**2051-13**
Coronoid Height	<0.0001**	0.0235**	0.0057**	<0.0001**	<0.0001**	0.0075**
M2 Length	0.1303	0.1660	0.1138	0.7022	0.9180	0.6478
M1 Grinding	0.7666	0.0085**	0.5935	0.0159**	0.8862	0.0431**

(Talonid Basin)						
M1 Shearing (Trigonid Basin)	0.2995	0.0659	0.0327**	0.5871	0.0159**	0.0311**
Premolar Arcade	0.4013	0.0256**	0.0518	0.0009**	0.0348**	0.4648
Molar Arcade	0.5663	0.0019**	0.0757	0.4556	0.0766	0.0096**
Canine Length	0.1334	<0.0001**	0.0492**	0.1439	0.8471	0.1270
Jaw Length	0.0030**	<0.0001**	0.0002**	0.5364	0.7573	0.3713
Corpus Depth 1	0.2985	0.0682	0.4322	0.5125	0.1514	0.0317**
Corpus Depth 2	0.0255**	0.0377**	0.9137	0.1491	0.0525	0.0007**
Corpus Depth 3	0.2235	0.9078	0.0378**	0.0539	0.6082	0.2368
Carnassial-Coronoid	0.0040**	0.0463**	0.1599	0.0070**	0.0007**	0.1891
Carnassial-Condyloid	0.6691	0.3160	0.0136**	0.1434	0.1445	0.7806
Carnassial-	0.0039**	0.7246	0.0094**	0.0402**	<0.0001**	0.0044**

Angular						
Carnassial-Masseter Fossa	0.6311	0.0049**	0.0764	0.6023	0.3686	0.1472

Corpus depth 1 regressions against centroid size for the complete dataset and for pit 61/67 were not significant (Table 3). Corpus Depth 1 regressed against the second molar length was significant for the complete dataset, but was not significant for pit 61/67 alone.

Corpus Depth 2 regressions against centroid size for the complete dataset and pit 61/67 were both significant (Table 3). For regressions of Corpus Depth 2 vs. M2 length, significance was only found in the complete dataset. Corpus Depth 3 regressions had similar results. For the complete data set, regressions of Corpus Depth 3 vs. centroid size and M2 length were both significant (Table 3). In the pit 61/67 subsample, Corpus Depth 3 regressed against M2 length was significant, while Corpus Depth 3 vs. centroid size was not.

Table 3. Corpus Depth regressions vs. Centroid Size and M2 Length. Regressions were performed on the entire dataset and 61/67 specimens separately.

Complete Dataset (n =157)	*Corpus Depth 1*	*Corpus Depth 2*	*Corpus Depth 3*
Centroid Size	F ratio 0.9879 p< 0.3218	F ratio 9.8619 p<0.0020**	F ratio 4.5014 p<0.0355**
M2 Length	F ratio 4.0358 p<0.0463**	F ratio 7.8839 p<0.0056**	F ratio p<0.0121**
61/67 only (n =83)			
Centroid Size	F ratio 0.0724	F ratio 12.6503	F ratio 2.5461

	p<0.7885	p<0.0006**	p<0.1145
M2 Length	F ratio 3.6788 p<0.0586	F ratio 2.0947 p<0.1517	F ratio 4.3608 p<0.0399**

Nine of the 15 linear measurements taken yielded insignificant, or isometric, results when regressed against centroid size for specimens of pit 61/67 only (Table 4). Three linear measurements, Carnassial-Condyloid, Corpus Depth 2, and Jaw Length, displayed positive allometry, or a positive correlation with centroid size. Negative allometry, or a negative correlation with centroid size, was detected for three measurements: Molar Arcade, Premolar Arcade, and M2 Length (Table 4).

Table 4. Regressions of interlandmark distances vs. centroid size. Significance is indicated by the stars. Interlandmark distances in gray have a significantly negative correlation with centroid size, while those italicized have a significantly positive correlation with centroid size. These regression are based on only 61/67 specimens.

Interlandmark Distance	**Regression on Centroid Size**
Coronoid Height	F ratio 0.1065, p< 0.7450
M2 Length	F ratio 5.9683, p< 0.0167**
M1 Grinding (Talonid Basin)	F ratio 2.7293, p< 0.1024
M1 Shearing (Trigonid Basin)	F ratio 1.0823, p< 0.3013
Premolar Arcade	F ratio 12.8941, p< 0.0006**
Molar Arcade	F ratio 12.5111, p< 0.0007**
Canine Length	F ratio 0.1526, p< 0.6971
Jaw Length	F ratio 22.5358, p< 0.0001**
Corpus Depth 1	F ratio 0.0724, p<0.7885
Corpus Depth 2	F ratio 12.6503, p<0.0006**
Corpus Depth 3	F ratio 2.5461, p<0.1145

Carnassial-Coronoid	F ratio 0.4680, p< 0.4959
Carnassial-Condyloid	F ratio 22.2960, p<0.0001**
Carnassial-Angular	F ratio 1.2778, p< 0.2616
Carnassial-Masseter Fossa	F ratio 0.6828, p< 0.4111

The length of the talonid basin of the carnassial and the length of the second molar were negatively correlated with centroid size when looking at the complete dataset (p-value=0.0023, R^2=0.058; p-value=0.0003, R^2=0.082, respectively). These patterns were consistent within each pit. The trend seen in the second molar length is stronger than the trend in the talonid basin, however. When examining only pit 61/67, only the regression of the second molar length vs. centroid size was significant (p-value= 0.0167, R^2 =0.069). The talonid basin displayed a negative trend against centroid size, but was not significant (p-value=0.1024, R^2= 0.032). In terms of sexual dimorphism, these results are consistent with trends seen in the extant gray wolf. *C. lupus* males have relatively larger body sizes and relatively smaller molars (O'Keefe et al., 2013). The trend of decreasing molar size with increasing centroid size can be seen in both of these global regressions (Figure 2). While it is not possible to differentiate individual *C. dirus* male specimens from female specimens, these trends suggest that the dire wolf displayed a similar degree of sexual dimorphism in their molars as extant gray wolves.

The same result does not hold for coronoid height. Male gray wolves have been shown to have relatively taller coronoid processes. As such, we expected to see a positive correlation of coronoid height with centroid size based on these trends. Regressions against centroid size, both separated and not separated by pit, do not display a significant trend (Figure 2; Global regression: p-value=0.302, R^2=0.007; Pit 61/67: p-value= 0.7450, R^2=0.0013).

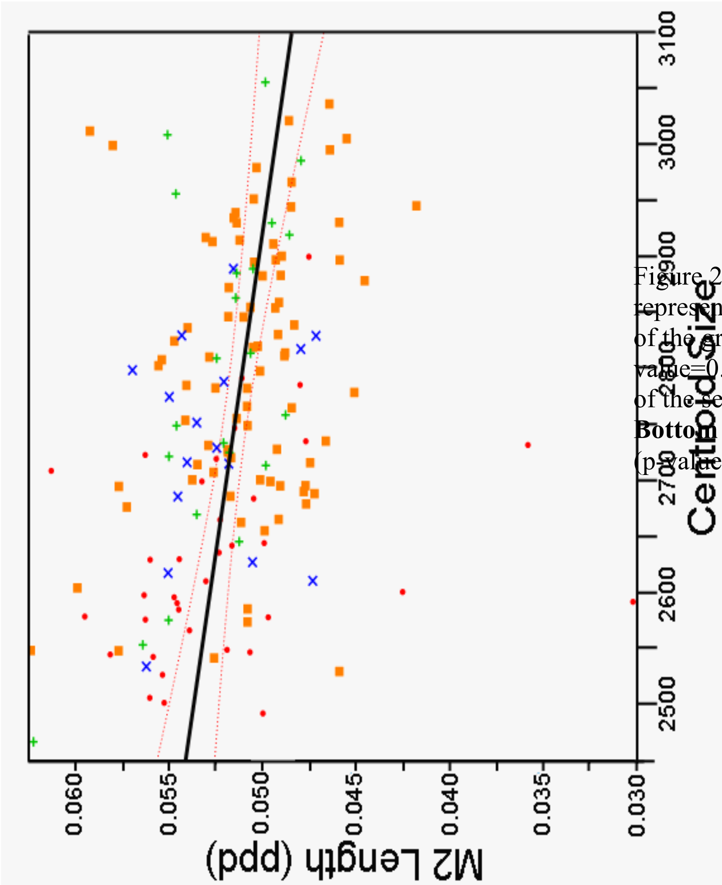
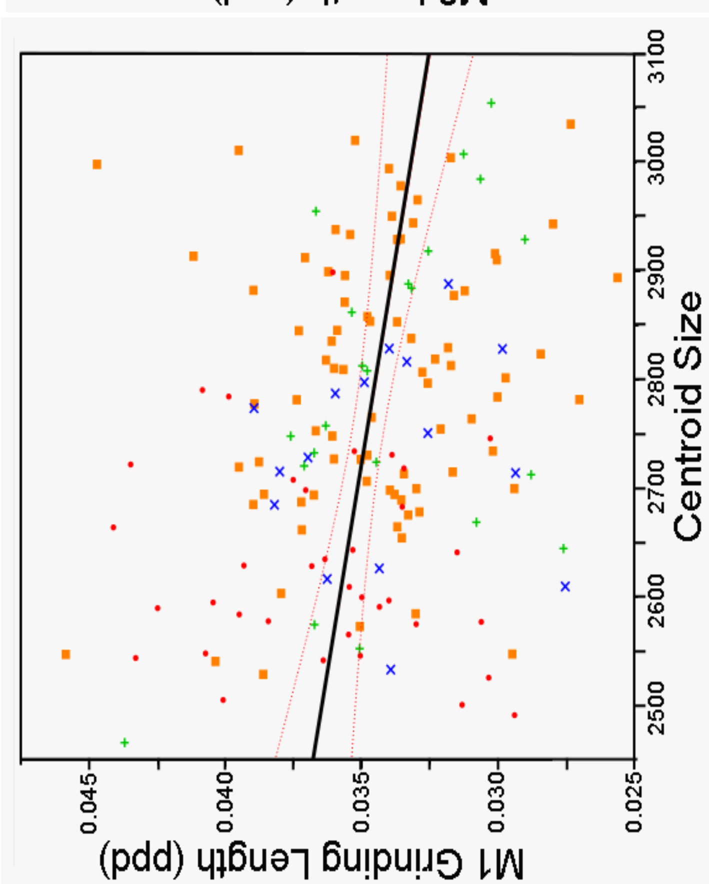
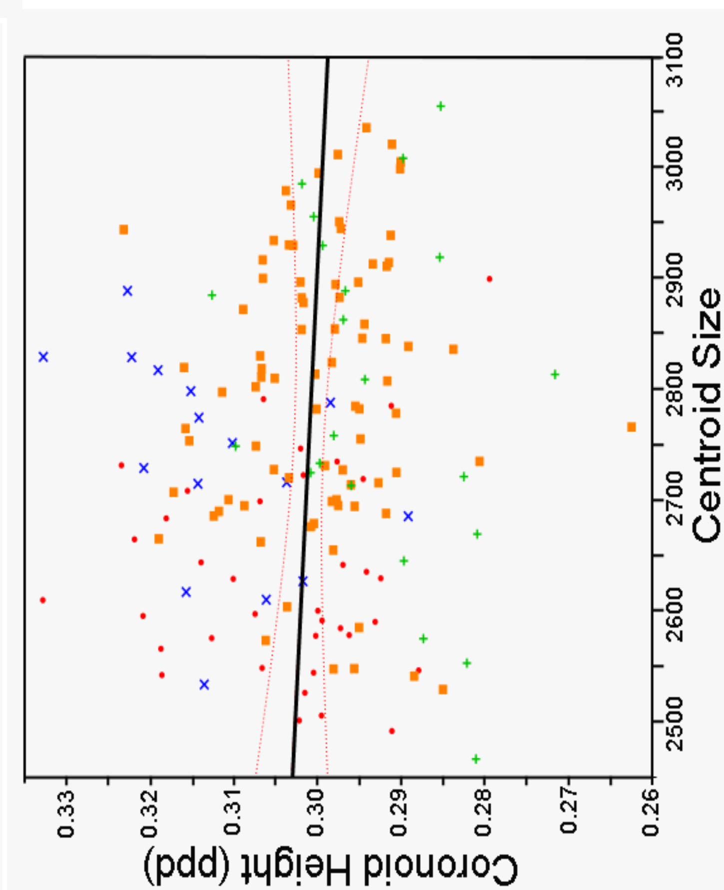


Figure 2. Black lines represent regression lines; red dotted lines represent confidence intervals. **Top left** Global regression of the length of the grinding portion of the carnassial against centroid size (p-value=0.0023, R^2=0.058). **Top Right** Global regression of the length of the second molar against centroid size (p-value=0.0003, R^2=0.082). **Bottom Left** Global regression of coronoid height against centroid size (p-value=0.302, R^2=0.007).





The ANOVA of the length of the upper carnassial (P4) showed that this tooth did not vary significantly among the pit ($p<0.1450$). Only pit 91 differed from pit 61/67. All other pit comparisons were not significant (Table 5). The ANOVA of the length of the trigonid basin of the lower carnassial did vary among the pits ($p<0.0261$; Table 5). Pit 91 wolves had longer trigonid basins than pits 2051 and 61/67. The mean value for pit 13 was also larger than that of pit 2051(Figure 3b).Finally, the ANOVA of the length of the talonid basin of the lower carnassial showed a significant difference among the pits ($p<0.0297$; Table 5). For this measurement, pit 13 had significantly higher values than the other pits (Figure 3c). All other comparisons among the pits were not significant.

Table 5. Significance of pairwise comparisons of carnassial interlandmark distances among pits based on one-way Student's T tests among means. Stars indicate significance after Bonferroni correction. Also see Figure 3.

Comparison	**61/67-2051**	**61/67-13**	**61/67-91**	**13-91**	**2051-91**	**2051-13**
Upper P4 Length	0.5759	0.3033	0.0292**	0.2576	0.0763	0.5861
Trigonid Basin Length, lower m1	0.2995	0.0659	0.0327**	0.5871	0.0159**	0.0311**
Talonid Basin Length, lower m1	0.7666	0.0085**	0.5935	0.0159**	0.8862	0.0431**

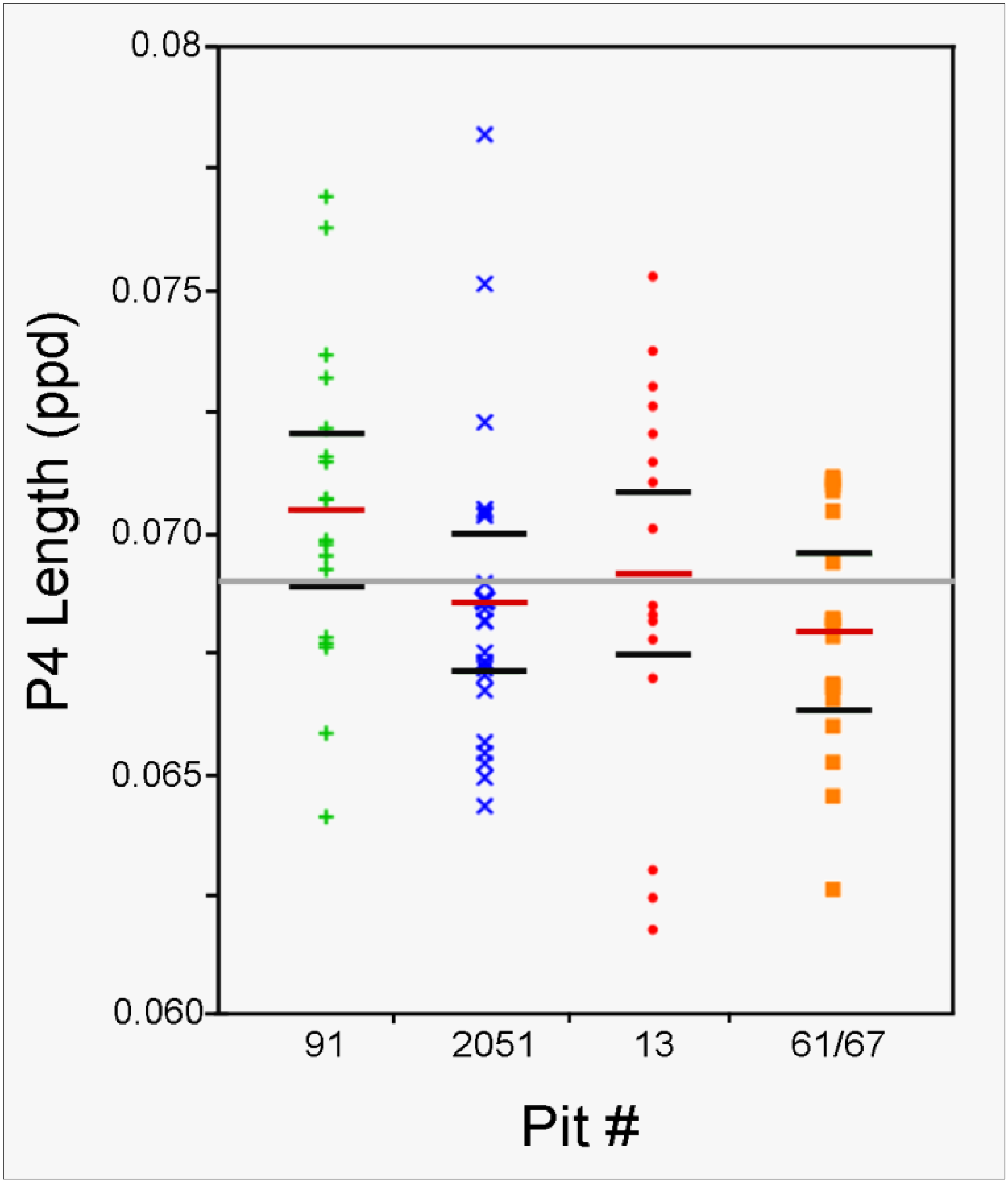


Figure 3a. Plot of ANOVA of upper P4 Length among pits. The red lines represent estimates of the mean for each pit. Black lines indicate 95% confidence intervals. Pit 91 has the largest mean values, while pit 61/67 has the smallest mean values. Pits are arranged in chronological order, from oldest (left) to youngest (right).

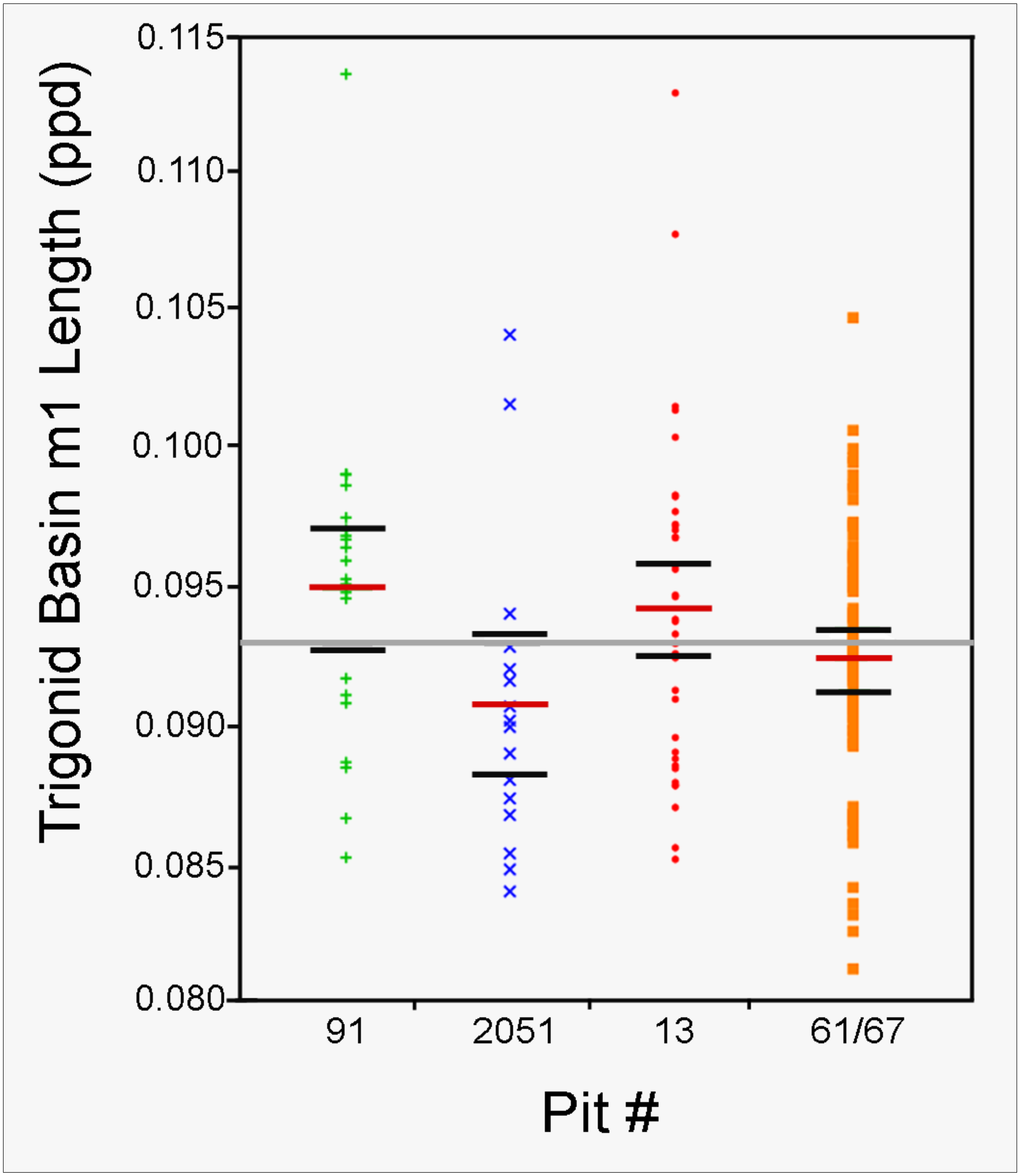


Figure 3b. Plot of ANOVA of Trigonid Basin Length of upper m1 among pits. The red lines represent estimates of the mean for each pit. Black lines indicate 95% confidence intervals. Pit 91 has the largest mean values.

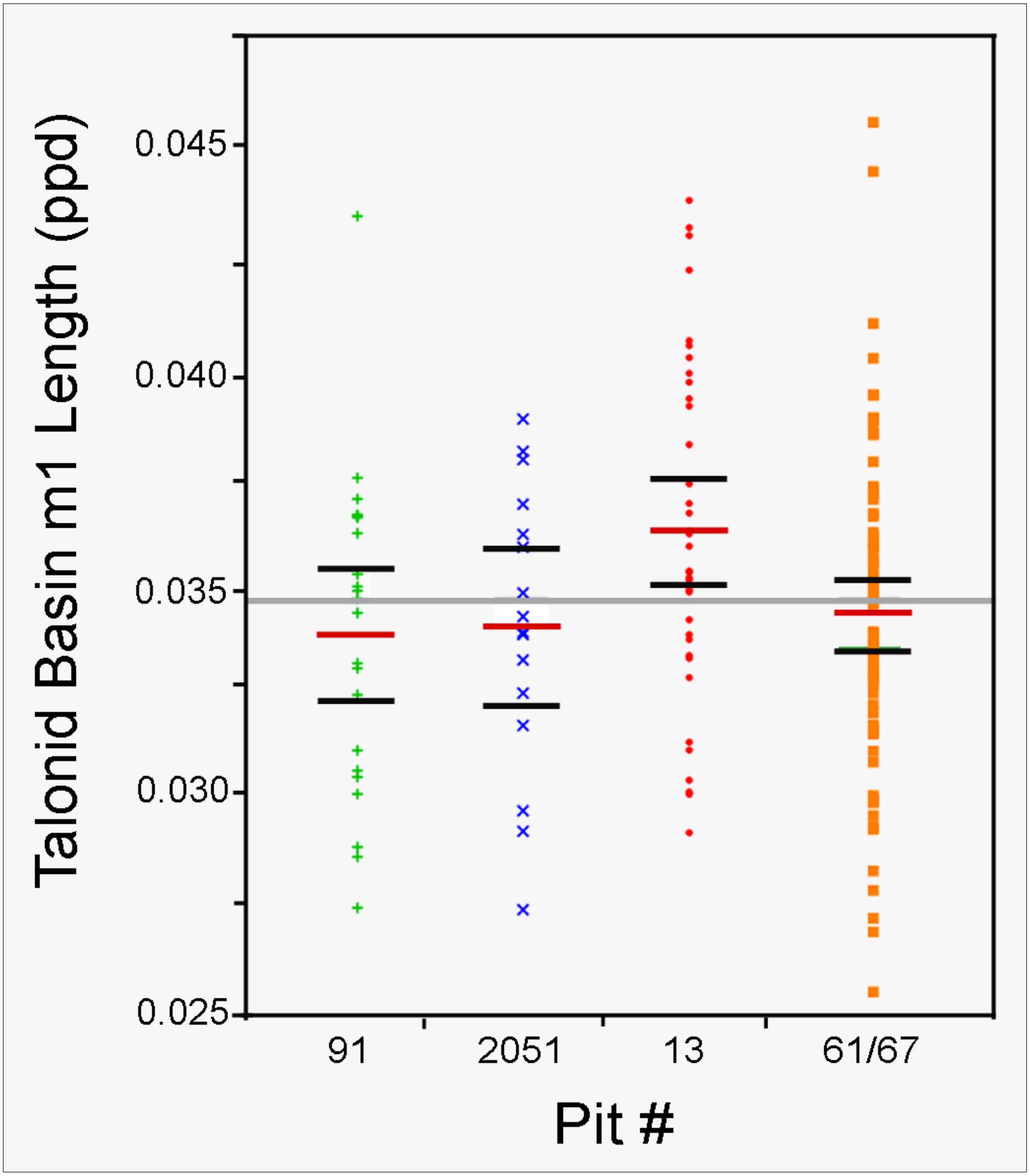


Figure 3c. Plot of ANOVA of Talonid Basin Length of upper m1 among pits. The red lines represent estimates of the mean for each pit. Black lines indicate 95% confidence intervals. Pit 13 has the largest mean values.

Discussion

Lack of Evolutionary Response in the Corpus. An ANOVA of Corpus Depth 3 indicates no significant difference in bone depth directly posterior to the carnassial among most pits. The only significant difference is between pits 91 and 61/67 (See Results). However, pit 91 is not different from pit 2051 and pit 2051 is not different from any other pit, indicating no real difference among any of the pits. On the contrary, pit 91 has the lowest values of Corpus Depth 3, demonstrating the opposite of what was expected if high tooth breakage and wear pits responded with increased corpus depth.

Looking at the other corpus depths measured, the Corpus Depth 1 ANOVA had the same results as Corpus Depth 3- no significant difference between the pits, except pit 13 is different from pit 2051. This may be attributable to neotenic effects, which can be seen in the shape of the jaws and skulls, in pit 13 (See Chapter 2; O' Keefe et al., 2014). Wolves of this pit are stunted; it is possible that these jaws were not able to develop a more adult-like jaw morphology by relatively thinning out the corpus anteriorly (Milinkovic et al., 2010).

The ANOVA of Corpus Depth 2 displays three significant differences among pits: 13 & 2051, 61/67 & 2051, and 13 & 61/67. Pit 13 wolves have the highest values, while wolves of pit 2051 have the thinnest corpora at Corpus Depth 2. Again, we see an ontogenetic stunting effect in wolves of pit 13; the corpus has not been allowed to thin out anteriorly, as shown in Corpus Depth 1. Wolves of pit 2051 have relatively thinner corpora directly anterior to the carnassial; wolves of this pit are not ontogenetically stunted (See Chapter 2, PC 1) and may be displaying adult corpus morphology of thinning towards the front of the jaw, the most out of the four pits.

It would be valuable if another corpus depth could have been calculated, one that was more caudal to Corpus Depth 3. It has been suggested that canids use the carnassial, specifically, the trigonid basin, in bone cracking, much like borophagine canids (Biknevicius and Ruff; 1992; Werdelin, 1989; Van Valkenburgh, 2007). If bone depth is greatest behind the site of bone cracking, another more caudal corpus depth measurement may have revealed an adaptive response to increased nutrient stress. Overall, from my results, corpus depths do not vary among the pits and have not reflected any evolutionary responses to increased nutrient stress.

Sexual Dimorphism in Corpus Depth. After determining molar size, particularly the size of the second molar, as sexually dimorphic in the dire wolf (see below), regressions of corpus depths against centroid size and M2 size were completed. Through examination of these regressions (Table 3), the overall dataset shows positive allometry in both Corpus Depth 2 and Corpus Depth 3 with centroid size (significant increase in both corpus depths with increasing centroid size). Corpus Depth 2 and Corpus Depth 3 both significantly decrease with increasing second molar size. These trends in relation to centroid size and the second molar size suggest that relative corpus depth under the molar arcade is greater in males. Looking at pit 61/67 specimens, the only significant regressions are centroid size vs. Corpus Depth 2 and second molar length vs. Corpus Depth 3. The regressions of centroid size vs. Corpus Depth 3 and second molar length vs. Corpus Depth 2 display the same trends as the overall data set, but are not significant. The trends in pit 61/67 still indicate that males have thicker corpora than females. Corpus depth is both sexually dimorphic and reflective of static allometry. In summary, females do not have more hyena-like corpora, even if they may have more completely processed carcasses as indicated by their relatively larger molars. Instead, females move down the static allometry axis relative to males.

Although not much can be said statistically, Corpus Depth 1 is interesting nonetheless. From the overall dataset, second molar length vs. Corpus Depth 1 was significant; with increasing second molar size, Corpus Depth 1 also increased. Second molar length vs. Corpus

Depth 1 for only 61/67 specimens was not significant, but displayed the same trend and was very close to being significant. Neither centroid size vs. Corpus Depth 1 regressions for the complete dataset nor 61/67 only were significant. However, due to the trends against second molar length, it can be inferred that females have relatively deeper corpora underneath the beginning of the premolar arcade than males. The same pattern can be found in extant gray wolves. Milenkovic et al. (2010) compared cranial and mandible shape variables among both females and males of two populations of gray wolves. In terms of allometric shape change, larger mandibles (representative of males) tended to be more narrow. This agrees with the Corpus Depth 1 trend found in the overall dataset. This agreement between the gray wolf study (Milenkovic et al., 2010) and this study would indicate a weak sexually dimorphic signal in Corpus Depth 1. However, Milenkovic et al (2010) had one less landmark on the ventral border of the mandible from the study I conducted; it is possible there is a trend in corpus thickness in these gray wolves that is not being picked up due to the lack of this landmark.

Sexual Dimorphism of Other Elements. Regressions of molar interlandmark distances against centroid size indicate sexual dimorphism. The length of the talonid basin, or grinding area, of the carnassial and the length of the second molar are both negatively allometric, or decrease with increasing centroid size (Figure 2). Small body sizes have relatively larger molars, which is consistent with patterns found in female *C. lupus* (O'Keefe et al., 2013). These trends are also evident in each individual pit, indicating this pattern did not change through time. The molar interlandmark regressions agree with the interpretation of PC3 (See Chapter 2). Both PC3 and molar regressions display the same relationship between centroid size and molar size, and are not time dependent, indicating a sexually dimorphic molar signal in the dire wolf. However, my results do not support a sexually dimorphic signal in the coronoid process, as seen in the gray wolf. The global regression shows no correlation between coronoid height and centroid size. There are several possibilities for the lack of detection of this trend in the dire wolf specimens. First, the coronoid height signal was not as strong as the molar signal in gray wolves, so we may not have the power to detect this pattern. Second, the coronoid process is subject to evolutionary change in orientation, as seen in PC 2 (See Chapter 2), which may be masking the signal. Or, finally, the dire wolf may not display this trend at all and is not sexually dimorphic in coronoid height like *C. lupus*. It is important to note that most bony measures of the jaw have positively allometric trends; because the coronoid process is of the bony jaw, other features, such as coronoid process width, show the coronoid process is different along the static allometry axis even though coronoid height lacks a significant correlation to centroid size. Additionally, as discussed in Chapter 2 (under description of PC 4), the placement of landmark 13, which was involved in calculating coronoid height, is more subjective, in the x-dimension, than any other landmark and may create noise in this specific landmark. The variance of landmark 13 in the y-dimension, however, was similar to that of the other landmarks. Since coronoid height focuses on the y-dimension of landmark 13, I believe noise in this landmark had a minimal effect in calculations of coronoid height.

Taking all 15 linear measurements into consideration, three measurements displayed significantly positive relationships with centroid size: Corpus Depth 2, Jaw Length, and Canasssial-Condyloid. The relationship between centroid size and Corpus Depth 2 has already been determined to be sexually dimorphic (see above for discussion). This measurement also represents static allometry, with larger wolves having deeper corpora at the beginning of the molar arcade. Comparing Corpus Depth 2 among the different pits, pit 13 is different from the other pits and has the largest relative values. This could be evidence of an evolutionary response to nutrient stress in pit 13 or ontogenetic responses. As discussed above, canids use their carnassial, as well as their other molars, in bone cracking; a thicker corpus underneath the carnassial would help resist higher bending stresses during bone cracking (Biknevicius and Ruff, 1992).

Size is inherently included in the measurement of Jaw Length. Much of this measurement is static allometric growth. However, since males have larger body sizes than females, this is also a sexually dimorphic characteristic. Much of jaw length is attributable to the bony part of the jaw, here specifically the ramus of the mandible. The dental row reaches maturity in gray wolves around 7 to 9 months, whereas the rest of the jaw can continue to grow for up to 2 years (O'Keefe et al., 2014; Kreeger, 2003; see Chapter 2, discussion of PC 1). This contribution to jaw length by the ramus can be seen in the significantly positive correlation between the carnassial-condyloid measurement and centroid size. Larger wolves have a bigger, wider ramus. Again, since males are larger than females, this implies that this measurement should also be sexually dimorphic. Since the ramus of the mandible is wider in males, this may allow for a larger area of attachment for the masseter and temporalis muscles. Because modern male gray wolves have been shown to be more successful in handling prey (O'Keefe et al., 2013), a larger ramus for larger muscles may also reflect this behavior in male dire wolves.

Three linear measurements taken were shown to have significantly negative relationships with centroid size; these include M2 Length, Premolar Arcade, and Molar Arcade. The second molar length has already been discussed as a sexually dimorphic characteristic (see above). Female dire wolves have relatively larger second molars than males, similar to the extant gray wolf (O'Keefe et al., 2013). Conversely, the Premolar Arcade trend is a result of ontogenetic allometry. Due to the bony jaw continuing to grow around the teeth, the relative size of the premolar arcade decreases as the bony jaw, especially the ramus, and centroid size increases.

The Molar Arcade measurement is the most interesting of the three that inversely correlate with centroid size. It is critical when evaluating this measurement to remember that the length of the molar arcade includes both the carnassial and the second molar. It has already been determined that the second molar length is sexually dimorphic, and so the molar arcade length includes some sexual dimorphism. However, both the trigonid and talonid basins of the carnassial do not significantly change with centroid size, indicating the carnassial is not sexually dimorphic. Prior studies have also indicated that dimorphism in the carnassial is due to feeding differences rather than differences among the sexes (Gittleman and Van Valkenburgh, 1997). The entire arcade can be seen to have a negative correlation with centroid size due to static allometry for the same reason the premolar arcade is interpreted this way-the bony jaw continues to grow around the teeth, making the relative length of the molar arcade decrease with increasing centroid size. The Molar Arcade measurement does, however, separate the pits into two groups- pits 13 and 91 clump together, while pits 2051 and 61/67 group with one another. This is the only measurement that splits the high tooth breakage and wear pits form the pits of low breakage and wear. I hypothesize the Molar Arcade is also picking up an evolutionary signal to times of increased nutrient stress. Looking at differences among the pits for the trigonid and talonid basins, pit 13 has the largest values for both measures. Pit 91 has similar values as pit 13 for the trigonid basin, but not the talonid basin. This may be an evolutionary response to increased nutrient stress, since canids utilize their carnassials, specifically the trigonid basin, in bone cracking (Biknevicius and Ruff, 1992; Biknevicius and Van Valkenburgh, 1996; Werdelin, 1989

Van Valkenburgh 2007). Overall, the Molar Arcade seems to be both sexually dimorphic and allometric, in addition to revealing an evolutionary effect to nutrient stress.

New Body Size Estimation. Due to conflicting body size estimates generated from dire wolf skulls and jaws, a new body indicator was needed. The results of the upper carnassial (P4) and the trigonid basin of the lower carnassial (m1) show similar patterns among the pits. In both proxies for body size, pit 91 contains the largest wolves. Pit 13 has the next largest mean body size. The pattern for pits 2051 and 61/67 differ between these measurements. Pit 2051 wolves are smallest according to the jaw data, but the cranial data results in the mean body size of pit 61/67 as being the smallest. However, in both measurement s comparisons among pits 2051 and 61/67 are not significantly different and confidence intervals overlap.

Although body size estimates from P4 and the trigonid basin of m1, these estimates still do not seem to follow a temporal Bergmann's rule. Pit 91 wolves are still the largest wolves, while pit 2051, a time of cold climate, has relatively small wolves. It seems as though wolves under assumed nutrient stress, pits 91 and 13, have larger body sizes in relation to wolves under lower nutrient stress (O'Keefe et al., 2014). This increase in body size may be due to an increase in intra- and interspecific competition for food sources, a response similar to that of coyotes, or a change in prey (Meachen and Samuels, 2012; DeSantis et al.,2012). However, pit 61/67 wolves seem to be adapted to warm climate, having an overall more gracile morphology and a small body size (O'Keefe et al., 2014). Both climate and environmental factors may be the causalities of the pattern seen here.

The talonid basin of m1reflects a different pattern among the pits from the pattern shown by P4 and the trigonid basin of m1. Pit 13 has significantly higher values than the other pits. This may implicate an evolutionary response to high nutrient stress, as inferred from the high incidences of tooth breakage and wear (O'Keefe et al., 2014). The increase in length of this tooth basin may be advantageous to more completely utilizing carcasses by allowing more surface area to aid in food processing. However, both pit 91 and pit 13 show higher incidences in tooth breakage and wear. It is possible that only pit 13 is showing this response because these wolves are stunted further down the ontogenetic axis, while only late-stage truncation of growth affected pit 91 wolves. The breakage and wear event of pit 13 may have been more severe than the event in pit 91(or began in pit 91 only after dental maturity was reached in the population), thus inducing an evolutionary response in the talonid basin of m1 (O'Keefe et al., 2014).

Conclusion. Allometric components of the dire wolf mandible have been determined from the designated linear measurements. While corpus depth was determined not to contain an evolutionary response and to have only a weak sexually dimorphic signal in Corpus Depth 1, the second molar length revealed that females have relatively larger M2s. The bony growth of the jaw relative to dental maturity reflects the relationships seen in jaw length, carnassial-condyloid distance, the premolar arcade, and the molar arcade with centroid size. Interestingly, the molar arcade also exhibited evidence for an evolutionary response to nutrient stress. Additionally, body size estimates from the crania and jaws now agree due to the use of a dental measurement, instead of centroid size. Much can be said about the relationships of shape and size of dire wolf mandibles across the four La Brea tar pits studied: Analyses of their shape continue to describe their similarities to the morphology of the extant gray wolves, reinforcing the idea that *Canis lupus* is the best model we have for the extinct *Canis dirus*.

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APPENDIX A

MARSHALL UNIVERSITY®
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Office of Research Integrity

September 23, 2013

Alexandria Brannick
845 10th Ave
Rear Apartment
Huntington, WV 25701

Dear Ms. Brannick:

This letter is in response to the submitted thesis abstract entitled *"Nutritional Stress Induces Morphological Changes in Dire Wolves from Rancho La Brea."* After assessing the abstract it has been deemed not to be human subject research and therefore exempt from oversight of the Marshall University Institutional Review Board (IRB). The Code of Federal Regulations (45CFR46) has set forth the criteria utilized in making this determination. Since the information in this study does not involve human subjects as defined in the above referenced instruction it is not considered human subject research. If there are any changes to the abstract you provided then you would need to resubmit that information to the Office of Research Integrity for review and a determination.

I appreciate your willingness to submit the abstract for determination. Please feel free to contact the Office of Research Integrity if you have any questions regarding future protocols that may require IRB review.

Sincerely,

Bruce F. Day, ThD, CIP
Director

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APPENDIX B-List of all specimens, Procrustes-adjusted landmark coordinates, and distance measurements.

Specimen #_Pit #	Pit #	Side	lnCentroid Size	Centroid Size	Coronoid Height	ln Coronoid Height
2301-L-101_13	13	L	7.86019065	2592.015	0.299452872	-1.20579823
2301-L-106_61-67	6167	L	8.00486441	2995.494	0.299878022	-1.204379481
2301-L-109_61-67	6167	L	7.90080809	2699.463	0.298282709	-1.209713554
2301-L-10_61-67	6167	L	7.97077985	2895.114	0.297839358	-1.211201005
2301-L-120_61-67	6167	L	7.94454879	2820.16	0.315947511	-1.152179184
2301-L-123_61-67	6167	L	7.99010739	2951.614	0.297404366	-1.212662564
2301-L-12_61-67	6167	L	7.90136079	2700.955	0.310634369	-1.169138721
2301-L-140_61-67	6167	L	7.92484344	2765.131	0.315768525	-1.152745848
2301-L-143_13	13	L	7.87456488	2629.542	0.310068697	-1.170961403
2301-L-148_61-67	6167	L	7.94243691	2814.21	0.300270064	-1.203072996
2301-L-154_61-67	6167	L	7.90699775	2716.223	0.292710797	-1.228570198
2301-L-155_61-67	6167	L	7.9442136	2819.215	0.306678464	-1.181955428
2301-L-156_61-67	6167	L	7.96296179	2872.568	0.30887886	-1.174806119

2301-L-164_61-67	6167	L	7.93838327	2802.825	0.307384718	-1.179655162
2301-L-167_61-67	6167	L	7.91911315	2749.332	0.307355811	-1.179749208
2301-L-173_13	13	L	7.93438705	2791.647	0.30645195	-1.182694305
2301-L-185_61-67	6167	L	7.94151154	2811.607	0.306712654	-1.181843952
2301-L-186_61-67	6167	L	7.89935566	2695.545	0.308737916	-1.17526253
2301-L-193_61-67	6167	L	7.91126199	2727.831	0.296977478	-1.214098976
2301-L-203_61-67	6167	L	7.95037126	2836.628	0.283762043	-1.259619269
2301-L-210_61-67	6167	L	7.92083107	2754.059	0.315318403	-1.154172347
2301-L-211_61-67	6167	L	7.99520605	2966.702	0.303186823	-1.193406087
2301-L-218_61-67	6167	L	7.98771741	2944.568	0.323153759	-1.129627035
2301-L-242_61-67	6167	L	7.98803542	2945.505	0.297210254	-1.213315464
2301-L-244_61-67	6167	L	7.95832331	2859.275	0.294388031	-1.222856547
2301-L-245_61-67	6167	L	7.95375408	2846.24	0.29183072	-1.23158137
2301-L-246_61-67	6167	L	7.90134218	2700.905	0.297721515	-1.211596744
2301-L-28_61-67	6167	L	7.91138507	2728.167	0.30520981	-1.186755838
2301-L-419_13	13	L	7.83471683	2526.82	0.301506135	-1.198964914

2301-L-425_61-67	6167	L	7.89747398	2690.478	0.311782073	-1.16545082
2301-L-428_61-67	6167	L	7.98286283	2930.308	0.302893746	-1.194373208
2301-L-42_61-67	6167	L	7.99955097	2979.62	0.30377898	-1.191454882
2301-L-430_61-67	6167	L	7.94617642	2824.754	0.298277686	-1.209730394
2301-L-433_61-67	6167	L	7.96509633	2878.706	0.301675154	-1.198404489
2301-L-447_13	13	L	7.82656003	2506.293	0.299518996	-1.205577437
2301-L-44_61-67	6167	L	7.93117193	2782.686	0.300127452	-1.203548055
2301-L-451_13	13	L	7.86726196	2610.408	0.332824256	-1.100140687
2301-L-455_61-67	6167	L	7.89336074	2679.434	0.300427579	-1.202548555
2301-L-466_13	13	L	7.91279026	2732.003	0.323431333	-1.12876845
2301-L-468_13	13	L	7.85403723	2576.114	0.312645295	-1.162685975
2301-L-469_61-67	6167	L	7.86497541	2604.446	0.303632737	-1.191936409
2301-L-474_13	13	L	7.82478356	2501.845	0.30218366	-1.196720302
2301-L-475_13	13	L	7.85750525	2585.063	0.297247731	-1.213189376
2301-L-482_61-67	6167	L	7.85774928	2585.694	0.295031177	-1.220674243
2301-L-48_61-67	6167	L	7.88820944	2665.667	0.318967768	-1.142665223

2301-L-490_13	13	L	7.8435148	2549.149	0.306614768	-1.182163146
2301-L-493_61-67	6167	L	7.84318652	2548.312	0.298085032	-1.210376491
2301-L-4_61-67	6167	L	8.01350509	3021.489	0.291094389	-1.234107704
2301-L-500_13	13	L	7.87699078	2635.929	0.294143487	-1.223687581
2301-L-509_61-67	6167	L	7.89589543	2686.234	0.312397744	-1.163478083
2301-L-50_61-67	6167	L	7.97838264	2917.209	0.306541841	-1.182401021
2301-L-511_61-67	6167	L	7.98439092	2934.789	0.305222762	-1.186713401
2301-L-514_61-67	6167	L	7.97267447	2900.605	0.306518658	-1.18247665
2301-L-516_61-67	6167	L	7.98301922	2930.766	0.303409046	-1.192673397
2301-L-517_61-67	6167	L	7.92982046	2778.928	0.290607267	-1.23578252
2301-L-518_61-67	6167	L	7.9512671	2839.17	0.289138113	-1.240850807
2301-L-537_61-67	6167	L	7.90636201	2714.497	0.296006183	-1.217374936
2301-L-63_13	13	L	7.91830158	2747.101	0.302016893	-1.197272326
2301-L-64_61-67	6167	L	7.95386413	2846.553	0.294642544	-1.221992373
2301-L-65_61-67	6167	L	8.01844266	3036.445	0.294147211	-1.223674919
2301-L-66_61-67	6167	L	7.91407363	2735.511	0.280630268	-1.270717248

2301-L-68_61-67	6167	L	7.91268058	2731.703	0.299094253	-1.206996529
2301-L-70_13	13	L	7.90953228	2723.117	0.301682166	-1.198381248
2301-L-72_13	13	L	7.88021163	2644.432	0.313911647	-1.158643711
2301-L-74_61-67	6167	L	7.95680585	2854.939	0.297930649	-1.210894542
2301-L-79_61-67	6167	L	7.97642668	2911.509	0.291719701	-1.231961867
2301-L-81_61-67	6167	L	7.96674491	2883.456	0.297351945	-1.21283884
2301-L-84_61-67	6167	L	7.97147079	2897.115	0.295124381	-1.22035838
2301-L-85_61-67	6167	L	8.00617492	2999.422	0.290117948	-1.237467722
2301-L-92_13	13	L	7.90823341	2719.582	0.29453884	-1.222344401
2301-L-93_13	13	L	7.91400803	2735.332	0.297656674	-1.211814557
2301-L-95_61-67	6167	L	7.94826242	2830.652	0.306850809	-1.181393614
2301-L-97_61-67	6167	L	7.92533536	2766.492	0.262456339	-1.337670538
2301-L-99_61-67	6167	L	7.84329887	2548.598	0.295611487	-1.21870923
28662_2051	2051	R	7.9332599	2788.502	0.298445631	-1.209167504
28663_2051	2051	R	7.9369596	2798.838	0.315132604	-1.154761763
28720_2051	2051	R	7.96878024	2889.331	0.322701357	-1.131027976

28736_2051	2051	R	7.87006225	2617.729	0.315697485	-1.152970849
28738b_2051	2051	R	7.91188192	2729.522	0.320757262	-1.137070635
28739_2051	2051	R	7.94368243	2817.717	0.319054146	-1.142394454
28756_2051	2051	R	7.94796081	2829.799	0.332762443	-1.100326428
28758_2051	2051	R	7.94785273	2829.493	0.322198718	-1.132586788
29041_2051	2051	R	7.9071295	2716.581	0.303686953	-1.191757868
29049_2051	2051	R	7.9066746	2715.346	0.314288949	-1.157442497
29056_2051	2051	R	7.86741088	2610.797	0.306120193	-1.183777466
29068_2051	2051	R	7.89580993	2686.004	0.289152689	-1.240800396
29075_2051	2051	R	7.92008774	2752.012	0.310159605	-1.170668261
29082_2051	2051	R	7.92839326	2774.965	0.314167153	-1.157830099
76919_2051	2051	R	7.83766721	2534.286	0.313529766	-1.159860977
associated with 2301-R-214_61-67	6167	L	8.01044723	3012.264	0.297568118	-1.212112113
JR3_2051	2051	R	7.87375493	2627.413	0.301731419	-1.198217997
LACMHC 54899_13	13	L	7.82098797	2492.367	0.291101729	-1.234082489
LACMHC 54901_13	13	L	7.90431813	2708.955	0.315534175	-1.153488284

LACMHC 54903_13	13	L	7.86175584	2596.075	0.320850541	-1.13677987
LACMHC 54909_13	13	L	7.87475813	2630.05	0.292433629	-1.229517546
LACMHC 54912_13	13	L	7.93222644	2785.622	0.291181894	-1.233807142
LACMHC 54913_13	13	L	7.86358145	2600.818	0.299956125	-1.204119064
LACMHC 54917_13	13	L	7.97248724	2900.062	0.279436356	-1.274980719
LACMHC 54921_13	13	L	7.89511492	2684.138	0.318076669	-1.145462829
LACMHC 54922_13	13	L	7.85484388	2578.193	0.300207556	-1.203281192
LACMHC 54924_13	13	L	7.87936933	2642.206	0.296955584	-1.214172699
LACMHC 54940_13	13	L	7.85510307	2578.861	0.296211437	-1.216681764
LACMHC 54943_13	13	L	7.84267528	2547.01	0.287906016	-1.245121184
LACMHC 54958_13	13	L	7.84103929	2542.846	0.318594342	-1.14383664
LACMHC 54959_13	13	L	7.86246458	2597.915	0.307458169	-1.179416235
LACMHC 54962_13	13	L	7.85029725	2566.497	0.318709252	-1.143476026
LACMHC 54975_13	13	L	7.84186778	2544.954	0.300464349	-1.202426172
LACMHC 54976_13	13	L	7.85973147	2590.825	0.293103351	-1.22723
LACMHC 54977_13	13	L	7.88802649	2665.179	0.321870341	-1.133606481

LACMHC 54983_13	13	L	7.90081502	2699.482	0.306872269	-1.181323678
LACMHC 55509_61-67	6167	L	7.94024728	2808.055	0.29165141	-1.232195992
LACMHC 55513_61-67	6167	L	7.88718154	2662.928	0.306777558	-1.181632359
LACMHC 55516_61-67	6167	L	7.90865057	2720.717	0.303407096	-1.192679823
LACMHC 55518_61-67	6167	L	7.85323401	2574.045	0.306186146	-1.183562043
LACMHC 55520_61-67	6167	L	7.9038449	2707.673	0.317198411	-1.148227798
LACMHC 55521_61-67	6167	L	7.88438566	2655.493	0.298116764	-1.210270043
LACMHC 55660_61-67	6167	L	7.93123277	2782.855	0.294986582	-1.22082541
LACMHC 55665_61-67	6167	L	7.92143724	2755.729	0.29485992	-1.221254882
LACMHC 55666_61-67	6167	L	8.00820454	3005.516	0.290061852	-1.237661095
LACMHC 55667_61-67	6167	L	7.9771287	2913.553	0.293386047	-1.226265969
LACMHC 55675_61-67	6167	L	7.97152389	2897.269	0.302028253	-1.197234712
LACMHC 55681_61-67	6167	L	7.8967662	2688.574	0.291800988	-1.231683257
LACMHC 55683_61-67	6167	L	7.96658224	2882.987	0.301881343	-1.197721244
LACMHC 55685_61-67	6167	L	7.89232363	2676.656	0.300776445	-1.201387997
LACMHC 55691_61-67	6167	L	7.97757837	2914.864	0.291469146	-1.232821124

LACMHC 55692_61-67	6167	L	7.98596001	2939.398	0.2912489	-1.233577051
LACMHC 55693_61-67	6167	L	7.93209913	2785.267	0.295473496	-1.219176139
LACMHC 55694_61-67	6167	L	7.84064574	2541.846	0.288441826	-1.243261856
LACMHC 55695_61-67	6167	L	7.83591056	2529.838	0.284999304	-1.25526854
LACMHC 675_61-67	6167	L	7.93665926	2797.997	0.311393347	-1.166698384
LACMHC 676_61-67	6167	L	7.91041489	2725.521	0.290566718	-1.235922064
LACMHC 680_61-67	6167	L	7.89915836	2695.013	0.295560257	-1.218882549
LACMHC 681_61-67	6167	L	7.89941516	2695.705	0.297520668	-1.212271583
LACMHC 682_61-67	6167	L	7.94112334	2810.516	0.305111338	-1.187078526
LACMHC 683_61-67	6167	L	7.95661931	2854.407	0.301887769	-1.197699957
R17460_91	91	L	8.00163951	2985.849	0.301855	-1.19780851
R17488_91	91	L	7.97918986	2919.565	0.28538309	-1.253922826
R17928_91	91	L	7.92254701	2758.789	0.298048556	-1.210498866
R18664_91	91	L	7.96743108	2885.435	0.312603701	-1.162819022
R27246_91	91	L	7.85384794	2575.626	0.287340513	-1.247087309
R28351_91	91	L	7.91906572	2749.201	0.309781145	-1.171889216

R28379_91	91	L	8.00932313	3008.88	0.28976655	-1.238679679
R28913_91	91	L	7.94071979	2809.382	0.294325811	-1.223067926
R30721_91	91	L	7.91345398	2733.817	0.299732082	-1.204866264
R30746_91	91	L	7.99167998	2956.259	0.300448363	-1.202479375
R31305_91	91	L	7.88981604	2669.953	0.280904854	-1.269739263
R34526_91	91	L	7.95971562	2863.259	0.296913252	-1.214315263
R34706_91	91	L	8.02481681	3055.861	0.285266547	-1.254331283
R38491_91	91	L	7.94233827	2813.933	0.271605913	-1.303403113
R39009_91	91	L	7.81077708	2467.047	0.281057332	-1.269196601
R39376_91	91	L	7.98283721	2930.233	0.299377656	-1.20604944
R39566_91	91	L	7.88071553	2645.765	0.289670238	-1.239012113
R39965_91	91	L	7.90904221	2721.782	0.282503205	-1.264065382
R40942_91	91	L	7.90608347	2713.741	0.295967769	-1.21750472
R52965_91	91	L	7.84525254	2553.582	0.282140873	-1.265348783
R53460_91	91	L	7.91031752	2725.256	0.300812439	-1.201268334
R53878_91	91	L	7.96877102	2889.304	0.296669544	-1.215136407

Specimen #_Pit #	M2 size	ln M2 size	M1 Grinding	ln M1 grinding	M1 Shearing	ln M1 Shearing
2301-L-101_13	0.03015419	-3.5014315	0.0343449	-3.3713017	0.08823617	-2.4277384
2301-L-106_61-67	0.046379	-3.0709084	0.03399546	-3.3815283	0.09615369	-2.3418074
2301-L-109_61-67	0.04956342	-3.0045022	0.03396187	-3.3825169	0.09520413	-2.351732
2301-L-10_61-67	0.05043452	-2.9870793	0.02561159	-3.6647103	0.09511816	-2.3526354
2301-L-120_61-67	0.05023927	-2.9909583	0.03230077	-3.4326641	0.09997234	-2.3028618
2301-L-123_61-67	0.05045811	-2.9866118	0.03388654	-3.3847373	0.09725619	-2.3304067
2301-L-12_61-67	0.05011242	-2.9934865	0.0293985	-3.5268118	0.10061319	-2.2964719
2301-L-140_61-67	0.04842418	-3.027756	0.03096252	-3.4749779	0.09281006	-2.3772002
2301-L-143_13	0.0560015	-2.8823768	0.03682773	-3.3015041	0.1015564	-2.2871409
2301-L-148_61-67	0.04877609	-3.0205151	0.03172089	-3.4507799	0.09273272	-2.3780339
2301-L-154_61-67	0.0474353	-3.0483886	0.03165733	-3.4527856	0.09738463	-2.3290869
2301-L-155_61-67	0.05049338	-2.985913	0.036307	-3.3157448	0.09081652	-2.3989141
2301-L-156_61-67	0.05179046	-2.9605492	0.03561903	-3.3348752	0.09552786	-2.3483374
2301-L-164_61-67	0.05555395	-2.8904006	0.02971811	-3.5159987	0.09532046	-2.3505108
2301-L-167_61-67	0.05078879	-2.9800795	0.03607482	-3.3221601	0.08704276	-2.4413558

2301-L-173_13	0.05108754	-2.9742146	0.04083768	-3.1981501	0.08992178	-2.4088151
2301-L-185_61-67	0.04881347	-3.0197489	0.03600869	-3.323995	0.09410976	-2.3632935
2301-L-186_61-67	0.0490399	-3.0151211	0.03378997	-3.3875913	0.09201563	-2.3857968
2301-L-193_61-67	0.05184	-2.9595932	0.03503396	-3.3514373	0.0953096	-2.3506247
2301-L-203_61-67	0.05399716	-2.9188238	0.03609617	-3.3215685	0.09198634	-2.3861152
2301-L-210_61-67	0.05411659	-2.9166144	0.03668033	-3.3055147	0.09236251	-2.3820341
2301-L-211_61-67	0.04843096	-3.0276159	0.03294721	-3.4128486	0.09691	-2.3339725
2301-L-218_61-67	0.04845464	-3.0271272	0.02797598	-3.5764091	0.09611878	-2.3421706
2301-L-242_61-67	0.04174889	-3.1760825	0.03310608	-3.4080383	0.09170911	-2.3891336
2301-L-244_61-67	0.04910565	-3.0137812	0.03478629	-3.3585319	0.09240129	-2.3816144
2301-L-245_61-67	0.05099768	-2.9759751	0.03730173	-3.2887155	0.09203852	-2.385548
2301-L-246_61-67	0.05374696	-2.9234683	0.03299142	-3.4115078	0.09331528	-2.3717714
2301-L-28_61-67	0.04921288	-3.0115999	0.03601308	-3.3238731	0.09006684	-2.4072032
2301-L-419_13	0.05533913	-2.8942749	0.03033658	-3.495401	0.09583632	-2.3451135
2301-L-425_61-67	0.04777947	-3.0411593	0.0335441	-3.3948943	0.09371749	-2.3674704
2301-L-428_61-67	0.05136857	-2.9687287	0.03369338	-3.3904539	0.08455082	-2.4704025

2301-L-42_61-67	0.0503073	-2.9896051	0.03356805	-3.3941806	0.09104775	-2.3963712
2301-L-430_61-67	0.05471193	-2.9056736	0.02842926	-3.5603363	0.09182122	-2.3879118
2301-L-433_61-67	0.04452001	-3.1118165	0.03161333	-3.4541763	0.09869761	-2.3156946
2301-L-447_13	0.0560216	-2.8820179	0.04007871	-3.21691	0.11257406	-2.184144
2301-L-44_61-67	0.05080791	-2.9797032	0.03738087	-3.2865962	0.08699306	-2.4419269
2301-L-451_13	0.05301775	-2.9371285	0.03545111	-3.3396008	0.09741131	-2.3288129
2301-L-455_61-67	0.04765013	-3.0438699	0.03287667	-3.414992	0.0871195	-2.4404745
2301-L-466_13	0.03577762	-3.3304328	0.03388514	-3.3847787	0.09838701	-2.3188465
2301-L-468_13	0.05625554	-2.8778507	0.03299771	-3.411317	0.09736861	-2.3292514
2301-L-469_61-67	0.05989757	-2.8151193	0.03795175	-3.2714395	0.08358668	-2.4818711
2301-L-474_13	0.05524902	-2.8959047	0.0313125	-3.4637379	0.08746603	-2.4365048
2301-L-475_13	0.05447137	-2.91008	0.03948778	-3.2317641	0.09487072	-2.3552402
2301-L-482_61-67	0.05078722	-2.9801106	0.03301846	-3.4106885	0.09856115	-2.3170781
2301-L-48_61-67	0.04912195	-3.0134494	0.03368963	-3.3905651	0.09623511	-2.3409611
2301-L-490_13	0.05188293	-2.9587654	0.04072431	-3.2009301	0.10047547	-2.2978417
2301-L-493_61-67	0.05769057	-2.8526615	0.04585066	-3.0823657	0.09964677	-2.3061236

2301-L-4_61-67	0.04857152	-3.024718	0.03523781	-3.3456356	0.09817604	-2.3209931
2301-L-500_13	0.05231497	-2.9504727	0.03634464	-3.3147086	0.09596562	-2.3437653
2301-L-509_61-67	0.05170244	-2.9622504	0.03897278	-3.2448918	0.09403591	-2.3640785
2301-L-50_61-67	0.05302783	-2.9369384	0.03010538	-3.5030515	0.09093333	-2.3976286
2301-L-511_61-67	0.05153291	-2.9655346	0.03541729	-3.3405551	0.09335156	-2.3713827
2301-L-514_61-67	0.04895653	-3.0168225	0.0362256	-3.3179891	0.09122226	-2.3944563
2301-L-516_61-67	0.04587943	-3.0817384	0.03356519	-3.3942657	0.09264905	-2.3789366
2301-L-517_61-67	0.04507197	-3.0994948	0.03893215	-3.2459348	0.09949409	-2.307657
2301-L-518_61-67	0.04828952	-3.0305408	0.03317938	-3.4058267	0.09298758	-2.3752893
2301-L-537_61-67	0.05347276	-2.9285829	0.03344873	-3.3977416	0.09212019	-2.3846611
2301-L-63_13	0.05148021	-2.9665578	0.03028157	-3.497216	0.08892899	-2.419917
2301-L-64_61-67	0.05181795	-2.9600188	0.03589648	-3.3271162	0.08739022	-2.4373719
2301-L-65_61-67	0.04640901	-3.0702617	0.02732666	-3.5998924	0.08612155	-2.4519956
2301-L-66_61-67	0.04660025	-3.0661494	0.0301827	-3.5004864	0.09435829	-2.3606561
2301-L-68_61-67	0.05288822	-2.9395746	0.03479032	-3.3584161	0.08982723	-2.4098671
2301-L-70_13	0.05626358	-2.8777079	0.04347097	-3.1356619	0.09492498	-2.3546684

2301-L-72_13	0.04989614	-2.9978116	0.03532241	-3.3432376	0.08883699	-2.4209522
2301-L-74_61-67	0.05063313	-2.9831493	0.03468382	-3.361482	0.08689877	-2.4430114
2301-L-79_61-67	0.04940281	-3.007748	0.03004088	-3.5051963	0.08697252	-2.4421631
2301-L-81_61-67	0.04900898	-3.0157517	0.03896748	-3.2450278	0.10457223	-2.2578773
2301-L-84_61-67	0.0458558	-3.0822535	0.03560785	-3.3351891	0.09575617	-2.3459502
2301-L-85_61-67	0.0580016	-2.8472848	0.04470636	-3.1076395	0.08169057	-2.5048167
2301-L-92_13	0.05246319	-2.9476434	0.03344486	-3.3978571	0.09843817	-2.3183266
2301-L-93_13	0.04766662	-3.0435239	0.03526535	-3.3448543	0.09786249	-2.324192
2301-L-95_61-67	0.04915483	-3.0127801	0.03182814	-3.4474045	0.09495425	-2.3543601
2301-L-97_61-67	0.05081431	-2.9795773	0.03462937	-3.3630531	0.09301621	-2.3749815
2301-L-99_61-67	0.06238846	-2.7743749	0.02946976	-3.5243905	0.09517116	-2.3520783
28662_2051	0.05205362	-2.9554809	0.03596361	-3.3252478	0.09104172	-2.3964374
28663_2051	0.05694844	-2.8656089	0.03489767	-3.3553352	0.09055269	-2.4018234
28720_2051	0.05154464	-2.9653071	0.03181493	-3.4478195	0.08723527	-2.4391465
28736_2051	0.05504267	-2.8996465	0.03626084	-3.317017	0.08939375	-2.4147045
28738b_2051	0.05243494	-2.9481821	0.0369647	-3.2977919	0.0931438	-2.3736107

28739_2051	0.04793609	-3.0378866	0.03333956	-3.4010105	0.09430721	-2.3611977
28756_2051	0.05431058	-2.9130362	0.03398351	-3.3818797	0.09194727	-2.38654
28758_2051	0.04712167	-3.0550223	0.02983	-3.5122407	0.0878148	-2.4325253
29041_2051	0.05402315	-2.9183425	0.03800276	-3.2700964	0.08454832	-2.4704321
29049_2051	0.05179109	-2.9605371	0.02935148	-3.5284122	0.10166719	-2.2860506
29056_2051	0.04729697	-3.051309	0.0275272	-3.5925806	0.1041109	-2.2622986
29068_2051	0.05452007	-2.9091863	0.0381948	-3.2650558	0.0903279	-2.4043089
29075_2051	0.0535056	-2.927969	0.03256781	-3.424431	0.08588543	-2.4547411
29082_2051	0.05497544	-2.9008688	0.03894611	-3.2455765	0.08846574	-2.4251399
76919_2051	0.05620636	-2.8787254	0.03393001	-3.3834553	0.08532057	-2.4613397
associated with 2301-R-214_61-67	0.0592259	-2.8263964	0.03950657	-3.2312884	0.08398211	-2.4771515
JR3_2051	0.05052132	-2.9853598	0.03434925	-3.3711752	0.09236025	-2.3820586
LACMHC 54899_13	0.04996501	-2.9964323	0.0293882	-3.5271619	0.09272554	-2.3781114
LACMHC 54901_13	0.06129604	-2.7920401	0.03750786	-3.2832047	0.08564268	-2.4575715
LACMHC 54903_13	0.05471559	-2.9056065	0.04044567	-3.2077957	0.08834121	-2.4265486

LACMHC 54909_13	0.05443935	-2.910668	0.03931749	-3.2360859	0.09286813	-2.3765748
LACMHC 54912_13	0.04797674	-3.0370391	0.03987334	-3.2220473	0.08604969	-2.4528304
LACMHC 54913_13	0.04248445	-3.1586171	0.0349911	-3.3526616	0.09694139	-2.3336488
LACMHC 54917_13	0.04750517	-3.0469167	0.03605475	-3.3227168	0.09400385	-2.3644195
LACMHC 54921_13	0.05045942	-2.9865859	0.03350961	-3.3959229	0.09127089	-2.3939234
LACMHC 54922_13	0.04967899	-3.0021733	0.0306097	-3.4864384	0.09322493	-2.3727401
LACMHC 54924_13	0.05162359	-2.9637766	0.03149513	-3.4579225	0.09355678	-2.3691867
LACMHC 54940_13	0.0595006	-2.8217688	0.03842037	-3.2591676	0.09696529	-2.3334022
LACMHC 54943_13	0.05065828	-2.9826525	0.03504865	-3.3510182	0.0891734	-2.4171725
LACMHC 54958_13	0.05584017	-2.8852618	0.03640578	-3.3130277	0.09158233	-2.3905169
LACMHC 54959_13	0.05632532	-2.8766112	0.03399775	-3.3814609	0.09721523	-2.3308279
LACMHC 54962_13	0.05389529	-2.9207122	0.03547615	-3.3388947	0.0894043	-2.4145865
LACMHC 54975_13	0.05813837	-2.8449294	0.04328704	-3.139902	0.10142352	-2.2884502
LACMHC 54976_13	0.05455953	-2.9084629	0.04248208	-3.1586729	0.09407485	-2.3636646
LACMHC 54977_13	0.05226062	-2.9515122	0.04410426	-3.121199	0.10760661	-2.2292732
LACMHC 54983_13	0.05323026	-2.9331282	0.03705156	-3.2954448	0.08824287	-2.4276624

LACMHC 55509_61-67	0.05537727	-2.8935861	0.03277064	-3.4182224	0.08637248	-2.4490862
LACMHC 55513_61-67	0.0511337	-2.9733116	0.03719229	-3.2916538	0.09509722	-2.3528556
LACMHC 55516_61-67	0.05166925	-2.9628925	0.03949925	-3.2314735	0.0900858	-2.4069927
LACMHC 55518_61-67	0.05079172	-2.9800218	0.03506356	-3.3505927	0.09088092	-2.3982052
LACMHC 55520_61-67	0.05260716	-2.944903	0.03481228	-3.3577852	0.08962024	-2.412174
LACMHC 55521_61-67	0.04987489	-2.9982376	0.03352389	-3.3954969	0.09730076	-2.3299485
LACMHC 55660_61-67	0.0525047	-2.9468526	0.02701056	-3.6115274	0.09099047	-2.3970005
LACMHC 55665_61-67	0.0513652	-2.9687945	0.03210006	-3.4388975	0.09110321	-2.3957622

LACMHC 55666_61-67	0.04548074	-3.0904664	0.03172566	-3.4506295	0.09250617	-2.3804799
LACMHC 55667_61-67	0.05266552	-2.9437943	0.03707449	-3.2948261	0.09202807	-2.3856616
LACMHC 55675_61-67	0.04927469	-3.0103448	0.0339673	-3.382357	0.0990612	-2.3120174
LACMHC 55681_61-67	0.04720178	-3.0533237	0.03721116	-3.2911465	0.09053237	-2.4020479
LACMHC 55683_61-67	0.04998311	-2.9960701	0.03121762	-3.4667726	0.08951202	-2.4133824
LACMHC 55685_61-67	0.05724871	-2.8603501	0.03329029	-3.4024894	0.0921711	-2.3841087
LACMHC 55691_61-67	0.05121393	-2.9717437	0.0411683	-3.1900867	0.08663092	-2.4460985
LACMHC 55692_61-67	0.05142848	-2.9675631	0.03595413	-3.3255112	0.09563654	-2.3472003

LACMHC 55693_61-67	0.05406025	-2.9176561	0.03001516	-3.5060527	0.09066179	-2.4006192
LACMHC 55694_61-67	0.05257796	-2.9454583	0.040361	-3.2098913	0.09528197	-2.3509147
LACMHC 55695_61-67	0.04587488	-3.0818375	0.03860837	-3.2542862	0.09031918	-2.4044054
LACMHC 675_61-67	0.05011741	-2.9933868	0.03257231	-3.4242928	0.08640252	-2.4487384
LACMHC 676_61-67	0.05183721	-2.9596471	0.03876337	-3.2502796	0.08300836	-2.488814
LACMHC 680_61-67	0.05767619	-2.8529108	0.03675138	-3.3035796	0.09650944	-2.3381145
LACMHC 681_61-67	0.04768681	-3.0431003	0.03858167	-3.2549779	0.09420496	-2.3622825
LACMHC 682_61-67	0.05283339	-2.940612	0.03566772	-3.3335092	0.09406357	-2.3637844
LACMHC 683_61-67	0.04930279	-3.0097746	0.03369783	-3.3903217	0.09093417	-2.3976195
R17460_91	0.04792886	-3.0380374	0.0306386	-3.4854945	0.09505928	-2.3532546
R17488_91	0.04854805	-3.0252012	0.03255171	-3.4249253	0.09552351	-2.3483829
R17928_91	0.04875159	-3.0210174	0.03631298	-3.3155801	0.09881562	-2.3144996
R18664_91	0.0513693	-2.9687145	0.0331693	-3.4061304	0.09534404	-2.3502635

R27246_91	0.05501315	-2.900183	0.03672656	-3.3042551	0.09663185	-2.3368469
R28351_91	0.05459161	-2.9078751	0.03759938	-3.2807676	0.09524346	-2.3513189
R28379_91	0.05507184	-2.8991167	0.03125676	-3.4655195	0.09616856	-2.3416527
R28913_91	0.05244199	-2.9480477	0.0347922	-3.3583621	0.09921819	-2.3104339
R30721_91	0.05207067	-2.9551534	0.03673948	-3.3039032	0.08712	-2.4404688
R30746_91	0.05462435	-2.9072755	0.03667333	-3.3057055	0.09725231	-2.3304465
R31305_91	0.0535079	-2.927926	0.03078743	-3.4806489	0.09116378	-2.3950976
R34526_91	0.05141727	-2.9677812	0.03535911	-3.3421992	0.08573774	-2.4564622
R34706_91	0.04983189	-2.9991002	0.03024271	-3.4985	0.09768428	-2.3260147
R38491_91	0.05062933	-2.9832242	0.03497327	-3.3531713	0.08908638	-2.4181488
R39009_91	0.06225017	-2.776594	0.04369062	-3.1306217	0.09919976	-2.3106196
R39376_91	0.04948411	-3.0061036	0.02900794	-3.5401857	0.09691581	-2.3339126
R39566_91	0.05123588	-2.9713153	0.02759385	-3.5901623	0.08890157	-2.4202254
R39965_91	0.05499448	-2.9005224	0.03710804	-3.2939216	0.09145096	-2.3919524
R40942_91	0.04980684	-2.999603	0.02878037	-3.5480616	0.09203379	-2.3855995
R52965_91	0.05639273	-2.875415	0.03507231	-3.3503434	0.11327186	-2.1779645

R53460_91	0.05176038	-2.9611302	0.03445702	-3.3680425	0.09705009	-2.3325281
R53878_91	0.05049325	-2.9859156	0.03328363	-3.4026897	0.09484263	-2.3555363

Specimen #_Pit #	**Premolar Arcade**	**ln Premolar Arcade**	**Canine Size**	**ln Canine Size**	**Molar Arcade**	**ln Molar Arcade**	**Jaw Length**	**ln Jaw Length**
2301-L-101_13	0.21147805	-1.5536341	0.0509972	-2.9759846	0.15043739	-1.8942083	0.72895639	-0.3161414
2301-L-106_61-67	0.2184055	-1.5214018	0.05292414	-2.9388958	0.17092373	-1.7665379	0.7248017	-0.3218572
2301-L-109_61-67	0.20664039	-1.5767752	0.04857905	-3.0245629	0.17459081	-1.7453103	0.73323609	-0.3102875
2301-L-10_61-67	0.21147696	-1.5536392	0.06781384	-2.690989	0.16573359	-1.7973737	0.75257085	-0.2842601
2301-L-120_61-67	0.20626312	-1.5786027	0.05727476	-2.8598952	0.17848695	-1.7232398	0.72996994	-0.3147519
2301-L-	0.19599381	-1.6296722	0.05253112	-2.9463494	0.17851841	-1.7230635	0.72736149	-0.3183317

123_61-67								
2301-L-12_61-67	0.20820559	-1.5692293	0.05925681	-2.8258746	0.1749427	-1.7432968	0.73151665	-0.3126353
2301-L-140_61-67	0.19332702	-1.6433721	0.0678239	-2.6908406	0.16881454	-1.7789545	0.73634782	-0.3060527
2301-L-143_13	0.19880706	-1.6154205	0.06678581	-2.7062647	0.1891287	-1.6653275	0.7246281	-0.3220967
2301-L-148_61-67	0.20023782	-1.6082495	0.06169107	-2.7856162	0.16980989	-1.7730757	0.73529666	-0.3074812
2301-L-154_61-67	0.21945473	-1.5166093	0.05920026	-2.8268294	0.17304416	-1.7542085	0.73215306	-0.3117657
2301-L-155_61-67	0.19843568	-1.6172902	0.07133174	-2.6404139	0.17484262	-1.743869	0.74156217	-0.2989963
2301-L-156_61-67	0.20332146	-1.592967	0.05317135	-2.9342355	0.17552077	-1.7399979	0.72392206	-0.3230715
2301-L-	0.20452745	-1.5870531	0.04196258	-3.170977	0.1773225	-1.7297852	0.7176322	-0.3317981

164_61-67								
2301-L- 167_61-67	0.20351237	-1.5920285	0.05187383	-2.9589409	0.17243008	-1.7577634	0.72167427	-0.3261814
2301-L- 173_13	0.19296961	-1.6452225	0.04797493	-3.0370768	0.17847022	-1.7233335	0.71582895	-0.334314
2301-L- 185_61-67	0.20361204	-1.5915388	0.06401242	-2.7486782	0.17439256	-1.7464465	0.73011953	-0.314547
2301-L- 186_61-67	0.20418905	-1.588709	0.06158756	-2.7872954	0.17324922	-1.7530241	0.73102204	-0.3133117
2301-L- 193_61-67	0.21104475	-1.5556851	0.06295565	-2.7653248	0.17749171	-1.7288314	0.72122751	-0.3268006
2301-L- 203_61-67	0.20962926	-1.5624147	0.06806136	-2.6873457	0.1770044	-1.7315807	0.727555	-0.3180657
2301-L- 210_61-67	0.19903535	-1.6142728	0.07068065	-2.6495835	0.17903209	-1.7201902	0.73024273	-0.3143783
2301-L-	0.20033951	-1.6077418	0.0631734	-2.7618719	0.17596332	-1.7374797	0.74400843	-0.2957029

211_61-67								
2301-L-218_61-67	0.19838828	-1.6175292	0.06318998	-2.7616095	0.17069436	-1.7678807	0.73478982	-0.3081708
2301-L-242_61-67	0.20544263	-1.5825884	0.06577903	-2.7214542	0.1639787	-1.8080188	0.74584353	-0.2932395
2301-L-244_61-67	0.20323088	-1.5934126	0.07175108	-2.6345524	0.17222827	-1.7589345	0.75062609	-0.2868476
2301-L-245_61-67	0.20475962	-1.5859186	0.06680002	-2.7060519	0.17534753	-1.7409854	0.73681813	-0.3054142
2301-L-246_61-67	0.20172002	-1.6008746	0.06204802	-2.7798467	0.17570321	-1.738959	0.73380765	-0.3095083
2301-L-28_61-67	0.20111083	-1.6038991	0.05712954	-2.8624339	0.17146309	-1.7633873	0.72486002	-0.3217767
2301-L-419_13	0.20729747	-1.5736005	0.04167652	-3.1778173	0.17888141	-1.7210322	0.71677408	-0.3329946
2301-L-	0.20078253	-1.6055329	0.06277123	-2.7682585	0.17054337	-1.7687657	0.72356417	-0.323566

425_61-67								
2301-L-428_61-67	0.20851832	-1.5677284	0.06084025	-2.7995037	0.16560165	-1.7981701	0.72767811	-0.3178965
2301-L-42_61-67	0.20174574	-1.6007471	0.06620094	-2.7150606	0.17029854	-1.7702023	0.72655968	-0.3194347
2301-L-430_61-67	0.21625685	-1.5312884	0.06762485	-2.6937797	0.16997425	-1.7721083	0.7345787	-0.3084581
2301-L-433_61-67	0.20627659	-1.5785374	0.05840605	-2.8403358	0.171317	-1.7642396	0.7321396	-0.3117841
2301-L-447_13	0.18747362	-1.6741171	0.06037899	-2.8071141	0.20617113	-1.5790487	0.71770578	-0.3316956
2301-L-44_61-67	0.20687099	-1.5756599	0.06540838	-2.7271049	0.17016342	-1.770996	0.73467727	-0.308324
2301-L-451_13	0.21052777	-1.5581377	0.06788227	-2.6899803	0.18082192	-1.7102426	0.72046529	-0.327858
2301-L-	0.21434073	-1.5401883	0.06331548	-2.7596254	0.16337064	-1.8117338	0.72897555	-0.3161151

455_61-67								
2301-L-466_13	0.20153867	-1.601774	0.04468887	-3.1080308	0.16509049	-1.8012615	0.72983856	-0.3149319
2301-L-468_13	0.19962351	-1.6113221	0.05488207	-2.9025686	0.18247881	-1.7011212	0.71309059	-0.3381468
2301-L-469_61-67	0.20266513	-1.5962003	0.07050846	-2.6520225	0.17834957	-1.7240098	0.73253224	-0.3112479
2301-L-474_13	0.19953133	-1.611784	0.05401937	-2.9184125	0.17190572	-1.7608091	0.71842439	-0.3306948
2301-L-475_13	0.19727397	-1.6231618	0.07449916	-2.5969674	0.18550876	-1.6846532	0.7402075	-0.3008247
2301-L-482_61-67	0.20404404	-1.5894194	0.06536077	-2.727833	0.17745915	-1.7290148	0.72776065	-0.3177831
2301-L-48_61-67	0.2032089	-1.5935208	0.06554987	-2.7249441	0.17481918	-1.7440031	0.7267181	-0.3192166
2301-L-	0.20213597	-1.5988147	0.06685487	-2.7052312	0.18916083	-1.6651577	0.72916468	-0.3158557

490_13								
2301-L-493_61-67	0.21056067	-1.5579815	0.06028674	-2.8086431	0.20104602	-1.6042215	0.72145128	-0.3264904
2301-L-4_61-67	0.19556391	-1.631868	0.06752369	-2.6952768	0.17771184	-1.7275919	0.73948903	-0.3017958
2301-L-500_13	0.19726847	-1.6231897	0.07142295	-2.6391361	0.18108215	-1.7088045	0.73554586	-0.3071424
2301-L-509_61-67	0.20117138	-1.6035981	0.05679137	-2.8683709	0.18070362	-1.710897	0.71776333	-0.3316154
2301-L-50_61-67	0.20644389	-1.5777266	0.05984077	-2.816068	0.1708838	-1.7667715	0.73134374	-0.3128717
2301-L-511_61-67	0.20085112	-1.6051914	0.06909549	-2.6722659	0.17468532	-1.7447691	0.73504373	-0.3078253
2301-L-514_61-67	0.20025559	-1.6081608	0.06621104	-2.714908	0.17279004	-1.7556781	0.73438866	-0.3087169
2301-L-	0.20044259	-1.6072274	0.06417698	-2.7461106	0.16827352	-1.7821645	0.74458343	-0.2949304

516_61-67								
2301-L-517_61-67	0.204079	-1.5892481	0.04978965	-2.9999481	0.17972459	-1.7163296	0.72492368	-0.3216889
2301-L-518_61-67	0.20348491	-1.5921634	0.06690427	-2.7044925	0.17087684	-1.7668122	0.72679215	-0.3191147
2301-L-537_61-67	0.20399292	-1.58967	0.06574849	-2.7219186	0.17616899	-1.7363116	0.73025382	-0.3143631
2301-L-63_13	0.18897445	-1.6661435	0.06479659	-2.7365023	0.16855544	-1.7804905	0.74115745	-0.2995422
2301-L-64_61-67	0.18643386	-1.6796787	0.06389064	-2.7505824	0.17209714	-1.7596962	0.73471062	-0.3082786
2301-L-65_61-67	0.20060919	-1.6063966	0.05935482	-2.8242219	0.15760306	-1.8476757	0.74072687	-0.3001233
2301-L-66_61-67	0.19934516	-1.6127175	0.05119179	-2.9721762	0.16891513	-1.7783589	0.72068701	-0.3275503
2301-L-68_61-67	0.2123208	-1.5496569	0.0698392	-2.6615598	0.1717736	-1.7615779	0.73649179	-0.3058572

2301-L-70_13	0.20042147	-1.6073328	0.05363516	-2.9255505	0.18853021	-1.668497	0.721824	-0.3259739
2301-L-72_13	0.20386692	-1.5902879	0.05823556	-2.8432591	0.16829637	-1.7820288	0.7281511	-0.3172467
2301-L-74_61-67	0.20628771	-1.5784834	0.06367792	-2.7539175	0.16892321	-1.778311	0.74121931	-0.2994587
2301-L-79_61-67	0.2045691	-1.5868495	0.06251904	-2.7722842	0.16269637	-1.8158696	0.74374191	-0.2960612
2301-L-81_61-67	0.19901348	-1.6143827	0.06898303	-2.6738947	0.18670054	-1.6782493	0.72280144	-0.3246207
2301-L-84_61-67	0.20460341	-1.5866818	0.06747187	-2.6960446	0.17241591	-1.7578456	0.73802421	-0.3037786
2301-L-85_61-67	0.19481831	-1.6356879	0.06902054	-2.6733512	0.17616016	-1.7363617	0.73633762	-0.3060665
2301-L-92_13	0.20123097	-1.6033019	0.05699405	-2.8648083	0.17950753	-1.7175381	0.72170586	-0.3261376
2301-L-93_13	0.19806617	-1.6191541	0.05124603	-2.9711171	0.17625092	-1.7358466	0.71705419	-0.3326039
2301-L-95_61-67	0.20692415	-1.575403	0.06194522	-2.7815048	0.17063352	-1.7682372	0.73625058	-0.3061848

2301-L-97_61-67	0.20942856	-1.5633726	0.07113221	-2.643215	0.17525898	-1.7414905	0.74784746	-0.2905563
2301-L-99_61-67	0.19555312	-1.6319232	0.06088352	-2.7987928	0.1859618	-1.682214	0.72513159	-0.3214021
28662_2051	0.21146304	-1.5537051	0.06758831	-2.6943203	0.17630609	-1.7355336	0.74669774	-0.2920948
28663_2051	0.20848665	-1.5678802	0.06767154	-2.6930895	0.17573858	-1.7387578	0.71341978	-0.3376853
28720_2051	0.19938446	-1.6125204	0.0546938	-2.906005	0.16656767	-1.7923536	0.7218873	-0.3258862
28736_2051	0.19962017	-1.6113389	0.05578532	-2.8862446	0.17741626	-1.7292565	0.72091793	-0.32723
28738b_2051	0.20482132	-1.5856173	0.05665279	-2.8708141	0.17610855	-1.7366547	0.707795	-0.3456008
28739_2051	0.20152786	-1.6018277	0.06377098	-2.752457	0.1692655	-1.7762868	0.73492429	-0.3079878
28756_2051	0.19323762	-1.6438346	0.05194235	-2.9576208	0.17302013	-1.7543474	0.71086319	-0.3412753
28758_2051	0.20213815	-1.5988039	0.06604326	-2.7174453	0.15997917	-1.8327117	0.73367428	-0.3096901
29041_2051	0.20890511	-1.5658752	0.04912576	-3.0133718	0.17273174	-1.7560155	0.72101298	-0.3270981
29049_2051	0.20486941	-1.5853825	0.05468638	-2.9061406	0.17662146	-1.7337465	0.71417498	-0.3366273
29056_2051	0.20047276	-1.6070769	0.06746566	-2.6961366	0.17224408	-1.7588427	0.73695181	-0.3052328
29068_2051	0.19886723	-1.6151178	0.05881991	-2.8332749	0.17947228	-1.7177345	0.72656851	-0.3194225

29075_2051	0.19919197	-1.6134862	0.04941972	-3.0074057	0.16684758	-1.7906746	0.7262928	-0.319802
29082_2051	0.20632523	-1.5783015	0.07000362	-2.6592083	0.1780108	-1.725911	0.72759649	-0.3180087
76919_2051	0.20552605	-1.5821825	0.05935245	-2.8242619	0.17162103	-1.7624665	0.72803111	-0.3174115
associated with 2301-R-214_61-67	0.17967397	-1.7166113	0.06183675	-2.7832574	0.18096602	-1.709446	0.73172054	-0.3123566
JR3_2051	0.19546266	-1.6323859	0.05977399	-2.8171847	0.17041859	-1.7694976	0.72733584	-0.318367
LACMHC 54899_13	0.2148417	-1.5378538	0.05898555	-2.8304628	0.16708942	-1.7892262	0.71198237	-0.3397021
LACMHC 54901_13	0.19947556	-1.6120636	0.0508565	-2.9787474	0.18095878	-1.709486	0.71382199	-0.3371217
LACMHC 54903_13	0.19280174	-1.6460929	0.0583265	-2.8416988	0.17988862	-1.7154174	0.71974745	-0.3288549
LACMHC 54909_13	0.19927204	-1.6130844	0.04986115	-2.9985131	0.18271662	-1.6998188	0.71290457	-0.3384077
LACMHC	0.20815292	-1.5694823	0.06253371	-2.7720495	0.16996133	-1.7721844	0.73540585	-0.3073328

54912_13								
LACMHC 54913_13	0.20922465	-1.5643467	0.06330627	-2.7597709	0.1710222	-1.7659619	0.73447249	-0.3086027
LACMHC 54917_13	0.19972358	-1.610821	0.0523514	-2.9497766	0.17472727	-1.744529	0.7335102	-0.3099138
LACMHC 54921_13	0.21123148	-1.5548007	0.06482956	-2.7359936	0.17139702	-1.7637727	0.72449437	-0.3222813
LACMHC 54922_13	0.19161691	-1.6522572	0.04305516	-3.1452732	0.16955227	-1.774594	0.71881673	-0.3301488
LACMHC 54924_13	0.20002828	-1.6092965	0.05291298	-2.9391065	0.17225493	-1.7587798	0.73726368	-0.3048097
LACMHC 54940_13	0.20407547	-1.5892654	0.04617046	-3.075415	0.18966657	-1.6624876	0.71200306	-0.3396731
LACMHC 54943_13	0.20831853	-1.568687	0.0598957	-2.8151506	0.17109331	-1.7655462	0.7351558	-0.3076728
LACMHC	0.20531417	-1.583214	0.0444088	-3.1143175	0.18040698	-1.71254	0.71456954	-0.336075

54958_13								
LACMHC 54959_13	0.19683209	-1.6254042	0.05323931	-2.9329582	0.18270069	-1.699906	0.71878798	-0.3301889
LACMHC 54962_13	0.19214434	-1.6495084	0.0554722	-2.8918733	0.17495357	-1.7432346	0.71422695	-0.3365545
LACMHC 54975_13	0.19909178	-1.6139893	0.05221299	-2.952424	0.19795201	-1.6197306	0.70529269	-0.3491424
LACMHC 54976_13	0.21271002	-1.5478254	0.05385043	-2.9215449	0.18661604	-1.6787021	0.71604081	-0.3340181
LACMHC 54977_13	0.19390519	-1.640386	0.05975613	-2.8174835	0.19798115	-1.6195834	0.70918989	-0.343632
LACMHC 54983_13	0.19671559	-1.6259963	0.06302733	-2.7641869	0.17541412	-1.7406057	0.72765215	-0.3179322
LACMHC 55509_61-67	0.21208906	-1.550749	0.06386544	-2.7509768	0.17003302	-1.7717626	0.73579448	-0.3068044
LACMHC	0.21260273	-1.54833	0.06303702	-2.7640331	0.17894813	-1.7206593	0.72457737	-0.3221667

55513_61-67								
LACMHC 55516_61-67	0.19378265	-1.6410181	0.05890099	-2.8318973	0.17711269	-1.7309691	0.72076834	-0.3274375
LACMHC 55518_61-67	0.20708163	-1.5746422	0.05500993	-2.9002417	0.17255106	-1.7570621	0.71874708	-0.3302458
LACMHC 55520_61-67	0.20876918	-1.566526	0.06065526	-2.802549	0.17220491	-1.7590702	0.73018245	-0.3144608
LACMHC 55521_61-67	0.20928789	-1.5640445	0.06166341	-2.7860645	0.17512005	-1.7422835	0.72157404	-0.3263203
LACMHC 55660_61-67	0.19497769	-1.6348702	0.05371549	-2.9240538	0.16785979	-1.7846262	0.73307729	-0.3105041
LACMHC 55665_61-67	0.20948386	-1.5631086	0.06248501	-2.7728285	0.17051054	-1.7689582	0.72485232	-0.3217873
LACMHC 55666_61-67	0.19531465	-1.6331434	0.05761754	-2.8539282	0.16710078	-1.7891582	0.73723202	-0.3048526
LACMHC	0.207621	-1.572041	0.06758715	-2.6943374	0.1764289	-1.7348373	0.74081913	-0.2999988

55667_61-67								
LACMHC 55675_61-67	0.20548179	-1.5823979	0.06838029	-2.6826706	0.1782288	-1.7246872	0.739425	-0.3018824
LACMHC 55681_61-67	0.21253653	-1.5486414	0.06871415	-2.6778001	0.17109967	-1.765509	0.72952216	-0.3153655
LACMHC 55683_61-67	0.19799741	-1.6195014	0.06363106	-2.7546535	0.16639169	-1.7934107	0.74058668	-0.3003126
LACMHC 55685_61-67	0.20699118	-1.5750791	0.06836889	-2.6828374	0.17788286	-1.72663	0.72499525	-0.3215902
LACMHC 55691_61-67	0.20058872	-1.6064987	0.05647424	-2.8739707	0.17631555	-1.73548	0.72980263	-0.3149812
LACMHC 55692_61-67	0.20766098	-1.5718484	0.05879362	-2.833722	0.18031867	-1.7130296	0.73077744	-0.3136463
LACMHC 55693_61-67	0.19991214	-1.6098773	0.05047178	-2.986341	0.17095352	-1.7663636	0.72637305	-0.3196916
LACMHC	0.22547069	-1.4895651	0.06060249	-2.8034193	0.18621995	-1.6808268	0.72401439	-0.322944

55694_61-67								
LACMHC 55695_61-67	0.22505448	-1.4914128	0.06950002	-2.6664283	0.17227958	-1.7586366	0.73300716	-0.3105998
LACMHC 675_61-67	0.20223353	-1.5983321	0.06280458	-2.7677273	0.16634394	-1.7936977	0.72961913	-0.3152326
LACMHC 676_61-67	0.1967038	-1.6260563	0.06483382	-2.7359278	0.16952714	-1.7747422	0.73201059	-0.3119603
LACMHC 680_61-67	0.19904709	-1.6142139	0.06734533	-2.6979217	0.18603254	-1.6818337	0.73635553	-0.3060422
LACMHC 681_61-67	0.20917563	-1.564581	0.05429852	-2.9132583	0.1768824	-1.7322702	0.72617529	-0.3199639
LACMHC 682_61-67	0.19763125	-1.6213524	0.06291341	-2.765996	0.17939568	-1.7181614	0.73191105	-0.3120963
LACMHC 683_61-67	0.20455663	-1.5869104	0.06455686	-2.7402088	0.16924141	-1.7764291	0.73009321	-0.3145831
R17460_91	0.21569338	-1.5338974	0.06370483	-2.7534948	0.16725883	-1.7882128	0.71340811	-0.3377016

R17488_91	0.210836	-1.5566747	0.04679462	-3.0619871	0.17127072	-1.7645098	0.7197582	-0.32884
R17928_91	0.20473169	-1.586055	0.05023165	-2.9911099	0.17919538	-1.7192786	0.7301556	-0.3144976
R18664_91	0.20412894	-1.5890034	0.06483327	-2.7359365	0.1769294	-1.7320045	0.72387169	-0.3231411
R27246_91	0.19999699	-1.609453	0.05255804	-2.9458372	0.18411072	-1.692218	0.70989863	-0.3426331
R28351_91	0.19444723	-1.6375945	0.05747584	-2.8563906	0.1831758	-1.697309	0.72398594	-0.3229833
R28379_91	0.20387637	-1.5902415	0.07146675	-2.6385229	0.17615658	-1.736382	0.73764497	-0.3042926
R28913_91	0.1940872	-1.6394477	0.04844193	-3.0273895	0.18075997	-1.7105853	0.71822852	-0.3309675
R30721_91	0.21147063	-1.5536692	0.06384563	-2.7512871	0.17242478	-1.7577942	0.71736001	-0.3321775
R30746_91	0.20549193	-1.5823485	0.05818557	-2.8441178	0.18393829	-1.693155	0.72604892	-0.3201379
R31305_91	0.22907368	-1.4737116	0.05663463	-2.8711347	0.17154516	-1.7629087	0.71787995	-0.3314529
R34526_91	0.21279649	-1.547419	0.05988635	-2.8153067	0.16846027	-1.7810553	0.72195756	-0.3257889
R34706_91	0.20638131	-1.5780298	0.06111595	-2.7949824	0.17153493	-1.7629684	0.73043164	-0.3141196
R38491_91	0.20852493	-1.5676967	0.06338232	-2.7585703	0.17035011	-1.7698995	0.73646536	-0.3058931
R39009_91	0.21823643	-1.5221763	0.07256091	-2.6233289	0.20115467	-1.6036812	0.73404831	-0.3091804
R39376_91	0.19556873	-1.6318434	0.05371939	-2.9239814	0.17249019	-1.7574149	0.7229819	-0.3243711
R39566_91	0.21128747	-1.5545357	0.05219715	-2.9527273	0.1658532	-1.7966522	0.72918804	-0.3158236

R39965_91	0.21540729	-1.5352247	0.05484701	-2.9032077	0.17933719	-1.7184875	0.72518681	-0.321326
R40942_91	0.20057808	-1.6065517	0.06488128	-2.7351961	0.16767169	-1.7857474	0.72501104	-0.3215684
R52965_91	0.20459754	-1.5867104	0.05874623	-2.8345283	0.20129385	-1.6029895	0.71995526	-0.3285662
R53460_91	0.20510918	-1.5842129	0.06597542	-2.718473	0.17981649	-1.7158185	0.72295	-0.3244152
R53878_91	0.21321809	-1.5454397	0.0592091	-2.8266801	0.17404322	-1.7484516	0.72258186	-0.3249246

Specimen #_Pit #	**Corpus Depth 2 (4-15)**	**ln Corpus Depth 2**	**Corpus Depth 3 (6-14)**	**ln Corpus Depth 3**	**Corpus Depth 1 (3-16)**	**ln Corpus Depth 1 (3-16)**
2301-L-101_13	0.124230096	-2.085619818	0.129657038	-2.042862483	0.09491002	-2.354826
2301-L-106_61-67	0.120848187	-2.113220172	0.127858721	-2.056829364	0.10148631	-2.2878314
2301-L-109_61-67	0.124471415	-2.08367919	0.134102791	-2.009148673	0.09927902	-2.3098211
2301-L-10_61-67	0.118130051	-2.135969134	0.117439741	-2.141829917	0.09809631	-2.3218056

2301-L-120_61-67	0.121628968	-2.106780116	0.149638602	-1.899532215	0.09538533	-2.3498305
2301-L-123_61-67	0.120629113	-2.11503462	0.135288918	-2.000342654	0.09284602	-2.3768128
2301-L-12_61-67	0.129954026	-2.040574541	0.134767639	-2.004203173	0.09663319	-2.336833
2301-L-140_61-67	0.130554372	-2.035965493	0.153700175	-1.872751491	0.10487748	-2.2549625
2301-L-143_13	0.123595679	-2.090739691	0.13158186	-2.028126113	0.11104662	-2.1978052
2301-L-148_61-67	0.114774649	-2.16478465	0.120815957	-2.11348691	0.09132224	-2.3933609
2301-L-154_61-67	0.120415315	-2.116808553	0.125576501	-2.07484014	0.09683681	-2.3347281
2301-L-155_61-67	0.128829605	-2.04926464	0.143268083	-1.9430377	0.10505368	-2.2532838

2301-L-156_61-67	0.12532387	-2.076853935	0.132633919	-2.020162434	0.10582864	-2.2459341
2301-L-164_61-67	0.116165548	-2.152738969	0.129082927	-2.047300235	0.10715133	-2.2335131
2301-L-167_61-67	0.119102503	-2.127770787	0.131256265	-2.030603643	0.09376201	-2.3669955
2301-L-173_13	0.113193125	-2.178659848	0.128980998	-2.048090189	0.09539462	-2.3497331
2301-L-185_61-67	0.116087487	-2.153411174	0.134499593	-2.006194106	0.10356061	-2.2675982
2301-L-186_61-67	0.120940299	-2.11245825	0.141717262	-1.953921319	0.09608518	-2.3425202
2301-L-193_61-67	0.103550955	-2.267691467	0.119336707	-2.125806307	0.08751181	-2.4359815
2301-L-203_61-67	0.12213313	-2.102643603	0.123385935	-2.092438153	0.09891063	-2.3135386

2301-L-210_61-67	0.125518319	-2.075303566	0.134342255	-2.007364594	0.09931842	-2.3094242
2301-L-211_61-67	0.124047604	-2.087089883	0.138541392	-1.976586141	0.10314705	-2.2715996
2301-L-218_61-67	0.12191989	-2.104391089	0.139918652	-1.96669408	0.09882603	-2.3143942
2301-L-242_61-67	0.129371485	-2.045067287	0.135820952	-1.996417788	0.09512072	-2.3526085
2301-L-244_61-67	0.124251405	-2.085448309	0.144177764	-1.936708272	0.10101829	-2.2924537
2301-L-245_61-67	0.121286353	-2.109600973	0.122370018	-2.100705891	0.10083663	-2.2942536
2301-L-246_61-67	0.119219303	-2.126790598	0.13032668	-2.037711059	0.10144748	-2.2882141
2301-L-28_61-67	0.119391254	-2.125349329	0.131318335	-2.030130865	0.08642807	-2.4484427

2301-L-419_13	0.125576423	-2.074840757	0.124889189	-2.080328421	0.09622041	-2.3411137
2301-L-425_61-67	0.120425297	-2.116725664	0.135664164	-1.997572828	0.09961057	-2.306487
2301-L-428_61-67	0.12118371	-2.110447619	0.129159527	-2.046706997	0.08717199	-2.4398722
2301-L-42_61-67	0.122774386	-2.097406872	0.132516271	-2.021049843	0.09453697	-2.3587643
2301-L-430_61-67	0.117532909	-2.141036907	0.124614652	-2.082529089	0.09947833	-2.3078154
2301-L-433_61-67	0.127835671	-2.057009658	0.135477963	-1.998946289	0.09761329	-2.3267417
2301-L-447_13	0.106132847	-2.243063699	0.124487282	-2.083551718	0.10493586	-2.254406
2301-L-44_61-67	0.123339191	-2.092817072	0.131938356	-2.025420464	0.09563769	-2.3471883

2301-L-451_13	0.138292533	-1.978384035	0.148252661	-1.908837289	0.10764599	-2.2289073
2301-L-455_61-67	0.125311853	-2.076949822	0.127729457	-2.057840867	0.10102158	-2.2924211
2301-L-466_13	0.125914957	-2.072148545	0.131771467	-2.026686166	0.09516828	-2.3521086
2301-L-468_13	0.134310836	-2.007598492	0.141686293	-1.95413987	0.1040334	-2.2630433
2301-L-469_61-67	0.117822791	-2.138573558	0.132347749	-2.02232236	0.09204525	-2.3854749
2301-L-474_13	0.108719778	-2.218981552	0.13110327	-2.031769943	0.09473011	-2.3567234
2301-L-475_13	0.132795822	-2.018942501	0.13120701	-2.030978977	0.1095434	-2.2114344
2301-L-482_61-67	0.12955902	-2.04361875	0.132652969	-2.020018815	0.10674116	-2.2373485

2301-L-48_61-67	0.117103995	-2.144692889	0.134727746	-2.00449923	0.09572044	-2.3463234
2301-L-490_13	0.130240147	-2.038375252	0.143577879	-1.940877682	0.11062585	-2.2016015
2301-L-493_61-67	0.109838107	-2.208747751	0.134435766	-2.006668774	0.10705136	-2.2344466
2301-L-4_61-67	0.131111762	-2.031705176	0.13078092	-2.034231723	0.10273499	-2.2756025
2301-L-500_13	0.124814275	-2.080928443	0.137717084	-1.982553816	0.10546569	-2.2493696
2301-L-509_61-67	0.120138925	-2.1191065	0.132939443	-2.017861572	0.09922542	-2.3103611
2301-L-50_61-67	0.115309095	-2.160138972	0.126845142	-2.064788289	0.10155019	-2.2872021
2301-L-511_61-67	0.111081747	-2.197488887	0.128118231	-2.054801759	0.1025633	-2.2772751

2301-L-514_61-67	0.129467133	-2.044328227	0.135991597	-1.995162182	0.10282046	-2.2747709
2301-L-516_61-67	0.122834769	-2.09691517	0.139555605	-1.969292154	0.09587996	-2.3446583
2301-L-517_61-67	0.114432621	-2.16776909	0.1234289	-2.09209	0.09895902	-2.3130494
2301-L-518_61-67	0.12644539	-2.067944766	0.132080843	-2.024341095	0.10143809	-2.2883066
2301-L-537_61-67	0.125272899	-2.077260728	0.138206545	-1.979006006	0.11310184	-2.1794666
2301-L-63_13	0.13177526	-2.026657385	0.140875757	-1.959876931	0.10046954	-2.2979007
2301-L-64_61-67	0.132766625	-2.019162395	0.134776435	-2.004137912	0.10881351	-2.2181198
2301-L-65_61-67	0.136344056	-1.992573768	0.14425366	-1.936182001	0.10176375	-2.2851013

2301-L-66_61-67	0.127581277	-2.05900165	0.135623639	-1.997871591	0.11222765	-2.1872259
2301-L-68_61-67	0.11970609	-2.122715787	0.127759123	-2.057608641	0.0940805	-2.3636045
2301-L-70_13	0.122300143	-2.101277065	0.126712235	-2.065836629	0.09806043	-2.3221713
2301-L-72_13	0.126339333	-2.068783876	0.133879518	-2.010815002	0.0998904	-2.3036817
2301-L-74_61-67	0.125592248	-2.074714746	0.126206671	-2.069834469	0.10089301	-2.2936946
2301-L-79_61-67	0.12597472	-2.071674028	0.13067009	-2.035079526	0.09881517	-2.3145041
2301-L-81_61-67	0.122075724	-2.103113737	0.133520323	-2.013501581	0.09814672	-2.3212918
2301-L-84_61-67	0.130474614	-2.036576601	0.140836516	-1.960155523	0.10182543	-2.2844954

2301-L-85_61-67	0.136692994	-1.99001779	0.129691648	-2.042595584	0.11468925	-2.1655289
2301-L-92_13	0.134026317	-2.009719104	0.138800189	-1.974719868	0.10490448	-2.254705
2301-L-93_13	0.125396112	-2.076277659	0.130879915	-2.033475052	0.10528951	-2.2510415
2301-L-95_61-67	0.121526768	-2.107620728	0.126119345	-2.070526634	0.10244988	-2.2783816
2301-L-97_61-67	0.125430126	-2.076006438	0.137719541	-1.98253597	0.10229562	-2.2798885
2301-L-99_61-67	0.123577408	-2.090887532	0.122594275	-2.098874952	0.10668204	-2.2379024
28662_2051	0.12198198	-2.103881947	0.131312515	-2.030175188	0.10580675	-2.246141
28663_2051	0.117269898	-2.143277184	0.131221211	-2.03087075	0.0968582	-2.3345073

28720_2051	0.110060628	-2.206723906	0.124250702	-2.085453964	0.09517837	-2.3520026
28736_2051	0.110019045	-2.207101795	0.125300052	-2.077043999	0.09779546	-2.3248772
28738b_2051	0.117602996	-2.140440771	0.136653937	-1.990303558	0.09672092	-2.3359256
28739_2051	0.128473267	-2.052034437	0.137700103	-1.982677124	0.10362998	-2.2669287
28756_2051	0.113824124	-2.173100793	0.134307962	-2.007619889	0.08946221	-2.413939
28758_2051	0.126171026	-2.070116941	0.143135629	-1.943962647	0.10319871	-2.271099
29041_2051	0.128065154	-2.05521613	0.126955168	-2.063921265	0.10167894	-2.2859351
29049_2051	0.115300775	-2.160211134	0.119989445	-2.120351501	0.08890443	-2.4201933
29056_2051	0.114908066	-	0.128696322	-2.050299741	0.09575696	-2.345942

		2.163622892				
29068_2051	0.107431682	-2.230900154	0.124528726	-2.083218855	0.09954072	-2.3071885
29075_2051	0.118458771	-2.133190306	0.131176738	-2.031209719	0.08684553	-2.4436242
29082_2051	0.11718512	-2.144000374	0.132097234	-2.024217009	0.10459279	-2.2576807
76919_2051	0.107432462	-2.230892885	0.1257029	-2.073834095	0.09722582	-2.3307189
associated with 2301-R-214_61-67	0.130295901	-2.037947253	0.137174882	-1.986498657	0.09668719	-2.3362744
JR3_2051	0.1291191	-2.047020042	0.132906596	-2.018108681	0.10546262	-2.2493987
LACMHC 54899_13	0.125683398	-2.073989251	0.122679126	-2.098183065	0.09913508	-2.3112719

LACMHC 54901_13	0.125688677	-2.073947249	0.128050593	-2.055329838	0.10135463	-2.2891297
LACMHC 54903_13	0.113916746	-2.172287396	0.130815629	-2.03396636	0.09580878	-2.3454009
LACMHC 54909_13	0.118248708	-2.134965177	0.12661357	-2.066615588	0.10456075	-2.257987
LACMHC 54912_13	0.138123436	-1.97960753	0.13867282	-1.975637934	0.10655303	-2.2391125
LACMHC 54913_13	0.125630257	-2.074412152	0.129083063	-2.047299183	0.09793442	-2.3234573
LACMHC 54917_13	0.129777546	-2.041933477	0.126993611	-2.063618498	0.1130348	-2.1800596
LACMHC 54921_13	0.129282831	-2.045752783	0.138969026	-1.973504207	0.10096969	-2.2929349
LACMHC 54922_13	0.140025405	-1.965931407	0.148946093	-1.904170832	0.10278592	-2.2751069

LACMHC 54924_13	0.130199203	-2.038689668	0.129063832	-2.047448176	0.10446092	-2.2589422
LACMHC 54940_13	0.123747239	-2.089514186	0.127634625	-2.05858359	0.10703524	-2.2345972
LACMHC 54943_13	0.122103976	-2.102882332	0.14055753	-1.962138409	0.10443693	-2.2591719
LACMHC 54958_13	0.126104117	-2.070647384	0.122407536	-2.10039934	0.08869388	-2.4225644
LACMHC 54959_13	0.124330451	-2.08481233	0.134723403	-2.004531465	0.10585411	-2.2456935
LACMHC 54962_13	0.128865344	-2.048987263	0.131904923	-2.025673895	0.10335938	-2.2695432
LACMHC 54975_13	0.118726032	-2.130936688	0.124020467	-2.087308674	0.10108501	-2.2917934
LACMHC 54976_13	0.113092074	-2.179552981	0.127372576	-2.06063882	0.0961084	-2.3422786

LACMHC 54977_13	0.120442777	-2.116580519	0.139203167	-1.971820778	0.09530391	-2.3506844
LACMHC 54983_13	0.122118224	-2.102765658	0.13388476	-2.010775846	0.09568942	-2.3466475
LACMHC 55509_61-67	0.129244978	-2.046045619	0.131598638	-2.02799861	0.09582166	-2.3452665
LACMHC 55513_61-67	0.126552427	-2.067098615	0.136691642	-1.99002768	0.09575999	-2.3459104
LACMHC 55516_61-67	0.122523847	-2.099449597	0.142758144	-1.94660338	0.09990472	-2.3035383
LACMHC 55518_61-67	0.114597029	-2.166333401	0.132002076	-2.024937631	0.09337513	-2.3711302
LACMHC 55520_61-67	0.116079594	-2.153479164	0.132365324	-2.022189577	0.09286711	-2.3765857
LACMHC 55521_61-67	0.1240857	-2.086782821	0.130451494	-2.036753817	0.09812583	-2.3215047

LACMHC 55660_61-67	0.125788576	-2.073152746	0.132961331	-2.017696937	0.09811121	-2.3216537
LACMHC 55665_61-67	0.113581572	-2.175234008	0.126282382	-2.069234754	0.09507467	-2.3530927
LACMHC 55666_61-67	0.131425435	-2.02931562	0.145732053	-1.925985598	0.09449292	-2.3592304
LACMHC 55667_61-67	0.120527662	-2.115875991	0.135200439	-2.000996869	0.09625752	-2.3407282
LACMHC 55675_61-67	0.116058556	-2.153660424	0.131468708	-2.028986416	0.09740217	-2.3289068
LACMHC 55681_61-67	0.120629889	-2.115028191	0.130804438	-2.034051909	0.09654304	-2.3377664
LACMHC 55683_61-67	0.124658813	-2.08217477	0.130528171	-2.036166205	0.1054536	-2.2494842
LACMHC 55685_61-67	0.116189749	-2.152530658	0.130760161	-2.034390463	0.10124572	-2.2902049

LACMHC 55691_61-67	0.121208344	-2.110244361	0.136110303	-1.994289672	0.09907279	-2.3119005
LACMHC 55692_61-67	0.109886453	-2.208307692	0.128599571	-2.051051803	0.09865966	-2.3160791
LACMHC 55693_61-67	0.123147972	-2.094368622	0.127815375	-2.057168438	0.10052895	-2.2973096
LACMHC 55694_61-67	0.106050678	-2.243838203	0.130638632	-2.035320306	0.10436401	-2.2598703
LACMHC 55695_61-67	0.113865982	-2.172733119	0.12296391	-2.095864379	0.09963072	-2.3062847
LACMHC 675_61-67	0.118214645	-2.135253285	0.135087631	-2.001831594	0.09215406	-2.3842935
LACMHC 676_61-67	0.12263817	-2.098516963	0.132756801	-2.019236386	0.09908537	-2.3117735
LACMHC 680_61-67	0.119851566	-2.121501254	0.12319273	-2.094005238	0.11057523	-2.2020592

LACMHC 681_61-67	0.124644915	-2.082286265	0.127989953	-2.055803509	0.10312766	-2.2717876
LACMHC 682_61-67	0.125866043	-2.072537086	0.141492057	-1.955511696	0.11358258	-2.1752251
LACMHC 683_61-67	0.12260591	-2.09878005	0.128946783	-2.048355495	0.09528224	-2.3509119
R17460_91	0.136981095	-1.987912354	0.139662375	-1.968527379	0.10349302	-2.2682511
R17488_91	0.129471343	-2.044295715	0.122278495	-2.101454087	0.10069993	-2.2956101
R17928_91	0.126053217	-2.071051106	0.133089136	-2.01673618	0.1038137	-2.2651573
R18664_91	0.124765014	-2.081323196	0.133775302	-2.011593736	0.09703907	-2.3326416
R27246_91	0.127736523	-2.057785551	0.134724521	-2.004523169	0.0986168	-2.3165136

R28351_91	0.11421557	-2.16966765	0.134221293	-2.008265403	0.09493666	-2.3545453
R28379_91	0.141914838	-1.952528134	0.135266288	-2.000509941	0.10269603	-2.2759818
R28913_91	0.121379007	-2.108837336	0.126362812	-2.068598052	0.0989548	-2.3130921
R30721_91	0.113028793	-2.180112687	0.128026662	-2.055516741	0.10059197	-2.2966829
R30746_91	0.116701542	-2.148135523	0.134629607	-2.005227927	0.09742042	-2.3287195
R31305_91	0.11882849	-2.130074083	0.126275018	-2.069293069	0.08775716	-2.4331818
R34526_91	0.1270559	-2.06312813	0.129052428	-2.047536539	0.09739572	-2.328973
R34706_91	0.133187063	-2.016000652	0.133841149	-2.011101635	0.10668073	-2.2379147
R38491_91	0.11300911	-2.180286842	0.113365039	-2.177142232	0.0945303	-2.3588349

R39009_91	0.11474714	-2.165024356	0.124862076	-2.080545547	0.1118864	-2.1902712
R39376_91	0.130260492	-2.038219051	0.137571941	-1.983608289	0.09852241	-2.3174713
R39566_91	0.122476767	-2.099833922	0.122884331	-2.096511764	0.09737725	-2.3291626
R39965_91	0.107365651	-2.231514973	0.123506464	-2.091461783	0.09857793	-2.3169079
R40942_91	0.125288292	-2.07713786	0.124182802	-2.086000587	0.11202247	-2.1890558
R52965_91	0.107677601	-2.22861369	0.124810164	-2.080961385	0.1098071	-2.2090301
R53460_91	0.120723174	-2.114255176	0.129162193	-2.046686353	0.10347653	-2.2684105
R53878_91	0.11770032	-2.139613545	0.132240746	-2.023131188	0.09972664	-2.3053225

Specimen #_Pit #	Carn.-Coronoid (5-9)	ln Carn.-Coronoid (5-9)	Carn.-Condyloid (5-11)	ln Carn.-Condyloid (5-11)	Carn.-Angular (5-12)	ln Carn.-Angular (5-12)
2301-L-101_13	0.322788311	-1.130758554	0.356486583	-1.031458676	0.343007725	-1.070002311
2301-L-106_61-67	0.321984616	-1.133251511	0.354878904	-1.035978664	0.338206405	-1.084098904
2301-L-109_61-67	0.32169394	-1.134154683	0.355655055	-1.033793966	0.332295563	-1.101730457
2301-L-10_61-67	0.335125205	-1.093251071	0.354554411	-1.036893457	0.321806943	-1.133803468
2301-L-120_61-67	0.313456223	-1.160095569	0.349595554	-1.050978353	0.350197104	-1.049259129
2301-L-123_61-67	0.329488382	-1.110214185	0.358486385	-1.025864597	0.341127387	-1.075499303
2301-L-	0.319150856	-1.142091387	0.341485966	-1.074448695	0.341318538	-1.074939107

12_61-67						
2301-L-140_61-67	0.328415825	-1.113474716	0.361506309	-1.017475786	0.355276198	-1.034859769
2301-L-143_13	0.332469094	-1.101208373	0.340587979	-1.077081804	0.346182807	-1.0607883
2301-L-148_61-67	0.339353862	-1.080711876	0.36188025	-1.016441922	0.35012824	-1.049455793
2301-L-154_61-67	0.320160734	-1.138932117	0.349746442	-1.050546837	0.333130921	-1.099219711
2301-L-155_61-67	0.3235	-1.128556165	0.364226447	-1.009979497	0.353472176	-1.039950508
2301-L-156_61-67	0.346839349	-1.058893577	0.359889451	-1.021958377	0.3393261	-1.080793687
2301-L-164_61-67	0.327645549	-1.115822897	0.359973365	-1.021725235	0.349924671	-1.050037374
2301-L-	0.334351892	-1.09556127	0.361540396	-1.017381499	0.34932217	-1.051760659

167_61-67						
2301-L-173_13	0.344301041	-1.066238886	0.36859403	-0.998059429	0.355776311	-1.033453084
2301-L-185_61-67	0.324914582	-1.124192956	0.35198243	-1.04417402	0.351173226	-1.046475657
2301-L-186_61-67	0.319683177	-1.140424845	0.357587493	-1.028375211	0.349210424	-1.052080606
2301-L-193_61-67	0.334285961	-1.095758482	0.352077842	-1.043902985	0.344270162	-1.066328574
2301-L-203_61-67	0.330535233	-1.107042019	0.352751524	-1.041991368	0.343893664	-1.067422787
2301-L-210_61-67	0.339225998	-1.081088733	0.360896624	-1.019163721	0.361052954	-1.018730645
2301-L-211_61-67	0.322449248	-1.131809525	0.359615562	-1.022719702	0.345485924	-1.062803377
2301-L-	0.338364845	-1.083630544	0.347330402	-1.057478784	0.341751518	-1.073671361

218_61-67						
2301-L-242_61-67	0.320080292	-1.139183401	0.35888389	-1.024756369	0.337901154	-1.08500187
2301-L-244_61-67	0.31989977	-1.139747552	0.355528261	-1.034150536	0.339427993	-1.080493451
2301-L-245_61-67	0.3382008	-1.084115477	0.363234321	-1.012707139	0.350484162	-1.048439761
2301-L-246_61-67	0.332355787	-1.101549235	0.352830708	-1.041766917	0.34775449	-1.056258536
2301-L-28_61-67	0.32354932	-1.12840372	0.357240729	-1.029345413	0.36813336	-0.999310016
2301-L-419_13	0.340191566	-1.078246392	0.353302044	-1.040431938	0.340337014	-1.077818935
2301-L-425_61-67	0.343504441	-1.06855524	0.3579653	-1.027319225	0.352758376	-1.041971943
2301-L-	0.341643394	-1.073987794	0.36612842	-1.004771133	0.355049456	-1.035498186

428_61-67						
2301-L- 42_61-67	0.34144262	-1.074575639	0.355140401	-1.035242072	0.35078398	-1.047584686
2301-L- 430_61-67	0.339211314	-1.08113202	0.361039461	-1.018768018	0.343598009	-1.068282883
2301-L- 433_61-67	0.325669094	-1.121873461	0.351868615	-1.044497426	0.338796207	-1.082356512
2301-L- 447_13	0.334113544	-1.096274393	0.349024281	-1.052613787	0.339202164	-1.081158994
2301-L- 44_61-67	0.338379513	-1.083587194	0.359911009	-1.021898475	0.346292525	-1.060471414
2301-L- 451_13	0.349531246	-1.05116232	0.349181757	-1.052162697	0.312292752	-1.163814224
2301-L- 455_61-67	0.334991637	-1.093649711	0.350303077	-1.048956565	0.353115897	-1.040958955
2301-L-	0.333708035	-1.097488815	0.363589762	-1.011729074	0.332365373	-1.101520395

466_13						
2301-L-468_13	0.333381121	-1.098468936	0.356090366	-1.032570744	0.354734496	-1.036385668
2301-L-469_61-67	0.332664538	-1.100620691	0.365420035	-1.006707806	0.358417846	-1.026055805
2301-L-474_13	0.340903453	-1.076155969	0.354437232	-1.037224009	0.352978294	-1.041348714
2301-L-475_13	0.32297522	-1.130179678	0.355379465	-1.034569146	0.348098931	-1.055268556
2301-L-482_61-67	0.325014007	-1.123886999	0.342007961	-1.072921264	0.340777729	-1.076524834
2301-L-48_61-67	0.330355837	-1.107584911	0.351926149	-1.044333929	0.353882363	-1.038790729
2301-L-490_13	0.317158072	-1.148354981	0.346575781	-1.059653779	0.344171456	-1.066615327
2301-L-	0.328356107	-1.113656568	0.346552743	-1.059720256	0.330289388	-1.107786077

493_61-67						
2301-L-4_61-67	0.327923016	-1.114976407	0.360452347	-1.020395518	0.34986132	-1.050218432
2301-L-500_13	0.310746055	-1.168779243	0.354516467	-1.037000482	0.34613619	-1.060922969
2301-L-509_61-67	0.337884594	-1.08505088	0.358001456	-1.027218226	0.351905706	-1.044392019
2301-L-50_61-67	0.319044176	-1.142425703	0.361429919	-1.017687117	0.357028987	-1.029938304
2301-L-511_61-67	0.333482609	-1.098164562	0.361147882	-1.018467758	0.349314971	-1.051781268
2301-L-514_61-67	0.328977891	-1.11176473	0.354994779	-1.035652196	0.350760771	-1.047650852
2301-L-516_61-67	0.331940366	-1.102799945	0.356129622	-1.032460508	0.338463226	-1.083339829
2301-L-	0.337000425	-1.087671086	0.359196386	-1.023886003	0.34154942	-1.074262895

517_61-67						
2301-L-518_61-67	0.337310015	-1.086752846	0.348235072	-1.054877534	0.348311298	-1.054658665
2301-L-537_61-67	0.324375477	-1.125853553	0.341882595	-1.073287891	0.33460816	-1.094795104
2301-L-63_13	0.337743139	-1.085469616	0.362591209	-1.014479226	0.351543321	-1.045422328
2301-L-64_61-67	0.342093178	-1.07267213	0.369630043	-0.995252657	0.35727127	-1.029259927
2301-L-65_61-67	0.313895516	-1.1586951	0.357700889	-1.028058148	0.348359702	-1.054519707
2301-L-66_61-67	0.32519275	-1.123337196	0.357166603	-1.029552931	0.352054601	-1.043969
2301-L-68_61-67	0.337629522	-1.085806075	0.355377658	-1.03457423	0.333593629	-1.097831707
2301-L-	0.346862495	-1.058826845	0.356535893	-1.031320362	0.345739232	-1.062070453

70_13						
2301-L-72_13	0.334427978	-1.095333734	0.357649608	-1.028201522	0.344770218	-1.064877118
2301-L-74_61-67	0.339423332	-1.080507185	0.363940122	-1.010765925	0.351853298	-1.044540959
2301-L-79_61-67	0.325701462	-1.121774077	0.361536201	-1.017393102	0.346939994	-1.058603442
2301-L-81_61-67	0.325929971	-1.121072734	0.36253624	-1.014630836	0.354667461	-1.036574658
2301-L-84_61-67	0.316363812	-1.150862422	0.351943197	-1.044285488	0.338353794	-1.083663204
2301-L-85_61-67	0.330532697	-1.107049693	0.374479076	-0.98221935	0.359894281	-1.021944954
2301-L-92_13	0.316432177	-1.15064635	0.353108999	-1.040978491	0.348092579	-1.055286803
2301-L-	0.342321599	-1.072004635	0.357438965	-1.028790657	0.346748591	-1.059155284

93_13						
2301-L-95_61-67	0.323538816	-1.128436185	0.357577089	-1.028404306	0.341565323	-1.074216335
2301-L-97_61-67	0.290417929	-1.23643426	0.360191277	-1.021120063	0.346570737	-1.059668334
2301-L-99_61-67	0.326514299	-1.119281535	0.344302807	-1.066233757	0.35278566	-1.041894601
28662_2051	0.3219532	-1.133349087	0.355236075	-1.034972712	0.335630348	-1.091744879
28663_2051	0.338465608	-1.083332794	0.347151135	-1.057995046	0.360611732	-1.019953433
28720_2051	0.360655896	-1.019830972	0.357530761	-1.028533876	0.35293094	-1.041482878
28736_2051	0.348539805	-1.054002836	0.357924541	-1.027433093	0.357687578	-1.028095359
28738b_2051	0.346057756	-1.061149592	0.347271967	-1.05764704	0.351926962	-1.04433162
28739_2051	0.326907124	-1.118079172	0.358342308	-1.026266581	0.351457176	-1.045667406
28756_2051	0.350395716	-1.048692146	0.361012233	-1.018843434	0.365016454	-1.007812847
28758_2051	0.341461934	-1.074519074	0.350419325	-1.048624769	0.34999401	-1.04983924
29041_2051	0.330763534	-1.106351557	0.365632291	-1.00612712	0.3636585	-1.011540037

29049_2051	0.336293764	-1.089770203	0.347560239	-1.056817279	0.353951765	-1.038594633
29056_2051	0.323688798	-1.127972723	0.341647149	-1.073976802	0.335866437	-1.091041706
29068_2051	0.327871617	-1.11513316	0.361669322	-1.017024959	0.3651362	-1.007484843
29075_2051	0.331719802	-1.103464635	0.364611228	-1.008923621	0.362919585	-1.013573998
29082_2051	0.34135085	-1.074844445	0.355297556	-1.034799655	0.350808397	-1.047515082
76919_2051	0.33298076	-1.09967057	0.357921965	-1.02744029	0.36363355	-1.011608648
associated with 2301-R-214_61-67	0.3479833	-1.05560079	0.385257797	-0.953842566	0.376389304	-0.977131289
JR3_2051	0.337561846	-1.086006539	0.363744941	-1.01130237	0.356191321	-1.032287273
LACMHC 54899_13	0.315370324	-1.154007698	0.327220894	-1.11711982	0.341299198	-1.074995774
LACMHC 54901_13	0.350599585	-1.048110491	0.359555098	-1.02288785	0.359663666	-1.022585945
LACMHC 54903_13	0.355923831	-1.033038528	0.363784595	-1.011193359	0.357085036	-1.029781329

LACMHC 54909_13	0.333138182	-1.099197913	0.353069461	-1.041090467	0.347164801	-1.057955681
LACMHC 54912_13	0.32541763	-1.122645907	0.35465245	-1.036616984	0.347254037	-1.057698673
LACMHC 54913_13	0.31148742	-1.166396326	0.345362841	-1.063159702	0.341725514	-1.073747454
LACMHC 54917_13	0.319017459	-1.142509446	0.353499977	-1.039871858	0.343872948	-1.067483027
LACMHC 54921_13	0.33055146	-1.106992927	0.34422927	-1.06644736	0.345344591	-1.063212545
LACMHC 54922_13	0.330375968	-1.107523975	0.355886742	-1.033142738	0.351710454	-1.044947017
LACMHC 54924_13	0.328223108	-1.114061696	0.358664366	-1.025368241	0.331116209	-1.105285879
LACMHC 54940_13	0.343722689	-1.067920084	0.36401182	-1.010568939	0.350824078	-1.047470384

LACMHC 54943_13	0.318155689	-1.145214429	0.364522257	-1.009167668	0.341875868	-1.073307566
LACMHC 54958_13	0.341340949	-1.074873449	0.363402995	-1.012242881	0.343982356	-1.067164913
LACMHC 54959_13	0.343964677	-1.067216311	0.349972369	-1.049901073	0.346474816	-1.059945143
LACMHC 54962_13	0.345029557	-1.064125193	0.36297905	-1.01341016	0.367169779	-1.001930926
LACMHC 54975_13	0.334406597	-1.095397671	0.362285772	-1.015321952	0.352250988	-1.043411324
LACMHC 54976_13	0.334895268	-1.09393743	0.348528279	-1.054035906	0.329951393	-1.108809929
LACMHC 54977_13	0.341515929	-1.074360957	0.348792337	-1.053278556	0.348020353	-1.055494316
LACMHC 54983_13	0.340590699	-1.077073819	0.37054317	-0.992785324	0.363016231	-1.013307733

LACMHC 55509_61-67	0.322002334	-1.133196487	0.3515814	-1.045314016	0.340352524	-1.077773364
LACMHC 55513_61-67	0.328536743	-1.113106597	0.348379309	-1.054463424	0.34138683	-1.074739047
LACMHC 55516_61-67	0.322557941	-1.131472498	0.367446751	-1.001176867	0.368637486	-0.99794154
LACMHC 55518_61-67	0.346931475	-1.058627997	0.354148039	-1.038040265	0.343348305	-1.069009881
LACMHC 55520_61-67	0.330221957	-1.107990255	0.35782307	-1.027716632	0.34669232	-1.059317577
LACMHC 55521_61-67	0.333943281	-1.096784118	0.345949664	-1.061461995	0.34125063	-1.075138085
LACMHC 55660_61-67	0.323138819	-1.129673267	0.368005459	-0.999657506	0.362936584	-1.013527159
LACMHC 55665_61-67	0.329633858	-1.109772763	0.353047025	-1.041154014	0.350728748	-1.047742152

LACMHC 55666_61-67	0.331115474	-1.1052881	0.363148022	-1.012944754	0.34344683	-1.068722967
LACMHC 55667_61-67	0.329463281	-1.110290369	0.350673152	-1.04790068	0.332666456	-1.100614924
LACMHC 55675_61-67	0.332260253	-1.101836723	0.351824298	-1.044623382	0.331932932	-1.102822343
LACMHC 55681_61-67	0.331314574	-1.10468698	0.3500637	-1.04964014	0.33793947	-1.084888482
LACMHC 55683_61-67	0.336132625	-1.090249479	0.358816927	-1.024942972	0.34607505	-1.061099619
LACMHC 55685_61-67	0.325573236	-1.122167848	0.349717372	-1.05062996	0.347413272	-1.057240222
LACMHC 55691_61-67	0.338981713	-1.081809118	0.365987311	-1.005156617	0.351154078	-1.046530184
LACMHC 55692_61-67	0.321714847	-1.134089693	0.353658546	-1.03942339	0.343879854	-1.067462944

LACMHC 55693_61-67	0.327826863	-1.115269666	0.364597274	-1.008961893	0.359286065	-1.023636369
LACMHC 55694_61-67	0.3124034	-1.163459978	0.343225599	-1.069367324	0.322231797	-1.132484126
LACMHC 55695_61-67	0.326985374	-1.117839837	0.349014276	-1.052642453	0.327047729	-1.117649157
LACMHC 675_61-67	0.329117611	-1.111340113	0.356286829	-1.032019174	0.358547617	-1.025693805
LACMHC 676_61-67	0.33074835	-1.106397465	0.360118883	-1.02132107	0.362818164	-1.013853496
LACMHC 680_61-67	0.326532821	-1.119224813	0.360517999	-1.020213396	0.351502783	-1.045537651
LACMHC 681_61-67	0.328129751	-1.114346165	0.353722778	-1.039241785	0.346788488	-1.05904023
LACMHC 682_61-67	0.334960653	-1.093742209	0.355565243	-1.034046523	0.344435641	-1.065848025

LACMHC 683_61-67	0.342563267	-1.071298916	0.358601367	-1.025543907	0.3456725	-1.062263484
R17460_91	0.32595149	-1.121006713	0.330724091	-1.106470812	0.337818422	-1.085246739
R17488_91	0.325374369	-1.122778855	0.350242473	-1.049129584	0.338593916	-1.082953779
R17928_91	0.333054681	-1.099448594	0.360311982	-1.020785005	0.328538594	-1.113100964
R18664_91	0.331164143	-1.105141126	0.350650419	-1.047965509	0.351428478	-1.045749064
R27246_91	0.324749346	-1.124701636	0.344700788	-1.065078518	0.345096771	-1.063930406
R28351_91	0.340461152	-1.07745425	0.365444694	-1.006640326	0.357902174	-1.027495586
R28379_91	0.320220347	-1.138745935	0.364243327	-1.009933154	0.34549175	-1.062786513
R28913_91	0.331048969	-1.105488973	0.353929948	-1.038656273	0.348887836	-1.053004795
R30721_91	0.339390861	-1.080602853	0.344252312	-1.066380426	0.344817949	-1.064738685
R30746_91	0.325058903	-1.123748873	0.357068658	-1.029827196	0.340732607	-1.076657253
R31305_91	0.312469255	-1.163249199	0.349491756	-1.051275307	0.334771184	-1.094308012
R34526_91	0.323439612	-1.128742854	0.357498372	-1.028624469	0.342571051	-1.071276195
R34706_91	0.325881884	-1.121220281	0.352654928	-1.042265241	0.334193408	-1.096035387
R38491_91	0.329844631	-1.10913355	0.357384015	-1.028944402	0.346679663	-1.059354086

R39009_91	0.306315115	-1.183140919	0.345216087	-1.063584719	0.329601891	-1.109869745
R39376_91	0.332847418	-1.100071098	0.358128634	-1.026863046	0.350229446	-1.049166778
R39566_91	0.324185664	-1.126438891	0.358373045	-1.026180809	0.336781785	-1.08832008
R39965_91	0.330061159	-1.108477312	0.353353201	-1.040287154	0.328554112	-1.11305373
R40942_91	0.329390191	-1.11051224	0.354965495	-1.035734691	0.353912519	-1.038705519
R52965_91	0.315035361	-1.15507039	0.343284541	-1.069195611	0.310615463	-1.169199585
R53460_91	0.322579446	-1.131405828	0.348649073	-1.053689385	0.356275495	-1.032050986
R53878_91	0.328933643	-1.111899242	0.346007328	-1.061295324	0.329275239	-1.110861285

Specimen #_Pit #	**Carn.-Mfossa (5-8)**	**ln Carn.-Mfossa (5-8)**	**Carnassial (4-6)**	**lnCarnassial (4-6)**
2301-L-101_13	0.127747095	-2.057702792	0.121156657	-2.110670882
2301-L-106_61-67	0.133748213	-2.011796252	0.127317602	-2.061070514
2301-L-109_61-67	0.111509203	-2.193648157	0.127486598	-2.059744033
2301-L-10_61-67	0.103827589	-2.265023556	0.119615963	-2.123468976
2301-L-120_61-67	0.111898233	-2.190165454	0.13015186	-2.039053356

2301-L-123_61-67	0.117529594	-2.141065112	0.130734212	-2.034588934
2301-L-12_61-67	0.10366967	-2.266545684	0.127622533	-2.058678329
2301-L-140_61-67	0.129871881	-2.041206847	0.122602952	-2.098804181
2301-L-143_13	0.115732031	-2.156477838	0.136164509	-1.993891501
2301-L-148_61-67	0.124468782	-2.083700344	0.123021383	-2.095397097
2301-L-154_61-67	0.102621749	-2.276705392	0.127860667	-2.056814149
2301-L-155_61-67	0.119347757	-2.125713718	0.126370428	-2.068537779
2301-L-156_61-67	0.115542453	-2.158117259	0.127121683	-2.062610517
2301-L-164_61-67	0.133028334	-2.017193134	0.124269059	-2.085306236
2301-L-167_61-67	0.132879064	-2.018315861	0.122769896	-2.097443442
2301-L-173_13	0.138242252	-1.978747687	0.130243741	-2.038347651
2301-L-185_61-67	0.123989626	-2.087557377	0.127716675	-2.057940949
2301-L-186_61-67	0.124296855	-2.085082585	0.125569771	-2.074893731
2301-L-193_61-67	0.113468857	-2.176226869	0.130191659	-2.038747615
2301-L-203_61-67	0.119844562	-2.121559693	0.1278853	-2.056621508
2301-L-210_61-67	0.119242981	-2.126592014	0.12837539	-2.052796572

2301-L-211_61-67	0.111418862	-2.19445865	0.128778411	-2.049662096
2301-L-218_61-67	0.111788435	-2.191147163	0.123785741	-2.089203106
2301-L-242_61-67	0.111635771	-2.192513755	0.124025498	-2.087268105
2301-L-244_61-67	0.109892101	-2.208256298	0.125836569	-2.072771286
2301-L-245_61-67	0.116548249	-2.149449936	0.128245138	-2.053811706
2301-L-246_61-67	0.12037617	-2.11713369	0.125115853	-2.078515145
2301-L-28_61-67	0.123614792	-2.090585065	0.125618023	-2.074509541
2301-L-419_13	0.116655606	-2.148529224	0.12518982	-2.07792413
2301-L-425_61-67	0.121610208	-2.106934366	0.125628254	-2.074428094
2301-L-428_61-67	0.137076974	-1.987212658	0.117189766	-2.143960724
2301-L-42_61-67	0.127894653	-2.056548376	0.123812205	-2.08898934
2301-L-430_61-67	0.119770034	-2.12218176	0.119713522	-2.122653708
2301-L-433_61-67	0.111752188	-2.191471467	0.128778043	-2.049664951
2301-L-447_13	0.145801657	-1.925508092	0.152050847	-1.883540296
2301-L-44_61-67	0.121261064	-2.109809502	0.123623658	-2.090513341
2301-L-451_13	0.113703049	-2.174165058	0.132100475	-2.024192475

2301-L-455_61-67	0.114067165	-2.170967835	0.118577294	-2.13219026
2301-L-466_13	0.12112557	-2.1109275	0.130709753	-2.034776037
2301-L-468_13	0.134556318	-2.005772449	0.129945787	-2.040637942
2301-L-469_61-67	0.134773358	-2.004160742	0.121424483	-2.108462749
2301-L-474_13	0.122625454	-2.098620661	0.118490819	-2.132919796
2301-L-475_13	0.122507304	-2.099584627	0.133378823	-2.014561905
2301-L-482_61-67	0.125608263	-2.07458724	0.129745907	-2.042177303
2301-L-48_61-67	0.122996381	-2.095600344	0.128633874	-2.050785094
2301-L-490_13	0.119833493	-2.121652058	0.139654454	-1.968584092
2301-L-493_61-67	0.134633219	-2.005201091	0.144867648	-1.931934723
2301-L-4_61-67	0.124626658	-2.082432748	0.131835344	-2.026201531
2301-L-500_13	0.134728687	-2.00449225	0.130884221	-2.033442152
2301-L-509_61-67	0.119685305	-2.122889442	0.132928492	-2.017943951
2301-L-50_61-67	0.11967467	-2.122978298	0.120663269	-2.114751515
2301-L-511_61-67	0.127813375	-2.05718409	0.127781574	-2.057432923
2301-L-514_61-67	0.131666892	-2.027480095	0.127035816	-2.063286219

2301-L-516_61-67	0.119466061	-2.124722956	0.1246081	-2.082581668
2301-L-517_61-67	0.120869237	-2.113046	0.137311337	-1.985504401
2301-L-518_61-67	0.12603709	-2.071179053	0.124468223	-2.08370483
2301-L-537_61-67	0.135433172	-1.999276954	0.12495074	-2.079835703
2301-L-63_13	0.123548753	-2.091119441	0.117958796	-2.137419902
2301-L-64_61-67	0.119455624	-2.124810327	0.123216914	-2.093808951
2301-L-65_61-67	0.125382729	-2.07638439	0.112350667	-2.186130342
2301-L-66_61-67	0.116237915	-2.152116194	0.123351159	-2.092720041
2301-L-68_61-67	0.122904274	-2.096349489	0.123810282	-2.089004869
2301-L-70_13	0.130551925	-2.03598424	0.136480283	-1.991575122
2301-L-72_13	0.133642193	-2.012589249	0.122158062	-2.102439481
2301-L-74_61-67	0.12068522	-2.114569607	0.121169176	-2.110567562
2301-L-79_61-67	0.121806499	-2.105321565	0.116754201	-2.147684403
2301-L-81_61-67	0.112682081	-2.183184866	0.140899314	-1.959709728
2301-L-84_61-67	0.115121623	-2.161766116	0.130151868	-2.039053296
2301-L-85_61-67	0.130416411	-2.037022789	0.125903386	-2.072240444

2301-L-92_13	0.125935663	-2.07198411	0.129916501	-2.040863334
2301-L-93_13	0.12431227	-2.084958573	0.13088043	-2.033471124
2301-L-95_61-67	0.128825474	-2.049296702	0.125060016	-2.078961532
2301-L-97_61-67	0.128069102	-2.0551853	0.126565642	-2.066994193
2301-L-99_61-67	0.122844558	-2.096835479	0.12427807	-2.085233725
28662_2051	0.108373686	-2.222169965	0.126245376	-2.069527834
28663_2051	0.118071067	-2.136468574	0.12437889	-2.084422806
28720_2051	0.116709917	-2.148063766	0.117674294	-2.139834693
28736_2051	0.123352154	-2.092711977	0.125086161	-2.078752488
28738b_2051	0.130894179	-2.033366076	0.12904821	-2.047569223
28739_2051	0.110601014	-2.201826022	0.12616882	-2.070134431
28756_2051	0.125868009	-2.072521465	0.124553007	-2.083023898
28758_2051	0.117908958	-2.137842496	0.116301569	-2.151568727
29041_2051	0.130296807	-2.037940298	0.121297605	-2.109508204
29049_2051	0.122168715	-2.102352283	0.128681133	-2.050417769
29056_2051	0.114975082	-2.163039856	0.128792619	-2.049551773

29068_2051	0.13121933	-2.030885085	0.127855727	-2.056852785
29075_2051	0.127779355	-2.057450293	0.117740995	-2.139268027
29082_2051	0.138130758	-1.979554523	0.126717869	-2.065792164
76919_2051	0.127937358	-2.056214525	0.118442279	-2.13332953
associated with 2301-R-214_61-67	0.146796941	-1.918705002	0.122797548	-2.097218231
JR3_2051	0.126160414	-2.070201054	0.124207699	-2.085800123
LACMHC 54899_13	0.134496616	-2.006216242	0.12125033	-2.109898026
LACMHC 54901_13	0.125468945	-2.075697001	0.123016513	-2.095436682
LACMHC 54903_13	0.128856286	-2.049057558	0.128382157	-2.052743862
LACMHC 54909_13	0.121820909	-2.105203273	0.13157621	-2.028169051
LACMHC 54912_13	0.127063901	-2.063065164	0.125176611	-2.07802965
LACMHC 54913_13	0.116483389	-2.150006603	0.131180768	-2.031178995
LACMHC 54917_13	0.121686873	-2.106304148	0.130046624	-2.039862248
LACMHC 54921_13	0.119778758	-2.122108919	0.123485769	-2.09162936
LACMHC 54922_13	0.139095657	-1.972593404	0.122660348	-2.098336141

LACMHC 54924_13	0.115746139	-2.156355944	0.124019225	-2.087318688
LACMHC 54940_13	0.12233946	-2.100955643	0.13432066	-2.007525355
LACMHC 54943_13	0.142524397	-1.94824209	0.123049658	-2.095167282
LACMHC 54958_13	0.134828587	-2.00375103	0.127966746	-2.055984847
LACMHC 54959_13	0.12425357	-2.085430883	0.129343637	-2.045282566
LACMHC 54962_13	0.132476282	-2.021351654	0.124207787	-2.085799415
LACMHC 54975_13	0.128854343	-2.049072635	0.143151681	-1.943850502
LACMHC 54976_13	0.145273751	-1.92913538	0.1339431	-2.010340198
LACMHC 54977_13	0.111067035	-2.197621338	0.147901024	-1.911211982
LACMHC 54983_13	0.125701999	-2.073841261	0.124249861	-2.085460736
LACMHC 55509_61-67	0.126277498	-2.069273427	0.118525392	-2.132628062
LACMHC 55513_61-67	0.116981174	-2.145742266	0.131072193	-2.032007015
LACMHC 55516_61-67	0.139596527	-1.968998964	0.128896462	-2.048745815
LACMHC 55518_61-67	0.134156333	-2.008749495	0.124842511	-2.080702252
LACMHC 55520_61-67	0.128839504	-2.049187804	0.123661264	-2.090209196
LACMHC 55521_61-67	0.127527087	-2.05942649	0.129237009	-2.046107279

LACMHC 55660_61-67	0.126878678	-2.064523943	0.117355657	-2.142546154
LACMHC 55665_61-67	0.122789322	-2.097285218	0.122758746	-2.097534267
LACMHC 55666_61-67	0.122629901	-2.09858439	0.123836807	-2.088790654
LACMHC 55667_61-67	0.118037459	-2.136753259	0.1285971	-2.051071016
LACMHC 55675_61-67	0.120843348	-2.113260218	0.130662947	-2.035134193
LACMHC 55681_61-67	0.12117169	-2.110546816	0.126928433	-2.06413187
LACMHC 55683_61-67	0.122418371	-2.100310827	0.120004377	-2.120227066
LACMHC 55685_61-67	0.136353418	-1.992505105	0.124535096	-2.083167706
LACMHC 55691_61-67	0.113707131	-2.174129167	0.127076928	-2.062962647
LACMHC 55692_61-67	0.117798171	-2.138782533	0.131053857	-2.032146921
LACMHC 55693_61-67	0.126138811	-2.070372304	0.119751024	-2.122340494
LACMHC 55694_61-67	0.117162372	-2.144194512	0.1350382	-2.002197578
LACMHC 55695_61-67	0.126683483	-2.066063565	0.128076935	-2.055124139
LACMHC 675_61-67	0.11908879	-2.127885933	0.117427561	-2.141933642
LACMHC 676_61-67	0.135380494	-1.999665995	0.121725896	-2.105983516
LACMHC 680_61-67	0.119908418	-2.121027014	0.132807361	-2.018855613

LACMHC 681_61-67	0.114578141	-2.166498238	0.131972789	-2.025159518
LACMHC 682_61-67	0.108044576	-2.225211393	0.128778876	-2.049658488
LACMHC 683_61-67	0.110897092	-2.199152606	0.123616814	-2.09056871
R17460_91	0.108468936	-2.221291448	0.123684996	-2.090017302
R17488_91	0.112325661	-2.186352941	0.126563548	-2.067010742
R17928_91	0.130131585	-2.039209149	0.133842725	-2.01108986
R18664_91	0.127772772	-2.057501808	0.127311324	-2.061119821
R27246_91	0.13995398	-1.966441624	0.132007309	-2.024897987
R28351_91	0.125701686	-2.073843755	0.131675108	-2.027417694
R28379_91	0.125837672	-2.07276252	0.125507637	-2.075388667
R28913_91	0.12090785	-2.112726596	0.132180265	-2.023588641
R30721_91	0.130934562	-2.033057606	0.122997047	-2.095594928
R30746_91	0.122244437	-2.101732661	0.132643149	-2.020092846
R31305_91	0.118844417	-2.129940058	0.120278766	-2.11794318
R34526_91	0.138747745	-1.975097781	0.120623617	-2.115080184
R34706_91	0.120110894	-2.119339844	0.125723619	-2.073669283

R38491_91	0.113406809	-2.176773844	0.123519628	-2.091355202
R39009_91	0.134848283	-2.003604965	0.14097603	-1.959165405
R39376_91	0.116894252	-2.146485582	0.124490526	-2.083525661
R39566_91	0.12560474	-2.074615285	0.116105875	-2.153252784
R39965_91	0.137362805	-1.98512964	0.127610633	-2.058771583
R40942_91	0.126689943	-2.066012568	0.120376654	-2.117129667
R52965_91	0.133028743	-2.017190061	0.147565594	-1.913482499
R53460_91	0.121151807	-2.110710915	0.130745846	-2.034499949
R53878_91	0.134496057	-2.006220393	0.126946155	-2.063992261

Specimen #_Pit #	**LM1 X**	**LM1 Y**	**LM2 X**	**LM2 Y**	**LM3 X**	**LM3 Y**	**LM4 X**	**LM4 Y**
2301-L-101_13	-0.3924795	-0.0008198	-0.3415538	0.00188078	-0.3095324	-0.0015914	-0.0981138	0.00342398
2301-L-106_61-67	-0.3895825	0.00210602	-0.33666	0.00168871	-0.322862	0.00070599	-0.1044642	-0.001134

2301-L-109_61-67	-0.3964031	0.00186339	-0.3478548	0.00359294	-0.3107	-0.0008102	-0.1040596	-0.0006819
2301-L-10_61-67	-0.409209	-0.0154699	-0.3447565	0.00561562	-0.3103814	-0.0008073	-0.0989052	-0.0002341
2301-L-120_61-67	-0.3967911	0.00459017	-0.3395487	0.00651595	-0.3117362	0.00363848	-0.1056194	-0.0041285
2301-L-123_61-67	-0.3897089	0.00028166	-0.3371787	0.00059997	-0.3051129	-0.0057938	-0.1091655	-0.0015298
2301-L-12_61-67	-0.4009979	-0.0044982	-0.3422655	0.00336737	-0.3125166	-0.0030859	-0.1044671	0.00497557
2301-L-140_61-67	-0.3967458	-0.0098964	-0.3304684	0.00450438	-0.3030422	0.00213998	-0.1097227	0.00385264
2301-L-143_13	-0.3986172	-0.0190251	-0.33494	0.00111362	-0.3111969	0.0048411	-0.1123933	0.00368309
2301-L-148_61-67	-0.3959729	-0.0145061	-0.3359816	-0.0001244	-0.3079895	-0.0037376	-0.1077879	0.00006968

2301-L-154_61-67	-0.395746	-0.0050669	-0.3365968	-0.007524	-0.3219965	-0.0055664	-0.1027931	0.0049336
2301-L-155_61-67	-0.3972573	-0.0130794	-0.3272114	0.00040334	-0.3043606	0.00420541	-0.1059263	0.00496219
2301-L-156_61-67	-0.3875294	0.00059045	-0.3344303	-0.0021811	-0.3113824	-0.0032061	-0.1081684	0.0034046
2301-L-164_61-67	-0.3801089	-0.001676	-0.3381599	-0.0006096	-0.3138595	-0.0021676	-0.1093772	0.00212918
2301-L-167_61-67	-0.387202	0.004541	-0.3357338	-0.001933	-0.3081964	-0.0049341	-0.1046848	-0.0043609
2301-L-173_13	-0.3778839	-0.0014903	-0.329941	-0.0032438	-0.3060879	-0.0074645	-0.1131185	-0.0071915
2301-L-185_61-67	-0.3964987	-0.0191639	-0.3364985	0.00314241	-0.3107696	0.00315693	-0.1071743	0.00055289
2301-L-186_61-67	-0.3893643	-0.0256153	-0.3373113	0.00730132	-0.3090502	0.0041371	-0.1048973	0.00029137

2301-L-193_61-67	-0.3826911	-0.0337002	-0.3313966	0.00280037	-0.3163786	0.0013933	-0.1054471	-0.0055192
2301-L-203_61-67	-0.3914992	-0.0251034	-0.3273972	-0.002228	-0.3158099	-0.0036223	-0.1063015	0.00349377
2301-L-210_61-67	-0.3937957	-0.0129937	-0.3250077	0.00325341	-0.3092241	0.00085958	-0.1102041	0.00332732
2301-L-211_61-67	-0.3998661	-0.0131753	-0.3385448	0.00200949	-0.3078407	-0.0012173	-0.1075226	0.00171337
2301-L-218_61-67	-0.4010442	-0.0085592	-0.3381044	-0.0029414	-0.3024526	-0.0071879	-0.1042089	0.0003845
2301-L-242_61-67	-0.4037993	-0.0113249	-0.3399869	0.0046395	-0.3083075	-0.0037996	-0.1031151	0.00633805
2301-L-244_61-67	-0.4115361	-0.0097194	-0.3406995	0.00169988	-0.3068803	-0.0014751	-0.1036504	-0.0008395
2301-L-245_61-67	-0.397258	-0.0143697	-0.3319437	-0.0003596	-0.3131585	-0.0016862	-0.1084107	0.00051232

2301-L-246_61-67	-0.4010107	-0.0117376	-0.3406772	0.00274805	-0.3088204	-0.0034221	-0.1072857	0.0052218
2301-L-28_61-67	-0.3882836	-0.0173466	-0.3333375	-0.0017032	-0.3076526	-0.0033353	-0.1066006	0.00152782
2301-L-419_13	-0.3834555	-0.0012815	-0.3433069	-0.0124628	-0.3155786	-0.0108811	-0.1088317	0.00421679
2301-L-425_61-67	-0.3879325	-0.018813	-0.3289726	0.00272665	-0.3100671	0.00429349	-0.1093386	-0.0003639
2301-L-428_61-67	-0.3899459	-0.005702	-0.329291	-0.0009572	-0.3132505	-0.0049902	-0.1047713	-0.0009508
2301-L-42_61-67	-0.3908449	-0.0254838	-0.3325418	0.005874	-0.30683	0.00168584	-0.1050855	0.00100468
2301-L-430_61-67	-0.3953087	-0.0012796	-0.3278511	-0.0060328	-0.3218879	-0.0052212	-0.1056395	-0.0033014
2301-L-433_61-67	-0.3950143	-0.0141748	-0.3401946	0.00597624	-0.3124832	-0.0004788	-0.1062939	0.00551899

2301-L-447_13	-0.3911427	0.00437104	-0.3308429	0.00127983	-0.3140108	0.00105057	-0.12709	-0.0133367
2301-L-44_61-67	-0.3969023	-0.0142137	-0.3329716	-0.0003891	-0.3090064	-0.000984	-0.102171	0.00285318
2301-L-451_13	-0.3823994	-0.0372788	-0.3331224	0.00940934	-0.3190904	0.01144697	-0.1086296	0.00613646
2301-L-455_61-67	-0.3992587	-0.0052213	-0.3359453	-0.0047054	-0.3143219	-0.0022544	-0.1001172	0.00538052
2301-L-466_13	-0.3831688	-0.0179976	-0.3427388	0.00104212	-0.3110889	0.00083257	-0.1095959	0.0051244
2301-L-468_13	-0.3863247	0.01090984	-0.332206	0.00178796	-0.3149159	0.00138791	-0.1152959	0.00257343
2301-L-469_61-67	-0.3940762	-0.0133705	-0.325279	0.00206952	-0.3085482	-0.0035507	-0.1058843	-0.0028472
2301-L-474_13	-0.3889638	-0.0070438	-0.3356819	0.00185155	-0.3037711	-0.0033636	-0.1044087	-0.0115731

2301-L-475_13	-0.4060361	-0.022928	-0.3394044	0.01039385	-0.3085506	0.0106575	-0.1113106	0.00699327
2301-L-482_61-67	-0.4041366	-0.0016424	-0.3390016	0.003785	-0.3113561	0.00243285	-0.1073121	0.00231596
2301-L-48_61-67	-0.3974974	-0.0066987	-0.3340767	0.0098723	-0.3122487	0.00663756	-0.1094227	-0.0058316
2301-L-490_13	-0.401025	-0.003766	-0.3350369	0.00696443	-0.312413	0.00508365	-0.1103263	0.00062272
2301-L-493_61-67	-0.3978641	0.0065752 1	-0.3375783	0.00624042	-0.3213987	0.00630893	-0.1122513	-0.018046
2301-L-4_61-67	-0.4034084	-0.0067081	-0.3370418	0.00573843	-0.3094879	0.00175572	-0.1139549	0.00523204
2301-L-500_13	-0.4053586	0.0059980 2	-0.3342811	0.01301395	-0.3056699	0.0017773	-0.1084278	-0.0014442
2301-L-509_61-67	-0.3862396	0.0032411 2	-0.3294614	0.00201708	-0.311806	-7.942E-05	-0.1107311	-0.0063107

2301-L-50_61-67	-0.3889022	-0.0202188	-0.3328447	0.00072104	-0.3123431	0.00363135	-0.1059004	0.00293767
2301-L-511_61-67	-0.3970832	-0.0151704	-0.3350827	0.01532749	-0.3081951	0.00738526	-0.107911	-0.0076966
2301-L-514_61-67	-0.4005749	-0.011506	-0.3370609	0.00719872	-0.3076237	0.00090464	-0.1073794	0.00302845
2301-L-516_61-67	-0.4039707	-0.0165733	-0.3421272	0.00057527	-0.3046489	-0.0029237	-0.1042569	0.001579
2301-L-517_61-67	-0.3872583	-0.0058461	-0.3374932	-0.0042844	-0.3179794	-0.0040623	-0.1139306	-0.0005522
2301-L-518_61-67	-0.4010606	-0.0106441	-0.3352668	0.00149475	-0.3112814	0.00205848	-0.1079009	0.00857634
2301-L-537_61-67	-0.4069971	-0.0090625	-0.3423303	0.00281445	-0.3099497	0.00153171	-0.1059655	0.00341766
2301-L-63_13	-0.4054011	-0.0041629	-0.341017	0.00313689	-0.2965612	0.00170032	-0.1076128	0.00484076

2301-L-64_61-67	-0.3950299	-0.0043558	-0.3314847	0.00227895	-0.2980734	-0.0023235	-0.1118402	0.00632291
2301-L-65_61-67	-0.4035229	-0.0039486	-0.3453306	0.0077412	-0.3014266	-0.0038742	-0.1011798	0.00817846
2301-L-66_61-67	-0.3890411	0.00304752	-0.3378507	0.00267628	-0.3115229	0.00091901	-0.1121795	0.00175498
2301-L-68_61-67	-0.4004718	-0.0140396	-0.3323319	0.00127263	-0.3156344	-0.0050307	-0.1033836	0.00042165
2301-L-70_13	-0.3906434	-0.0117384	-0.3372417	-0.0067398	-0.3145617	-0.0076877	-0.1145974	0.0058425
2301-L-72_13	-0.3961849	0.00231256	-0.3379627	0.00356036	-0.3068883	0.00082218	-0.1030215	0.00103075
2301-L-74_61-67	-0.4005348	-0.0141459	-0.3386797	0.00098082	-0.3106806	-0.0016233	-0.1044887	0.00466239
2301-L-79_61-67	-0.4017604	-0.0139989	-0.3412125	0.0015761	-0.3065198	-0.0031751	-0.1020951	0.0045085

2301-L-81_61-67	-0.3765273	-0.0394859	-0.3284784	0.01001122	-0.3172743	0.00861164	-0.1182973	0.00479652
2301-L-84_61-67	-0.4024945	-0.0080438	-0.3365065	0.00602901	-0.3093899	0.00291615	-0.1047865	0.00296144
2301-L-85_61-67	-0.3982865	-0.0018369	-0.3295002	0.00384378	-0.3047951	0.0041873	-0.1100872	0.010746
2301-L-92_13	-0.3920598	0.00148019	-0.3351254	0.00408825	-0.3133359	0.00250976	-0.1121266	0.00546926
2301-L-93_13	-0.3847847	0.00092773	-0.3335392	0.00116084	-0.3110525	-0.0016397	-0.1129864	-0.0014508
2301-L-95_61-67	-0.3991853	-0.0085419	-0.3384348	0.00356555	-0.3151785	0.00028295	-0.1083001	0.00463335
2301-L-97_61-67	-0.40467	-0.0148877	-0.3356178	0.00218834	-0.315244	0.00116027	-0.1058179	0.0021747
2301-L-99_61-67	-0.3991493	-0.0144541	-0.3406779	0.00251362	-0.3042409	0.00083055	-0.1088688	0.00924375

28662_2051	-0.4042249	-0.0175442	-0.3396627	0.00245347	-0.3119865	0.0000483	-0.1005415	0.00281107
28663_2051	-0.3945236	0.0086694 2	-0.3270192	0.00391587	-0.3131033	0.00463224	-0.1049729	-0.0075504
28720_2051	-0.3906253	-0.005983	-0.3361838	-0.0007363	-0.3047007	-0.0038585	-0.1053228	-0.0054671
28736_2051	-0.3885786	-0.0045448	-0.3328595	-0.0018287	-0.3071996	-0.003781	-0.107611	-0.0073307
28738b_205 1	-0.385002	0.0009209 4	-0.3284079	-0.0016567	-0.3131686	0.0019657	-0.1085178	-0.0063923
28739_2051	-0.3948146	-0.0123355	-0.3355236	0.01114483	-0.3064332	0.0082369	-0.1050151	0.0015854
28756_2051	-0.3746209	-0.0215458	-0.3348075	0.0118144	-0.3033302	0.00450564	-0.110347	-0.0054074
28758_2051	-0.4031273	-0.0051293	-0.3384907	0.00842914	-0.3032125	-0.0018873	-0.101082	-0.0001266
29041_2051	-0.383887	-0.0061921	-0.3349207	-0.0022372	-0.3162261	-0.0047566	-0.107602	0.00607435
29049_2051	-0.3888314	0.0023794 1	-0.3344127	-0.0030248	-0.3159842	-0.0029707	-0.1111262	-0.0008092
29056_2051	-0.404427	-0.019168	-0.3387102	-0.0039062	-0.3097469	-0.0009638	-0.1093093	0.00278966
29068_2051	-0.3926062	-0.0124054	-0.3361669	0.00415911	-0.3101197	0.00296997	-0.1114856	-0.006657
29075_2051	-0.3875522	-0.0076596	-0.3382154	-0.004798	-0.3050623	-0.0056664	-0.1059328	-0.0006787

29082_2051	-0.3982715	-0.0092962	-0.3294917	0.00373631	-0.3141039	0.00451468	-0.1078711	-0.001662
76919_2051	-0.3951179	0.00311512	-0.3363472	-0.0051744	-0.3082596	-0.003917	-0.1027397	-0.0054984
associated with 2301-R-214_61-67	-0.3812745	-0.0232925	-0.3216418	-0.0069303	-0.296663	-0.0093134	-0.1179758	0.00949147
JR3_2051	-0.3918763	0.00148271	-0.3322118	-0.0021327	-0.3062	0.00114438	-0.1107507	0.00343116
LACMHC 54899_13	-0.4021381	0.00621836	-0.343399	0.00083162	-0.3140186	0.00015436	-0.0992397	0.00534538
LACMHC 54901_13	-0.3840228	-0.002062	-0.3331849	-0.0006842	-0.3084289	-0.0032299	-0.108975	-0.0002906
LACMHC 54903_13	-0.3897796	-0.0005176	-0.3314914	-0.0026301	-0.3051371	-0.0034019	-0.1123418	-0.0049723
LACMHC 54909_13	-0.3861191	0.00002056	-0.3363221	0.00254752	-0.308939	0.00116167	-0.1096869	-0.0016579

LACMHC 54912_13	-0.4021058	-0.0171569	-0.3450004	0.00832708	-0.3111923	0.00235458	-0.1031687	0.0096893
LACMHC 54913_13	-0.3996095	-0.0212601	-0.3433425	0.00775215	-0.312257	0.00413271	-0.1030366	0.00547717
LACMHC 54917_13	-0.3997142	-0.0168661	-0.3542898	0.00915879	-0.3097804	0.00601022	-0.1100597	0.00708217
LACMHC 54921_13	-0.3997461	-0.0073059	-0.3353648	0.00030451	-0.3147568	0.00072694	-0.1036005	0.00636195
LACMHC 54922_13	-0.3874223	-0.0067268	-0.3445761	-0.0024899	-0.3044926	-0.0051835	-0.1137849	0.01346049
LACMHC 54924_13	-0.4006883	-0.0011006	-0.3477997	0.00050327	-0.3077308	-0.0046381	-0.1080876	0.00776742
LACMHC 54940_13	-0.3780212	-0.004408	-0.3321331	0.00068972	-0.3214376	-0.0001078	-0.1173902	0.00327611
LACMHC 54943_13	-0.3959195	0.0046725	-0.3360317	0.00369749	-0.3123267	-0.0033215	-0.1040581	0.00124127

LACMHC 54958_13	-0.3765296	-0.0027538	-0.3326397	-0.0095232	-0.3165215	-0.0091058	-0.1113782	-0.0007314
LACMHC 54959_13	-0.3925499	0.0023431 6	-0.3393564	0.00013449	-0.3089533	-0.0023423	-0.1121212	-0.0022758
LACMHC 54962_13	-0.3860642	0.0085972 4	-0.3309622	0.00219947	-0.3046221	0.00218016	-0.1124909	-6.448E-05
LACMHC 54975_13	-0.3682684	-0.0305898	-0.3309706	0.00594889	-0.3206325	0.00369925	-0.1215421	0.00443351
LACMHC 54976_13	-0.392082	0.0032516 1	-0.3382362	0.00254243	-0.3215056	-0.0039751	-0.1088172	-0.0070087
LACMHC 54977_13	-0.3845607	0.0042809 7	-0.3249117	0.0007041	-0.3134324	-0.0022972	-0.1195562	-0.0056483
LACMHC 54983_13	-0.3911119	0.0049376 5	-0.3285368	-0.0025987	-0.306879	-0.0014352	-0.1101905	0.00183242
LACMHC 55509_61-67	-0.4030841	-0.0140191	-0.340809	0.00014447	-0.3117796	-0.0030425	-0.0999871	0.00817101

LACMHC 55513_61-67	-0.3941724	0.0009572 5	-0.3311424	0.00002057	-0.3186509	-0.0049261	-0.1061042	-4.598E-05
LACMHC 55516_61-67	-0.3857966	-0.0039237	-0.3271861	0.00191876	-0.3086533	-1.164E-05	-0.1148808	-0.0019936
LACMHC 55518_61-67	-0.3898441	-0.0056894	-0.334889	-0.0032343	-0.3147314	-0.0043853	-0.1076703	-0.0072984
LACMHC 55520_61-67	-0.394081	-0.0024969	-0.3334374	-0.0013078	-0.3126801	-0.0038157	-0.1039121	-0.003123
LACMHC 55521_61-67	-0.3966753	0.0023228 5	-0.335012	0.00245174	-0.3174389	0.00102582	-0.1081686	-0.0016875
LACMHC 55660_61-67	-0.3931553	0.0004641 5	-0.3394402	0.00026669	-0.3059166	-0.0034456	-0.1110905	0.00424234
LACMHC 55665_61-67	-0.3919871	-0.0178207	-0.3314465	-0.0023544	-0.3158474	-0.0018234	-0.1064349	0.00364241
LACMHC 55666_61-67	-0.3933896	-0.0141885	-0.3378952	0.00130834	-0.3031323	-0.0040653	-0.1079432	0.00293583

LACMHC 55667_61-67	-0.4056479	-0.0180136	-0.3413664	0.00286497	-0.3106582	-0.0008964	-0.1030378	-0.0003755
LACMHC 55675_61-67	-0.4027827	-0.0076276	-0.3346855	-0.0014125	-0.3126454	-0.0048538	-0.1071985	-0.0010692
LACMHC 55681_61-67	-0.3947756	-0.0288433	-0.3329329	0.00110865	-0.3161556	0.00154347	-0.1036279	0.00347288
LACMHC 55683_61-67	-0.4018741	-0.0087875	-0.3385195	-0.0028622	-0.3030783	-0.0056358	-0.1054886	0.00706327
LACMHC 55685_61-67	-0.3977272	-0.0152668	-0.3318189	0.00291021	-0.3157832	0.00394645	-0.1088223	0.00040825
LACMHC 55691_61-67	-0.3916137	-0.0064248	-0.3352875	-0.002338	-0.3078734	-0.0041415	-0.1073768	0.0019369
LACMHC 55692_61-67	-0.3976648	-0.0023191	-0.3388731	-0.0027999	-0.3175717	-0.0053582	-0.1099123	-0.0045487
LACMHC 55693_61-67	-0.3883778	-0.0005229	-0.3379756	-0.0031735	-0.3101121	-0.0040583	-0.110389	0.00463518

LACMHC 55694_61-67	-0.3982107	0.0080975 8	-0.337614	0.00726418	-0.3244831	0.00724961	-0.1000445	-0.0142988
LACMHC 55695_61-67	-0.396446	-0.0318843	-0.3364396	0.00317972	-0.32614	0.00277185	-0.101086	0.00323499
LACMHC 675_61-67	-0.3962121	-0.00877	-0.3345	0.00289309	-0.3053102	-0.0012523	-0.1030769	-0.0009593
LACMHC 676_61-67	-0.4005978	-0.0098527	-0.3366456	0.00080292	-0.3033643	-0.0028084	-0.1067369	0.00267294
LACMHC 680_61-67	-0.4000715	-0.0100507	-0.3356428	0.00955363	-0.3122882	0.00548146	-0.11338	-0.0019527
LACMHC 681_61-67	-0.3947842	-0.0056296	-0.3405374	-0.003262	-0.3198317	-0.0051361	-0.1110758	0.0081096
LACMHC 682_61-67	-0.4004494	-0.0081031	-0.3397754	0.00853326	-0.3073457	0.00475585	-0.1097321	0.00211551
LACMHC 683_61-67	-0.3952931	-0.0090159	-0.3324376	0.0057075	-0.3119344	0.00045405	-0.1073851	-0.0012841

R17460_91	-0.3971366	0.00296865	-0.3334335	0.00248667	-0.3158321	-0.0018407	-0.1003985	0.0087421
R17488_91	-0.3894337	-0.0024536	-0.3426391	-0.002425	-0.3174879	-0.0027581	-0.1069553	0.00854969
R17928_91	-0.3934936	0.00324705	-0.3432827	0.0018057	-0.3164559	0.0005175	-0.111729	-0.0008795
R18664_91	-0.3934855	-0.0060201	-0.3286969	-0.008427	-0.3136064	-0.0056322	-0.1099532	0.0082957
R27246_91	-0.3915161	-0.0006011	-0.3395326	0.00714874	-0.3136333	0.0043983	-0.1139115	-0.0060906
R28351_91	-0.3887564	0.00021895	-0.3314473	0.00459408	-0.3088947	0.00149067	-0.1147489	-0.0093325
R28379_91	-0.3964175	-0.0110408	-0.3276528	0.00842468	-0.315079	0.00343208	-0.1113587	0.01140753
R28913_91	-0.3896973	-0.0020791	-0.3412844	-0.000402	-0.3077322	-0.0054972	-0.1138018	0.00230165
R30721_91	-0.3935453	-0.0254479	-0.3366514	0.00352349	-0.3156893	0.00155462	-0.1042475	-0.001939
R30746_91	-0.3908036	-0.0014774	-0.3328221	0.00339207	-0.3153228	0.00058721	-0.109957	-0.0066127
R31305_91	-0.3894971	0.00073189	-0.332991	0.00454482	-0.3289253	-0.0009999	-0.0998524	-0.0016021
R34526_91	-0.388696	-0.021612	-0.3367012	0.00810198	-0.3167761	0.00758308	-0.1039847	0.00610636

R34706_91	-0.3983479	0.00171976	-0.3373648	-0.0023078	-0.3145047	0.00243384	-0.1081441	0.00535367
R38491_91	-0.4007809	-0.0203578	-0.3424778	0.00450304	-0.3126567	0.00147998	-0.1041716	-0.0025922
R39009_91	-0.4109826	0.00016806	-0.3398209	0.01434884	-0.3266987	0.01474958	-0.1097903	-0.0092901
R39376_91	-0.3887669	0.00130723	-0.3351165	-0.0014128	-0.3091988	-0.0062435	-0.113911	0.00423532
R39566_91	-0.3902696	-0.0083849	-0.3383417	-0.0030903	-0.3125433	-0.0027047	-0.1013565	0.00381834
R39965_91	-0.3961441	-0.0020275	-0.3414888	0.00255459	-0.3200948	0.00213523	-0.105059	-0.0105094
R40942_91	-0.3969814	-0.0009371	-0.3326235	0.00728716	-0.3100767	0.00396528	-0.1095125	0.00160731
R52965_91	-0.3929842	0.00537779	-0.3342382	0.00522494	-0.3224949	0.00574259	-0.1190106	-0.0155716
R53460_91	-0.3903983	-0.0257677	-0.3329894	0.00674331	-0.3151469	0.00388726	-0.1100435	0.00542186
R53878_91	-0.3943519	-0.0036985	-0.3351448	-0.0041822	-0.317858	-0.0031257	-0.1046469	-0.0014038

Specimen #_Pit #	LM5 X	LM5 Y	LM6 X	LM6 Y	LM7 X	LM7 Y	LM8 X	LM8 Y
2301-L-101_13	-0.0101514	-0.0035204	0.02302746	0.00535298	0.05196248	0.01384059	0.10906092	-0.0494307
2301-L-106_61-67	-0.008728	-0.0100848	0.02279756	0.00263639	0.06486385	0.02216686	0.12443208	-0.0226137
2301-L-109_61-67	-0.0089454	-0.004818	0.02325256	0.00598489	0.06841893	0.026394	0.0974693	-0.038138
2301-L-10_61-67	-0.0039107	-0.0050828	0.02068906	0.00204498	0.0645997	0.02685419	0.09256085	-0.0434678
2301-L-120_61-67	-0.0056475	-0.00444	0.02390988	0.00858693	0.06973023	0.02918983	0.09776397	-0.0471867
2301-L-123_61-67	-0.0119094	-0.0014168	0.02142008	0.0047024	0.06724483	0.02582379	0.09879768	-0.0408776
2301-L-12_61-67	-0.0040244	-0.0008791	0.0230304	0.01062345	0.06838608	0.03193346	0.0924532	-0.0388195

2301-L-140_61-67	-0.0169237	0.005285	0.01233341	0.01541897	0.05588893	0.03658068	0.10371921	-0.0427981
2301-L-143_13	-0.0109508	-0.0011257	0.02352816	0.01181597	0.07390611	0.03627472	0.1005187	-0.0322458
2301-L-148_61-67	-0.0152294	-0.0056123	0.01518883	0.0033847	0.06075282	0.02079244	0.10610435	-0.033372
2301-L-154_61-67	-0.0055557	-0.0004189	0.02503717	0.00772146	0.06902865	0.02546568	0.09169833	-0.0331737
2301-L-155_61-67	-0.0151278	0.00315522	0.02029375	0.0111247	0.06710744	0.03004718	0.096605	-0.0387932
2301-L-156_61-67	-0.0134881	-0.0092926	0.01893682	0.00544979	0.06564557	0.02782265	0.10034047	-0.0291195
2301-L-164_61-67	-0.0141722	-0.0025605	0.0148821	0.00368572	0.06659259	0.02399008	0.11663238	-0.0267825
2301-L-167_61-67	-0.0176701	-0.0021506	0.01775153	0.00468318	0.0658874	0.02088317	0.11219653	-0.0302843

2301-L-173_13	-0.023252	-0.0040389	0.01653977	0.00514452	0.06159746	0.02922234	0.11320695	-0.0261723
2301-L-185_61-67	-0.0131507	-0.0034749	0.02018146	0.01014831	0.06467573	0.03022355	0.10986791	-0.0189618
2301-L-186_61-67	-0.0129395	0.00355315	0.02034227	0.00939123	0.06639811	0.02623674	0.10681191	-0.029753
2301-L-193_61-67	-0.0101532	-0.0037898	0.02459834	0.00065003	0.06894768	0.02749257	0.10043138	-0.0292111
2301-L-203_61-67	-0.0143396	0.0013729	0.0215751	0.00498805	0.0684169	0.03184953	0.10500369	-0.0095771
2301-L-210_61-67	-0.0179875	-0.001863	0.01816744	0.00432284	0.06723675	0.02714407	0.09647779	-0.0352782
2301-L-211_61-67	-0.0106379	0.0039243	0.02064182	0.01427324	0.0658978	0.03152011	0.09561091	-0.0296221
2301-L-218_61-67	-0.0083696	0.00770935	0.01876916	0.01450209	0.06315533	0.03393711	0.09499764	-0.0348566

2301-L-242_61-67	-0.0114862	0.00250382	0.02086978	0.00951118	0.05986263	0.02442853	0.09427353	-0.0332373
2301-L-244_61-67	-0.0113347	0.00313451	0.02109006	0.01573309	0.06358012	0.04034934	0.09344927	-0.0299805
2301-L-245_61-67	-0.0165196	-0.0046957	0.01979114	0.0038453	0.0647955	0.02783219	0.09881539	-0.0214686
2301-L-246_61-67	-0.0141241	-0.0001324	0.01779443	0.00821267	0.06653694	0.03086003	0.09835146	-0.0430237
2301-L-28_61-67	-0.0165347	0.00193013	0.01880235	0.00887546	0.06207642	0.03231181	0.10061019	-0.0375376
2301-L-419_13	-0.013049	0.00101019	0.01627483	0.00878322	0.06862993	0.02670983	0.10102849	-0.0233794
2301-L-425_61-67	-0.015747	-0.0052195	0.01617082	0.00509841	0.05916354	0.02594316	0.1035802	-0.0286728
2301-L-428_61-67	-0.020289	-0.0043532	0.01230612	0.00417941	0.05852194	0.02660324	0.11151671	-0.042001

2301-L-42_61-67	-0.0141746	-0.0039865	0.01871474	0.00272949	0.06338962	0.02585911	0.11183838	-0.0258444
2301-L-430_61-67	-0.0138183	-0.0033097	0.01390989	0.00296489	0.0608085	0.03114139	0.10467253	-0.0207678
2301-L-433_61-67	-0.0078181	-0.0010945	0.02246038	0.0079949	0.06403103	0.02392953	0.09822115	-0.0363682
2301-L-447_13	-0.0146535	-0.0077747	0.02416548	0.00219496	0.07559779	0.02440166	0.12984554	-0.0272212
2301-L-44_61-67	-0.0153193	-0.0021052	0.02143908	0.0046881	0.06593933	0.0292069	0.10056912	-0.0378
2301-L-451_13	-0.0112322	0.00448772	0.02332169	0.0124128	0.06917605	0.03902595	0.08916793	-0.0488807
2301-L-455_61-67	-0.0133058	-0.0019398	0.01845431	0.00655576	0.06194319	0.02603016	0.09819388	-0.0260053
2301-L-466_13	-0.0114537	-0.0018116	0.02108984	0.00762875	0.05487641	0.01939759	0.10506509	-0.034899

2301-L-468_13	-0.0181142	-0.0034575	0.01463474	0.00058682	0.06596738	0.02360086	0.11366457	-0.030656
2301-L-469_61-67	-0.0226308	0.00460847	0.01532064	0.00445142	0.06936068	0.03028538	0.10615646	-0.0351118
2301-L-474_13	-0.017181	-0.0051213	0.01329354	0.00207429	0.06356146	0.02500004	0.10500303	-0.0155171
2301-L-475_13	-0.016738	-0.0005213	0.02206804	0.00678466	0.07329134	0.02531312	0.1004065	-0.0363712
2301-L-482_61-67	-0.0090095	-0.0048185	0.02239788	0.00536949	0.06845323	0.02677617	0.11454223	-0.0274549
2301-L-48_61-67	-0.0132161	-0.0081741	0.01898969	0.00171426	0.06286713	0.023799	0.10496735	-0.0422444
2301-L-490_13	-0.0098513	0.00031008	0.02875377	0.01327614	0.07556239	0.03565452	0.1023114	-0.0418752
2301-L-493_61-67	-0.0129414	-0.0098591	0.03108988	0.00292864	0.08385174	0.02626077	0.12158392	-0.0152474

2301-L-4_61-67	-0.0161327	-0.0030955	0.01787744	0.00612494	0.06266225	0.02492688	0.10301159	-0.039653
2301-L-500_13	-0.0125461	-0.0054575	0.02230478	0.00485502	0.07078343	0.02451912	0.11676614	-0.043275
2301-L-509_61-67	-0.0167441	-0.0032796	0.02199935	0.00094246	0.06698108	0.02643336	0.09793265	-0.0375407
2301-L-50_61-67	-0.014986	0.00108452	0.01472553	0.00593844	0.06322686	0.02737606	0.09938982	-0.034132
2301-L-511_61-67	-0.0145652	-0.0087305	0.01960096	0.00060015	0.06301005	0.02837229	0.10717483	-0.0476617
2301-L-514_61-67	-0.0161571	0.00300947	0.01949506	0.00942942	0.06297732	0.03192464	0.10652362	-0.0447985
2301-L-516_61-67	-0.0116079	0.00148443	0.01979532	0.01333603	0.06093199	0.03365096	0.10323559	-0.0314263
2301-L-517_61-67	-0.0144828	-0.0035877	0.02321834	0.00612504	0.06388797	0.02555346	0.10074775	-0.0400747

2301-L-518_61-67	-0.0157159	-0.0036149	0.01649532	0.00434178	0.06269342	0.01839927	0.1049663	-0.0399626
2301-L-537_61-67	-0.013858	0.0049492	0.01862174	0.01294181	0.06736064	0.03493853	0.11756394	-0.0277679
2301-L-63_13	-0.0188293	-0.0002429	0.0103031	0.00802017	0.06019339	0.02071548	0.09359651	-0.0514751
2301-L-64_61-67	-0.0244992	0.00338933	0.01136786	0.0048425	0.05928802	0.02455944	0.08832349	-0.0358623
2301-L-65_61-67	-0.015087	0.00595511	0.01101815	0.01403405	0.05510276	0.02853726	0.1024704	-0.0376464
2301-L-66_61-67	-0.0178301	0.00045726	0.01091882	0.0096494	0.05527155	0.0239469	0.09128011	-0.0396204
2301-L-68_61-67	-0.0135778	-0.0015382	0.02027899	0.00646729	0.06490359	0.03485407	0.10405454	-0.0371486
2301-L-70_13	-0.0200215	-0.0022901	0.02183527	0.00944611	0.07153411	0.03582063	0.1073667	-0.0308569

2301-L-72_13	-0.014689	-0.0084233	0.01913437	0.00175756	0.0636624	0.02427154	0.11602206	-0.0362594
2301-L-74_61-67	-0.0177297	-0.0002651	0.01667918	0.00409341	0.06335697	0.02371221	0.09900992	-0.030872
2301-L-79_61-67	-0.0151403	0.00274996	0.01463838	0.00671017	0.05875612	0.02894219	0.10346926	-0.0249735
2301-L-81_61-67	-0.0141681	-0.0048187	0.0225609	0.00819842	0.06678587	0.0293179	0.09378136	-0.0371322
2301-L-84_61-67	-0.0091512	-0.0018483	0.02529753	0.00716309	0.0656644	0.02891787	0.10281	-0.0286378
2301-L-85_61-67	-0.0293673	-0.0018093	0.01531817	-0.0004411	0.06508855	0.02934305	0.09684331	-0.0346625
2301-L-92_13	-0.0141479	-0.0040299	0.01778915	0.00589912	0.06618533	0.02615243	0.10736468	-0.037113
2301-L-93_13	-0.0152873	-0.0071041	0.01771906	0.00531457	0.06133816	0.02453646	0.1068102	-0.030465

2301-L-95_61-67	-0.0137403	-0.0040126	0.01675908	0.00508779	0.06089791	0.0267202	0.11240647	-0.0301468
2301-L-97_61-67	-0.0128271	0.00435082	0.02008348	0.01512516	0.0659447	0.03700763	0.11212625	-0.0237268
2301-L-99_61-67	-0.0139532	0.00227362	0.01534989	0.00540308	0.07700587	0.01493515	0.10272236	-0.0361658
28662_2051	-0.0095291	0.00511998	0.02514685	0.01465743	0.07260415	0.03604397	0.08375666	-0.0500401
28663_2051	-0.0145586	-0.0125557	0.01936533	-0.0043696	0.06753038	0.02601551	0.09937438	-0.0435403
28720_2051	-0.0180964	-0.0067133	0.01200204	0.00359567	0.05812942	0.02659816	0.09040567	-0.0497076
28736_2051	-0.0182344	-0.0055773	0.01707408	0.0026784	0.06645222	0.02699907	0.1028149	-0.0293009
28738b_2051	-0.0153742	-0.0062186	0.02009611	0.00418559	0.06272539	0.03471701	0.10831738	-0.04904
28739_2051	-0.0108777	-0.0040709	0.02109688	0.00537116	0.0617015	0.03084926	0.0876957	-0.0542294

28756_2051	-0.0184557	-0.0086133	0.01401995	0.0013973	0.05843486	0.03265358	0.09902905	-0.0537807
28758_2051	-0.0132673	-2.48E-06	0.01475902	0.01021283	0.05508459	0.0345911	0.09724708	-0.041101
29041_2051	-0.0233153	-0.0005728	0.01367828	0.00812678	0.06364665	0.02866122	0.10481138	-0.024254
29049_2051	-0.0100313	-0.0115814	0.01755281	-0.0015501	0.06413207	0.02109252	0.10719181	-0.0459898
29056_2051	-0.0052439	-0.0002893	0.01911422	0.01253368	0.05945901	0.03721771	0.10175907	-0.0423563
29068_2051	-0.0211631	-0.005672	0.01599083	0.00318419	0.06465448	0.02776645	0.1060371	-0.0378998
29075_2051	-0.0200482	-0.0010605	0.01157512	0.00672575	0.05708547	0.03486215	0.10287548	-0.0359506
29082_2051	-0.019433	-0.0038724	0.01872323	0.00393146	0.06739086	0.0295002	0.11273296	-0.0440254
76919_2051	-0.0174406	-0.0035812	0.01516039	0.00582191	0.06461463	0.03253207	0.10340137	-0.0455952

associated with 2301-R-214_61-67	-0.0340127	0.007702	0.00466114	0.0157704 9	0.06155761	0.03221733	0.10955577	-0.0229154
JR3_2051	-0.0189415	-0.0066431	0.01344958	0.0047887	0.05771857	0.02913332	0.10336434	-0.0375903
LACMHC 54899_13	-0.0073622	-0.0071666	0.02172509	-0.0029716	0.06742704	0.01722332	0.12580234	-0.0260493
LACMHC 54901_13	-0.0233462	-0.0018299	0.01403129	0.0012953	0.07003153	0.02621873	0.09939982	-0.0278276
LACMHC 54903_13	-0.0240021	-0.0044574	0.01581375	0.0026527 5	0.06460839	0.02740915	0.09977927	-0.0402641
LACMHC 54909_13	-0.0168935	-0.0053827	0.02185669	0.0012722 4	0.0711723	0.02432899	0.09813248	-0.0454995
LACMHC 54912_13	-0.0173324	0.0036320 4	0.02200717	0.0101343 5	0.06553773	0.03030506	0.10413337	-0.0336681
LACMHC 54913_13	-0.0062126	0.0007093 9	0.02812981	0.0074159 9	0.06688901	0.02481292	0.10387367	-0.0373616

LACMHC 54917_13	-0.0161062	0.00400489	0.01994842	0.00391741	0.06406955	0.02152613	0.10146669	-0.0273688
LACMHC 54921_13	-0.0124503	0.00167023	0.0198075	0.01074381	0.06601336	0.03102117	0.098579	-0.0432681
LACMHC 54922_13	-0.0207256	0.00790505	0.00885355	0.0157808	0.05427587	0.0359008	0.11266366	-0.0315273
LACMHC 54924_13	-0.0148811	-0.0003206	0.01592225	0.00624419	0.06305618	0.02730096	0.09648146	-0.0318729
LACMHC 54940_13	-0.0208526	-0.0058206	0.0169149	0.00123233	0.07087247	0.02631026	0.0981049	-0.0343875
LACMHC 54943_13	-0.01509	-0.0048068	0.0189717	0.00345184	0.06561935	0.0232068	0.12627174	-0.0229741
LACMHC 54958_13	-0.019818	0.00128513	0.01651661	0.00355995	0.06672725	0.02799386	0.1134729	-0.0190195
LACMHC 54959_13	-0.0149166	-0.003713	0.01676199	0.00862858	0.06687027	0.03435214	0.10501143	-0.0362126

LACMHC 54962_13	-0.0232731	-0.005836	0.01171689	0.0000173 4	0.06112182	0.02155464	0.10310725	-0.0455598
LACMHC 54975_13	-0.0206288	-0.0057274	0.02160799	0.0037501	0.07519977	0.02628877	0.10665133	-0.0258075
LACMHC 54976_13	-0.0148433	-0.0113646	0.02464825	0.0042925 8	0.07496578	0.02538495	0.12952964	-0.0275177
LACMHC 54977_13	-0.0120624	-0.0105742	0.02765724	0.0085970 8	0.07509055	0.03053456	0.09574395	-0.0372892
LACMHC 54983_13	-0.0221799	-0.0045656	0.01405196	0.0031848 4	0.06415562	0.02115938	0.09233649	-0.0564017
LACMHC 55509_61-67	-0.0139468	0.0006038 6	0.01850085	0.0051936 3	0.0688583	0.02823205	0.11117471	-0.0164437
LACMHC 55513_61-67	-0.0110142	-0.0012152	0.0246259	0.0094172 6	0.0696372	0.03367912	0.0993926	-0.0398796
LACMHC 55516_61-67	-0.0248223	0.0002233	0.01346138	0.0099470 3	0.05812522	0.03592495	0.11176971	-0.0285832

LACMHC 55518_61-67	-0.0167923	-0.0065725	0.01666821	0.00390848	0.06113684	0.0284511	0.11733592	-0.0038238
LACMHC 55520_61-67	-0.0142971	-0.0021553	0.01935336	0.00676347	0.06417695	0.03430179	0.11000868	-0.0360331
LACMHC 55521_61-67	-0.0110888	-0.0082412	0.02103267	0.00135382	0.0648901	0.02510315	0.11333853	-0.0361878
LACMHC 55660_61-67	-0.0201938	0.0001124	0.00625751	0.00558026	0.05568495	0.02329103	0.10228007	-0.0330289
LACMHC 55665_61-67	-0.0153858	0.00050349	0.01630838	0.00559222	0.06224208	0.02858088	0.10161011	-0.0367683
LACMHC 55666_61-67	-0.0154447	0.00413354	0.01567391	0.01030992	0.05709919	0.0290834	0.1050087	-0.0188679
LACMHC 55667_61-67	-0.0110102	-8.156E-05	0.02533334	0.00724389	0.06967019	0.03566749	0.1035413	-0.0285559
LACMHC 55675_61-67	-0.0081406	-0.0018828	0.02279451	0.01214556	0.06796832	0.03182605	0.1065769	-0.0398698

LACMHC 55681_61-67	-0.0131348	0.00080472	0.02318434	0.0089034	0.06540003	0.03001841	0.10427116	-0.0291688
LACMHC 55683_61-67	-0.0160214	0.00423019	0.01445087	0.01101117	0.05865049	0.03435009	0.09686006	-0.0431411
LACMHC 55685_61-67	-0.0166928	-0.0023598	0.01559894	0.00573274	0.06610857	0.0326807	0.11642248	-0.0318994
LACMHC 55691_61-67	-0.0207557	0.00063048	0.01948566	0.00931741	0.06689915	0.02867787	0.08530995	-0.0403499
LACMHC 55692_61-67	-0.0143856	0.00003449	0.02044383	0.00895696	0.06683735	0.03114998	0.09915123	-0.0313629
LACMHC 55693_61-67	-0.0199473	-0.0016786	0.0093619	0.00479276	0.05928113	0.02554321	0.10295419	-0.0300725
LACMHC 55694_61-67	-0.0048816	-0.0095363	0.03415698	0.00071058	0.08291863	0.02037637	0.10828844	-0.0398605
LACMHC 55695_61-67	-0.0108035	0.00066106	0.02685279	0.00918225	0.06975993	0.02541439	0.11181647	-0.0311674

LACMHC675_61-67	-0.0166998	-0.0030563	0.01402717	0.0077516	0.06134154	0.0242775	0.09844162	-0.0334635
LACMHC676_61-67	-0.0237362	0.0037989	0.01492547	0.00660536	0.06028815	0.03169168	0.10770617	-0.028617
LACMHC680_61-67	-0.0169009	-0.0043729	0.01938334	0.00146841	0.07005738	0.02901264	0.09972525	-0.0322365
LACMHC681_61-67	-0.0170071	0.00304467	0.02087807	0.01034241	0.06449343	0.02962278	0.09152099	-0.0336949
LACMHC682_61-67	-0.0157123	-0.0007551	0.01892282	0.00776512	0.06781833	0.02778001	0.0876101	-0.032348
LACMHC683_61-67	-0.0165626	-0.0057886	0.01618362	0.0021631	0.05977033	0.02520575	0.08813682	-0.0423427
R17460_91	-0.0058297	-0.0009023	0.02328646	0.00863562	0.06526928	0.03175744	0.09405971	-0.0431825
R17488_91	-0.0120084	-0.0019295	0.01958105	0.00592696	0.06331919	0.02699562	0.09160815	-0.0452962

R17928_91	-0.0130209	-0.0054871	0.02202378	0.00402628	0.06539464	0.02629029	0.11033714	-0.0469242
R18664_91	-0.0147477	0.00315698	0.01731373	0.01165789	0.06580656	0.02860636	0.10767598	-0.033426
R27246_91	-0.0172849	-0.0070978	0.01770472	0.00406307	0.06687559	0.02873436	0.12149045	-0.0252229
R28351_91	-0.0195089	-0.0085167	0.01637402	0.00271403	0.06446807	0.02854436	0.10092312	-0.0445311
R28379_91	-0.0162328	-0.0027153	0.01399692	0.00523152	0.06398124	0.02835025	0.10333459	-0.0419424
R28913_91	-0.0148197	-0.0045389	0.01832565	0.0060386	0.06475889	0.0304131	0.10280376	-0.0325288
R30721_91	-0.0171303	-0.0012427	0.01831109	0.00843713	0.06484269	0.03180731	0.11258079	-0.0191003
R30746_91	-0.0127129	-0.0053491	0.02205403	0.00632103	0.06962951	0.03316118	0.10333916	-0.0437628
R31305_91	-0.0090641	-0.0098672	0.02042497	-0.0010205	0.07062613	0.01749808	0.1066413	-0.0370014

R34526_91	-0.0186403	-0.0020972	0.01654659	0.00138802	0.06374417	0.02178714	0.11512853	-0.0389323
R34706_91	-0.0109773	-0.0046879	0.01757953	0.00526857	0.06187699	0.02809294	0.10540038	-0.034401
R38491_91	-0.0151501	-0.0059926	0.0193229	-9.836E-05	0.06419023	0.02335909	0.0944208	-0.0352386
R39009_91	-0.0107123	-0.0142027	0.03094312	-0.0010232	0.08900597	0.02142208	0.12278014	-0.0332773
R39376_91	-0.0170128	0.00238792	0.01033304	0.01206616	0.05676763	0.02916898	0.09059093	-0.0432817
R39566_91	-0.0124964	0.00110413	0.01473641	0.00555344	0.06361215	0.02092475	0.10613314	-0.0401704
R39965_91	-0.0136123	-0.0113933	0.02226089	-0.0019002	0.07101548	0.02354355	0.12325407	-0.023061
R40942_91	-0.0175937	-0.0029919	0.01086376	0.00130716	0.05719147	0.01959553	0.10539334	-0.0333979
R52965_91	-0.0058932	-0.0096582	0.027678	0.00049283	0.07792343	0.02609628	0.1258892	-0.0278255
R53460_91	-0.0130691	0.0015882	0.02066333	0.0086173	0.06821112	0.02907084	0.10199129	-0.0363441

		7		6				
R53878_91	-0.0098062	-0.0007908	0.0218242	0.0095686 1	0.06560546	0.03472352	0.12005647	-0.0357889

Specimen #_Pit #	**LM9 X**	**LM9 Y**	**LM10 X**	**LM10 Y**	**LM11 X**	**LM11 Y**	**LM12 X**	**LM12 Y**
2301-L-101_13	0.20744001	0.23490416	0.27881306	0.10141725	0.3281955	0.10874746	0.33282511	-0.00815
2301-L-106_61-67	0.20036773	0.23476832	0.26886364	0.09691981	0.32852985	0.10035143	0.32943651	-0.0154068
2301-L-109_61-67	0.20245955	0.23765871	0.27413757	0.09706516	0.32970882	0.10382759	0.32303144	-0.0193695
2301-L-10_61-67	0.22082578	0.24351811	0.26809421	0.09605019	0.33418796	0.1016792	0.31720177	-0.0262131
2301-L-	0.18534673	0.2441078	0.26582001	0.0995078	0.32614072	0.10571273	0.34427925	-0.0181977

120_61-67								
2301-L-123_61-67	0.20911029	0.2429454	0.27263263	0.0963187	0.32977362	0.10705075	0.3285738	-0.0223715
2301-L-12_61-67	0.19861622	0.24568536	0.27072155	0.09262992	0.32371615	0.09503123	0.33641436	-0.0253699
2301-L-140_61-67	0.20553133	0.24688529	0.27335275	0.09953107	0.33061292	0.10480931	0.33647756	-0.0311664
2301-L-143_13	0.21154038	0.2459237	0.27450551	0.10123842	0.31842747	0.08553547	0.33409079	-0.0292124
2301-L-148_61-67	0.21693048	0.241901	0.2773721	0.09895179	0.32977501	0.10360891	0.33425887	-0.026772
2301-L-154_61-67	0.2163636	0.23035102	0.27800641	0.09595798	0.32823608	0.10401123	0.32696601	-0.0205569
2301-L-155_61-67	0.2017478	0.24319111	0.27520298	0.09292877	0.33518476	0.10286491	0.33753611	-0.0207352
2301-L-	0.21926057	0.24785635	0.27573367	0.09678296	0.32963473	0.09927589	0.32569778	-0.0190452

156_61-67								
2301-L-164_61-67	0.20248756	0.24322433	0.27824487	0.09575297	0.32972989	0.10379832	0.33493486	-0.0264676
2301-L-167_61-67	0.20626562	0.24613144	0.27051815	0.09423367	0.32729594	0.10606162	0.33101078	-0.0233077
2301-L-173_13	0.21514182	0.24437934	0.27937785	0.10876009	0.33105512	0.09758817	0.33179885	-0.0267482
2301-L-185_61-67	0.20251908	0.23953956	0.27667284	0.09884204	0.32447911	0.09601244	0.33676009	-0.0332248
2301-L-186_61-67	0.20101847	0.24108063	0.28105072	0.09346486	0.32979617	0.10553868	0.33525143	-0.0231108
2301-L-193_61-67	0.21620451	0.24219662	0.26657822	0.09351298	0.32565522	0.10200029	0.3331554	-0.0295032
2301-L-203_61-67	0.22578491	0.22851552	0.27995484	0.0893453	0.32656714	0.09201641	0.32904354	-0.017359
2301-L-	0.210845	0.24855656	0.27656453	0.09763005	0.32699282	0.10413197	0.34245831	-0.0227922

210_61-67								
2301-L-211_61-67	0.20652504	0.24228074	0.27277985	0.09451516	0.33496155	0.10334462	0.33213673	-0.0392741
2301-L-218_61-67	0.22512556	0.25259864	0.27200723	0.10069525	0.32475731	0.10601932	0.32984381	-0.0413393
2301-L-242_61-67	0.20561575	0.2377019	0.27784623	0.09473868	0.33344695	0.10159352	0.32514719	-0.0267391
2301-L-244_61-67	0.20479425	0.23898226	0.27373065	0.09339737	0.33133942	0.09787007	0.32529684	-0.0403466
2301-L-245_61-67	0.22328116	0.23378991	0.27845055	0.09688733	0.32990349	0.1045298	0.33321533	-0.0276001
2301-L-246_61-67	0.21521755	0.24041443	0.27347072	0.09435085	0.32428356	0.09971626	0.33261409	-0.0266993
2301-L-28_61-67	0.20057647	0.24181952	0.277989	0.09034486	0.32706017	0.09972344	0.35073339	-0.0232959
2301-L-	0.23136025	0.23764157	0.28134227	0.09764381	0.3261507	0.09983268	0.32643769	-0.0230326

419_13								
2301-L- 425_61-67	0.2169373	0.24747266	0.27745441	0.09645676	0.32511354	0.10411141	0.33658171	-0.0226248
2301-L- 428_61-67	0.21051644	0.24753785	0.2761409	0.09558248	0.32939281	0.10414883	0.33413747	-0.0253775
2301-L- 42_61-67	0.22380484	0.24085803	0.27049549	0.10069155	0.32399673	0.10447939	0.33617491	-0.0214397
2301-L- 430_61-67	0.2228542	0.23969327	0.27179516	0.09272492	0.33236794	0.09918215	0.32914654	-0.0241594
2301-L- 433_61-67	0.21166729	0.23950167	0.2735437	0.09607027	0.3270196	0.10705005	0.33012388	-0.0251383
2301-L- 447_13	0.20674233	0.24245675	0.26642483	0.0996039	0.32216205	0.08373088	0.32454506	-0.0093492
2301-L- 44_61-67	0.22263991	0.23846928	0.27191257	0.09816186	0.32776268	0.10666367	0.3305264	-0.0196908
2301-L-	0.22454266	0.26252316	0.28618869	0.10584629	0.3253765	0.0973449	0.29893325	-0.0319009

451_13								
2301-L-455_61-67	0.21583267	0.24242672	0.26780721	0.09258732	0.32231027	0.09843021	0.33867898	-0.0301814
2301-L-466_13	0.20612958	0.25120728	0.29034009	0.10866532	0.33640397	0.10398325	0.31937209	-0.0337653
2301-L-468_13	0.20356299	0.24554495	0.2743599	0.09883581	0.32015541	0.10778112	0.33624822	-0.0197005
2301-L-469_61-67	0.21100666	0.24141902	0.27738277	0.10079158	0.3289642	0.10417134	0.33436351	-0.0273043
2301-L-474_13	0.21632447	0.24325415	0.28006839	0.10490828	0.32156605	0.09916774	0.33509814	-0.0273273
2301-L-475_13	0.20414311	0.23511512	0.27503726	0.09426866	0.32357993	0.10184216	0.33065768	-0.0226374
2301-L-482_61-67	0.20937274	0.23589565	0.26947062	0.09585906	0.31645305	0.10026991	0.33133833	-0.0219304
2301-L-	0.1953787	0.24799614	0.27062357	0.10568299	0.32106705	0.10185681	0.34039824	-0.0219451

48_61-67								
2301-L-490_13	0.19928621	0.23874403	0.2714646	0.09917091	0.31948169	0.10826637	0.33291645	-0.0307426
2301-L-493_61-67	0.19808313	0.24170871	0.26351862	0.09512947	0.31864339	0.09088964	0.31722389	-0.0189112
2301-L-4_61-67	0.21031801	0.23408292	0.26862405	0.09065242	0.32746688	0.10583224	0.33333109	-0.0197697
2301-L-500_13	0.19100819	0.22933763	0.27193304	0.10274357	0.32290721	0.109229	0.33346249	-0.0148549
2301-L-509_61-67	0.21142163	0.24593197	0.27408299	0.10288576	0.32409621	0.10623272	0.33489753	-0.0169111
2301-L-50_61-67	0.1947163	0.24153024	0.28435392	0.09802786	0.332279	0.10127747	0.34041839	-0.0329366
2301-L-511_61-67	0.20049039	0.24614545	0.27167127	0.09965681	0.32793451	0.10581979	0.33439098	-0.0245599
2301-L-	0.20826322	0.2435546	0.27591934	0.09955338	0.32526156	0.10024409	0.33336942	-0.0263897

514_61-67								
2301-L-516_61-67	0.21657656	0.24255758	0.27432958	0.09331135	0.33243491	0.09347823	0.32595746	-0.0231527
2301-L-517_61-67	0.21849487	0.23990908	0.27780716	0.09412862	0.33032389	0.09706217	0.32664557	-0.0205423
2301-L-518_61-67	0.21721287	0.24035691	0.27148253	0.08791668	0.31776368	0.09667986	0.3324668	-0.0130789
2301-L-537_61-67	0.21696355	0.23285455	0.26662595	0.10041984	0.31563977	0.09613532	0.31860558	-0.0328737
2301-L-63_13	0.21322738	0.24515501	0.27959374	0.10145872	0.32721225	0.10805137	0.33191176	-0.0239797
2301-L-64_61-67	0.21823782	0.2444422	0.28361637	0.0975448	0.33217524	0.10039304	0.33172026	-0.0240053
2301-L-65_61-67	0.20056541	0.23404379	0.27644365	0.09385881	0.32970566	0.10118099	0.33181674	-0.0258615
2301-L-	0.21180972	0.23070904	0.27805373	0.09297569	0.32501548	0.10058167	0.33377815	-0.0172653

66_61-67								
2301-L-68_61-67	0.21924193	0.24297909	0.27599151	0.09751908	0.32730613	0.09891809	0.31876621	-0.0303861
2301-L-70_13	0.22378858	0.24442887	0.28142501	0.09864443	0.32353752	0.0930255	0.32421276	-0.0345145
2301-L-72_13	0.20033534	0.24771451	0.27793388	0.10375524	0.3248303	0.10400383	0.32980496	-0.0222217
2301-L-74_61-67	0.22322679	0.23879177	0.27903671	0.09299913	0.33150572	0.10214116	0.33356658	-0.0200556
2301-L-79_61-67	0.21221208	0.23597159	0.27817158	0.09637786	0.33334583	0.09900913	0.33008005	-0.0317501
2301-L-81_61-67	0.20454352	0.23683307	0.28098505	0.10044132	0.33232248	0.10184341	0.33982972	-0.0266029
2301-L-84_61-67	0.19887585	0.23650193	0.27268916	0.09682748	0.32743021	0.10099614	0.32835387	-0.0257986
2301-L-	0.20113727	0.23508632	0.28000639	0.09742642	0.3309439	0.10022234	0.32993258	-0.022486

85_61-67								
2301-L-92_13	0.19778215	0.23094879	0.28393181	0.10201495	0.32256755	0.10231242	0.33379536	-0.0142256
2301-L-93_13	0.21780574	0.24359833	0.27701812	0.09781407	0.32512418	0.10190332	0.33114602	-0.0218862
2301-L-95_61-67	0.19700414	0.24147493	0.27656136	0.09285404	0.32964416	0.09572944	0.32712887	-0.0258088
2301-L-97_61-67	0.19506386	0.20714115	0.27781414	0.09800876	0.33412929	0.10109281	0.33215315	-0.0288139
2301-L-99_61-67	0.20822689	0.24153828	0.27431933	0.0951981	0.31772921	0.09463798	0.33778139	-0.024938
28662_2051	0.21061009	0.24005108	0.27749764	0.09581108	0.33365669	0.09685992	0.32447648	-0.0278654
28663_2051	0.19574985	0.25264106	0.27004276	0.10906668	0.3125331	0.10374097	0.34575239	-0.0272795
28720_2051	0.22478225	0.25989998	0.28047091	0.10070251	0.32371309	0.0981415	0.33458115	-0.0200852
28736_2051	0.21562999	0.25285533	0.28030943	0.1002838	0.32558394	0.09391591	0.3391319	-0.0207333
28738b_2051	0.20889898	0.25732938	0.27090737	0.10243331	0.3162715	0.0967812	0.33625169	-0.0207726

28739_2051	0.19204277	0.25223272	0.28151492	0.09803288	0.33090913	0.10359047	0.34020551	-0.0202798
28756_2051	0.20001856	0.26533222	0.27479442	0.10692946	0.32570507	0.10039681	0.34595832	-0.0295764
28758_2051	0.21182691	0.25676363	0.27285117	0.10386582	0.32335199	0.09736865	0.33489502	-0.0357626
29041_2051	0.20121365	0.24230837	0.28787485	0.09428871	0.33041355	0.09196287	0.33943157	-0.0263057
29049_2051	0.20558611	0.24649345	0.28072608	0.10190473	0.31830317	0.10241244	0.3439161	-0.0133392
29056_2051	0.20685514	0.24422745	0.27805913	0.10435968	0.3245606	0.08888336	0.32842192	-0.0386739
29068_2051	0.20666636	0.23011089	0.27927191	0.09898684	0.32573245	0.09664228	0.34393419	-0.0110052
29075_2051	0.2040634	0.24350445	0.28185301	0.10118073	0.33119435	0.09676586	0.34208543	-0.0249316
29082_2051	0.20834654	0.25036542	0.27714226	0.09724465	0.32179207	0.09513161	0.33114974	-0.0164528
76919_2051	0.19833552	0.25002643	0.27811054	0.10440287	0.32745402	0.09210477	0.3453907	-0.027722
associated with 2301-R-214_61-67	0.22809708	0.23659242	0.27982069	0.0908818	0.33989078	0.10054453	0.34116277	-0.0225015
JR3_2051	0.20175964	0.24877612	0.28289486	0.10806837	0.32870608	0.10036865	0.33553601	-0.041542
LACMHC 54899_13	0.19523631	0.23451975	0.27106766	0.09661315	0.3047734	0.09104186	0.33381982	-0.0161108

LACMHC 54901_13	0.21561203	0.25472239	0.28085924	0.09945848	0.32340513	0.09326703	0.33577912	-0.021502
LACMHC 54903_13	0.21960502	0.25503709	0.27725723	0.10529451	0.32154218	0.10928978	0.33198415	-0.0324492
LACMHC 54909_13	0.20736526	0.24096879	0.27460069	0.0998565	0.31945683	0.10197886	0.32994627	-0.020402
LACMHC 54912_13	0.21578396	0.23068575	0.275392	0.09551567	0.32381714	0.10056159	0.32904102	-0.0210825
LACMHC 54913_13	0.19521355	0.23830555	0.27385148	0.09503181	0.3250553	0.09836745	0.33440585	-0.0267756
LACMHC 54917_13	0.21181216	0.22722082	0.27290439	0.09422728	0.32485228	0.09732978	0.32658146	-0.0245216
LACMHC 54921_13	0.2088758	0.24718812	0.27516345	0.09838417	0.31607709	0.1044494	0.33137483	-0.0306899
LACMHC 54922_13	0.21398875	0.24040764	0.27850567	0.09093524	0.32392632	0.09662048	0.32897683	-0.0296243

LACMHC 54924_13	0.21073411	0.23806602	0.28055927	0.10102606	0.32974018	0.09905897	0.3146993	-0.032175
LACMHC 54940_13	0.22294232	0.23647953	0.27613365	0.09687463	0.3251904	0.10713461	0.32981177	-0.0164065
LACMHC 54943_13	0.19424301	0.2347818	0.29259484	0.09872237	0.33224847	0.1057935	0.32607329	-0.0268679
LACMHC 54958_13	0.2138796	0.25008035	0.28527842	0.09734583	0.33135261	0.09477801	0.32331705	-0.0228432
LACMHC 54959_13	0.22075204	0.24683038	0.26954632	0.09801801	0.31976171	0.09861537	0.33091413	-0.0248298
LACMHC 54962_13	0.20561406	0.25234243	0.27604554	0.10176028	0.32107683	0.10895493	0.3436632	-0.0189293
LACMHC 54975_13	0.21580018	0.23076602	0.28700255	0.09848237	0.32316649	0.10853457	0.33138031	-0.0187792
LACMHC 54976_13	0.20633765	0.24009882	0.26932456	0.09841317	0.31872858	0.08963927	0.31502864	-0.018606

LACMHC 54977_13	0.20157945	0.25586583	0.27440014	0.10425253	0.3177275	0.10298081	0.33529909	-0.0319798
LACMHC 54983_13	0.20819597	0.24629089	0.27650813	0.10743565	0.32786335	0.11697432	0.33996401	-0.0297163
LACMHC 55509_61-67	0.20890682	0.23302971	0.27517182	0.08834707	0.32443108	0.09604968	0.325671	-0.021748
LACMHC 55513_61-67	0.20537534	0.24599311	0.27500296	0.09523061	0.32466214	0.09200247	0.32999709	-0.0172236
LACMHC 55516_61-67	0.19528407	0.23601306	0.28009552	0.10086778	0.3259831	0.10955164	0.34191697	-0.0371385
LACMHC 55518_61-67	0.22058302	0.24643822	0.2708046	0.09216882	0.32122328	0.09909837	0.32557904	-0.0324561
LACMHC 55520_61-67	0.19895361	0.249977	0.26987287	0.0956619	0.32908813	0.09846263	0.33139488	-0.0284736
LACMHC 55521_61-67	0.21153006	0.24067436	0.26410667	0.09460672	0.31879913	0.09594681	0.33015957	-0.0094943

LACMHC 55660_61-67	0.20205617	0.23468358	0.27798182	0.09208931	0.33232007	0.10576265	0.34204402	-0.0223979
LACMHC 55665_61-67	0.2161428	0.23513726	0.27204576	0.09695054	0.32306566	0.10096661	0.33434266	-0.025967
LACMHC 55666_61-67	0.21777782	0.23917545	0.27273925	0.09156323	0.33511294	0.09892703	0.32657692	-0.0271221
LACMHC 55667_61-67	0.21738309	0.23736852	0.27237395	0.09345103	0.32646821	0.09520724	0.32088479	-0.0227236
LACMHC 55675_61-67	0.21343491	0.24570789	0.26808351	0.09368391	0.32891768	0.09897373	0.32244534	-0.0317559
LACMHC 55681_61-67	0.22019529	0.23602037	0.27486562	0.09219503	0.32438474	0.09367632	0.32416424	-0.0199901
LACMHC 55683_61-67	0.21724252	0.24624898	0.28158344	0.09604114	0.33173525	0.09263219	0.32849762	-0.0285509
LACMHC 55685_61-67	0.20415813	0.23685307	0.27220849	0.09432446	0.31842208	0.09764158	0.32997506	-0.0251064

LACMHC 55691_61-67	0.21966655	0.23959857	0.27279014	0.09593689	0.32920042	0.10776326	0.32907345	-0.0298451
LACMHC 55692_61-67	0.20567958	0.23470822	0.28292671	0.09287721	0.32690134	0.09275769	0.32874044	-0.0227224
LACMHC 55693_61-67	0.20294997	0.23871119	0.28117641	0.09159671	0.33176946	0.09437591	0.33890723	-0.0192818
LACMHC 55694_61-67	0.19537685	0.23023952	0.2543478	0.102649	0.31967156	0.10212861	0.31734073	-0.0120037
LACMHC 55695_61-67	0.22070646	0.23157788	0.2647528	0.0896301	0.32596447	0.09230333	0.31553815	-0.020818
LACMHC 675_61-67	0.19604415	0.2480581	0.27675259	0.09542325	0.32615349	0.09385576	0.3412982	-0.0229017
LACMHC 676_61-67	0.21476852	0.23294947	0.26946919	0.09202992	0.32291495	0.10136227	0.33790068	-0.0254553
LACMHC 680_61-67	0.20360188	0.23646364	0.27182478	0.0945413	0.32784997	0.10107898	0.33404146	-0.0242146

LACMHC 681_61-67	0.21011096	0.23987057	0.27390626	0.09088011	0.32420223	0.09629689	0.32759647	-0.035822
LACMHC 682_61-67	0.2153089	0.24178941	0.27260944	0.09426701	0.32157897	0.11176705	0.3274301	-0.0305745
LACMHC 683_61-67	0.21593081	0.24579917	0.27296789	0.09296539	0.32712963	0.09653733	0.32907678	-0.0105743
R17460_91	0.20968016	0.2436378	0.2646371	0.09231287	0.31002943	0.09713555	0.33144874	-0.0199949
R17488_91	0.21238653	0.23368761	0.27034115	0.09267732	0.32292486	0.10048894	0.32590134	-0.0234442
R17928_91	0.21613265	0.23620294	0.28062845	0.10722914	0.32923019	0.10715806	0.31530684	-0.0172567
R18664_91	0.20815055	0.24807747	0.27589265	0.0895392	0.322917	0.09769928	0.33524368	-0.0285919
R27246_91	0.20413457	0.23046384	0.26786546	0.0903641	0.31189033	0.09518752	0.32780583	-0.009138
R28351_91	0.20728965	0.24540497	0.26913688	0.10045954	0.32740377	0.10638073	0.33831336	-0.0160791
R28379_91	0.20215154	0.23148413	0.27262475	0.09903468	0.33238705	0.10281873	0.3288635	-0.0192417
R28913_91	0.21279895	0.23584239	0.27504267	0.09897654	0.31944786	0.11178656	0.33236654	-0.0389548
R30721_91	0.22192677	0.23966786	0.26931815	0.09244092	0.3139646	0.09302201	0.32653313	-0.0294361
R30746_91	0.20014976	0.24031893	0.27367864	0.10047859	0.32783096	0.1020189	0.32762302	-0.0217851

R31305_91	0.19722231	0.22483044	0.27039693	0.10012461	0.32059415	0.10619297	0.32568264	-0.0139168
R34526_91	0.20072213	0.23558598	0.27268719	0.10361175	0.32159524	0.10765178	0.32261449	-0.0320983
R34706_91	0.21069926	0.23418137	0.27304619	0.0970156	0.32517876	0.1019171	0.32259461	-0.0250603
R38491_91	0.21951196	0.2258073	0.27349905	0.09563174	0.32536037	0.10252448	0.33115338	-0.0221387
R39009_91	0.1826688	0.22335301	0.2584863	0.10065921	0.31700247	0.09432012	0.31888937	-0.0146171
R39376_91	0.213811	0.24219576	0.27401669	0.09623672	0.32734351	0.10074891	0.3319921	-0.0268743
R39566_91	0.21263354	0.23436979	0.27583941	0.0986187	0.32957865	0.10794944	0.32312147	-0.0268715
R39965_91	0.21130267	0.23017161	0.2693642	0.09693565	0.32190917	0.09943907	0.31492303	-0.0149055
R40942_91	0.20865175	0.23640504	0.2705931	0.09701171	0.31999248	0.1067171	0.33563127	-0.0250413
R52965_91	0.20187045	0.22715728	0.27443722	0.10692256	0.32157859	0.09332978	0.30470449	-0.0129828
R53460_91	0.20419329	0.24003018	0.2737305	0.09609305	0.32171737	0.09892368	0.34153495	-0.0328817
R53878_91	0.215706	0.23867027	0.26894136	0.09439571	0.32034636	0.10274835	0.31827181	-0.0288441

Specimen #_Pit #	LM13 X	LM13 Y	LM14 X	LM14 Y	LM15 X	LM15 Y	LM16 X	LM16 Y
2301-L-101_13	0.2008814	-0.0644769	0.02572806	-0.1242759	-0.0973422	-0.1208037	-0.30876	-0.0965
2301-L-106_61-67	0.20123769	-0.0651084	0.03227706	-0.1248704	-0.0955045	-0.1216496	-0.315	-0.10048
2301-L-109_61-67	0.21042515	-0.0605176	0.03489205	-0.1276118	-0.0932031	-0.124679	-0.30263	-0.09976
2301-L-10_61-67	0.20202395	-0.0537272	0.03343356	-0.1147012	-0.0864312	-0.1177037	-0.30002	-0.09836
2301-L-120_61-67	0.20013117	-0.0714936	0.04025681	-0.1401561	-0.0928168	-0.1250818	-0.30122	-0.09117
2301-L-123_61-67	0.21611688	-0.0543764	0.02417134	-0.1305585	-0.109514	-0.1221584	-0.30525	-0.09864
2301-L-12_61-67	0.2058877	-0.0648639	0.03720706	-0.1233965	-0.0904418	-0.1242194	-0.30172	-0.09911

2301-L-140_61-67	0.20577689	-0.0688831	0.0258391	-0.1376867	-0.0985569	-0.1262234	-0.29407	-0.10235
2301-L-143_13	0.20326698	-0.0640346	0.03358726	-0.1193808	-0.1029447	-0.1195509	-0.30233	-0.10585
2301-L-148_61-67	0.20268174	-0.0580308	0.0229832	-0.1171796	-0.1007202	-0.1144872	-0.30237	-0.09489
2301-L-154_61-67	0.19701225	-0.0617194	0.0356781	-0.1174034	-0.0923433	-0.1150274	-0.313	-0.10198
2301-L-155_61-67	0.20220725	-0.063487	0.02478813	-0.1320729	-0.1062453	-0.123867	-0.30454	-0.10085
2301-L-156_61-67	0.20320804	-0.0606051	0.02506459	-0.1270425	-0.1020306	-0.1217689	-0.30649	-0.10892
2301-L-164_61-67	0.20380151	-0.0641576	0.02278188	-0.1251553	-0.109219	-0.1140363	-0.30519	-0.10897
2301-L-167_61-67	0.21270875	-0.0611568	0.02571658	-0.1263312	-0.1037805	-0.1234599	-0.31208	-0.09862

2301-L-173_13	0.20800732	-0.0619896	0.02132421	-0.1237477	-0.1202612	-0.1201591	-0.3075	-0.10285
2301-L-185_61-67	0.20535203	-0.06716	0.02937265	-0.1240369	-0.101553	-0.1153984	-0.30424	-0.1002
2301-L-186_61-67	0.19993648	-0.0676554	0.02233934	-0.132312	-0.10256	-0.1206263	-0.30682	-0.09192
2301-L-193_61-67	0.22006922	-0.0547557	0.0228236	-0.1186735	-0.1116506	-0.1088842	-0.32075	-0.08601
2301-L-203_61-67	0.20277768	-0.0543123	0.0256557	-0.1183304	-0.1107988	-0.1185565	-0.31863	-0.10249
2301-L-210_61-67	0.19664987	-0.0664422	0.02844952	-0.1296254	-0.1070742	-0.122152	-0.30055	-0.09808
2301-L-211_61-67	0.19794349	-0.0607846	0.03299434	-0.1237164	-0.096357	-0.1218307	-0.29872	-0.10396
2301-L-218_61-67	0.19067742	-0.0687138	0.02745907	-0.1251465	-0.0962979	-0.1212785	-0.29631	-0.10582

2301-L-242_61-67	0.20854487	-0.0594939	0.03348955	-0.1257222	-0.091207	-0.1224842	-0.30119	-0.09865
2301-L-244_61-67	0.20631567	-0.0554018	0.03851216	-0.1273882	-0.0894804	-0.1242802	-0.29453	-0.10174
2301-L-245_61-67	0.19346855	-0.056514	0.03057441	-0.1180487	-0.1009854	-0.1205465	-0.30402	-0.10211
2301-L-246_61-67	0.2076342	-0.0572105	0.03054023	-0.1214893	-0.0956262	-0.113426	-0.2989	-0.10438
2301-L-28_61-67	0.20572867	-0.0633468	0.02391298	-0.1223434	-0.1073815	-0.1178609	-0.3077	-0.08976
2301-L-419_13	0.19292293	-0.0614045	0.02476628	-0.115817	-0.0982764	-0.1209152	-0.30642	-0.10666
2301-L-425_61-67	0.20482575	-0.0640741	0.02244074	-0.1304208	-0.104474	-0.1206909	-0.30574	-0.09522
2301-L-428_61-67	0.2066369	-0.0553311	0.02313825	-0.1245251	-0.0980786	-0.1219496	-0.30668	-0.09191

2301-L-42_61-67	0.20258086	-0.0621786	0.01551274	-0.1297481	-0.1104987	-0.1216503	-0.30653	-0.09285
2301-L-430_61-67	0.19720153	-0.0574793	0.03001249	-0.120605	-0.0894394	-0.1197124	-0.30882	-0.10384
2301-L-433_61-67	0.20243169	-0.0620321	0.03311764	-0.1270632	-0.0962573	-0.1219221	-0.30456	-0.09777
2301-L-447_13	0.21832826	-0.0568381	0.03388142	-0.1219126	-0.1184675	-0.1191188	-0.30549	-0.10354
2301-L-44_61-67	0.19842695	-0.0606799	0.02824482	-0.1270746	-0.1025926	-0.1204853	-0.3085	-0.09662
2301-L-451_13	0.19607814	-0.0690817	0.04065485	-0.1348231	-0.0924609	-0.1312076	-0.3065	-0.09546
2301-L-455_61-67	0.20720294	-0.0578769	0.02843051	-0.1207835	-0.0891626	-0.1194516	-0.30674	-0.10299
2301-L-466_13	0.18996219	-0.0718197	0.033937	-0.123515	-0.0973197	-0.1201907	-0.30181	-0.09388

2301-L-468_13	0.20321405	-0.0671002	0.03365315	-0.1398173	-0.0972675	-0.1305219	-0.30134	-0.10176
2301-L-469_61-67	0.20030765	-0.0620252	0.0260361	-0.1274618	-0.1011001	-0.1205728	-0.31138	-0.09555
2301-L-474_13	0.21436244	-0.0589231	0.01157528	-0.1290177	-0.1058336	-0.1202835	-0.30501	-0.09809
2301-L-475_13	0.20940356	-0.0620861	0.03705305	-0.1235638	-0.0972471	-0.1250558	-0.29635	-0.0982
2301-L-482_61-67	0.20659707	-0.0591225	0.03263072	-0.1268882	-0.0973179	-0.126857	-0.30312	-0.10399
2301-L-48_61-67	0.20891153	-0.0706844	0.03726013	-0.1317689	-0.0940287	-0.1219193	-0.29997	-0.08829
2301-L-490_13	0.19763834	-0.0678663	0.0421533	-0.1296751	-0.0989166	-0.1291167	-0.302	-0.10505
2301-L-493_61-67	0.21316337	-0.0559946	0.04863369	-0.1303575	-0.10522	-0.1276588	-0.30854	-0.09997

2301-L-4_61-67	0.21279969	-0.0570009	0.03649506	-0.123324	-0.095281	-0.1245431	-0.29728	-0.10025
2301-L-500_13	0.21302385	-0.0639808	0.02739691	-0.1327679	-0.1024031	-0.126113	-0.3009	-0.10358
2301-L-509_61-67	0.2045079	-0.0663893	0.03151313	-0.1316561	-0.1044673	-0.1262863	-0.30798	-0.09923
2301-L-50_61-67	0.20953401	-0.0646533	0.01959319	-0.1208133	-0.0975531	-0.1120689	-0.30571	-0.0977
2301-L-511_61-67	0.21015131	-0.0589244	0.02894203	-0.1271771	-0.1001519	-0.118507	-0.30038	-0.09488
2301-L-514_61-67	0.19854214	-0.0628099	0.03197505	-0.1259883	-0.0961554	-0.1259512	-0.29738	-0.1014
2301-L-516_61-67	0.19937362	-0.0603634	0.02907139	-0.125911	-0.0966916	-0.1210226	-0.2984	-0.0986
2301-L-517_61-67	0.20384117	-0.0503285	0.0359962	-0.1166407	-0.102084	-0.1143699	-0.30773	-0.10249

2301-L-518_61-67	0.2212562	-0.0487529	0.0273473	-0.1272925	-0.0975119	-0.1174415	-0.30295	-0.09904
2301-L-537_61-67	0.22147968	-0.0631172	0.0295851	-0.1248292	-0.0945703	-0.1213359	-0.29878	-0.11102
2301-L-63_13	0.20730295	-0.0568038	0.02538714	-0.1320457	-0.0935032	-0.1261769	-0.2858	-0.09819
2301-L-64_61-67	0.21659073	-0.0501957	0.0160509	-0.1298526	-0.106225	-0.1263249	-0.29022	-0.11085
2301-L-65_61-67	0.21891561	-0.0595305	0.02406847	-0.1296281	-0.0904138	-0.1277399	-0.29315	-0.1053
2301-L-66_61-67	0.23220728	-0.049179	0.02640651	-0.125087	-0.0976102	-0.1249917	-0.29871	-0.11057
2301-L-68_61-67	0.20518938	-0.0557849	0.03104109	-0.1208377	-0.0936647	-0.1188893	-0.30771	-0.09878
2301-L-70_13	0.19436591	-0.0558151	0.03490533	-0.1165903	-0.1016935	-0.115775	-0.30421	-0.1052

2301-L-72_13	0.20176757	-0.0661939	0.02389302	-0.1320374	-0.0972907	-0.1251785	-0.30135	-0.09891
2301-L-74_61-67	0.18675121	-0.0568976	0.0298504	-0.1214241	-0.0931522	-0.1204172	-0.29772	-0.10168
2301-L-79_61-67	0.20264043	-0.055591	0.0253732	-0.1235182	-0.0928152	-0.121124	-0.29914	-0.10171
2301-L-81_61-67	0.20570168	-0.0605166	0.03071066	-0.125073	-0.1108461	-0.1170516	-0.31163	-0.08937
2301-L-84_61-67	0.21249849	-0.0583079	0.03107726	-0.1335548	-0.0981542	-0.1273445	-0.30421	-0.09878
2301-L-85_61-67	0.2268058	-0.0538939	0.02411816	-0.1298338	-0.1008122	-0.125632	-0.29735	-0.11026
2301-L-92_13	0.209056	-0.0633742	0.03111166	-0.1322602	-0.0990229	-0.1279149	-0.30377	-0.10196
2301-L-93_13	0.20767546	-0.0538859	0.02484941	-0.125371	-0.1061548	-0.1266606	-0.30568	-0.10679

2301-L-95_61-67	0.21440304	-0.0648822	0.03360171	-0.1199019	-0.0920708	-0.1158049	-0.3015	-0.10125
2301-L-97_61-67	0.21048411	-0.0548618	0.03025689	-0.1222181	-0.0961918	-0.1228855	-0.30769	-0.10086
2301-L-99_61-67	0.22002768	-0.0538376	0.01958184	-0.1171181	-0.1060616	-0.1143018	-0.29979	-0.10576
28662_2051	0.19608932	-0.0580411	0.03539616	-0.1162545	-0.0909423	-0.1187926	-0.30235	-0.10532
28663_2051	0.21302131	-0.0620179	0.03110202	-0.1350649	-0.0946662	-0.1243665	-0.30563	-0.09194
28720_2051	0.20383526	-0.0621208	0.02191629	-0.1202589	-0.0971915	-0.1152269	-0.29772	-0.09878
28736_2051	0.19584332	-0.0622215	0.02098413	-0.1225606	-0.1045131	-0.1173061	-0.30483	-0.10155
28738b_2051	0.21238667	-0.0634089	0.02626337	-0.1323291	-0.1032104	-0.1238755	-0.30844	-0.09464
28739_2051	0.19736753	-0.066777	0.03257876	-0.1318494	-0.0946563	-0.1264696	-0.29779	-0.09503
28756_2051	0.21357328	-0.067154	0.01697272	-0.1328782	-0.107114	-0.1191856	-0.29983	-0.08489
28758_2051	0.19804955	-0.0651404	0.03016255	-0.1320916	-0.0871945	-0.125531	-0.29185	-0.10446
29041_2051	0.20343893	-0.0613704	0.02110559	-0.1186109	-0.0959401	-0.1214587	-0.30372	-0.10566
29049_2051	0.19548331	-0.0676331	0.03115017	-0.1207667	-0.0966304	-0.1151951	-0.30703	-0.09142

29056_2051	0.21041187	-0.0618721	0.03380501	-0.1153214	-0.096573	-0.1114104	-0.29844	-0.09605
29068_2051	0.211555	-0.0590005	0.02503975	-0.1210153	-0.1045985	-0.1138677	-0.30274	-0.0963
29075_2051	0.20848542	-0.0666236	0.01820774	-0.1242832	-0.0999433	-0.118986	-0.30067	-0.0924
29082_2051	0.20097502	-0.0637152	0.03180314	-0.1275166	-0.0987209	-0.1184893	-0.30216	-0.09939
76919_2051	0.19843517	-0.0635033	0.02387294	-0.1195787	-0.0936238	-0.1125434	-0.30125	-0.10089
associated with 2301-R-214_61-67	0.2128707	-0.0605859	-0.0056885	-0.1210134	-0.1243341	-0.1206492	-0.29603	-0.106
JR3_2051	0.20450935	-0.0529428	0.0293881	-0.1271587	-0.100411	-0.1252733	-0.29694	-0.10391
LACMHC 54899_13	0.22685441	-0.0548598	0.02533644	-0.1255975	-0.0943268	-0.120242	-0.31156	-0.09895
LACMHC 54901_13	0.20524525	-0.0606414	0.01847514	-0.1266782	-0.1025122	-0.125813	-0.30237	-0.1044
LACMHC 54903_13	0.20957086	-0.0656565	0.02270747	-0.1279811	-0.1045678	-0.1186235	-0.29555	-0.09873
LACMHC	0.23047587	-0.0505502	0.02248114	-0.1253398	-0.1091037	-0.1199052	-0.30842	-0.1034

54909_13								
LACMHC 54912_13	0.19846722	-0.0599808	0.03459299	-0.1279662	-0.0921327	-0.1279926	-0.29784	-0.10336
LACMHC 54913_13	0.20612851	-0.0614519	0.03433772	-0.1215177	-0.0967683	-0.1199966	-0.30666	-0.09364
LACMHC 54917_13	0.22038147	-0.0520841	0.03361155	-0.1223391	-0.0926923	-0.121528	-0.29299	-0.10577
LACMHC 54921_13	0.20434936	-0.0708563	0.03659748	-0.1272072	-0.0880581	-0.1219832	-0.30286	-0.09954
LACMHC 54922_13	0.21987364	-0.0597422	0.02368795	-0.1324247	-0.0999083	-0.1258756	-0.29384	-0.10742
LACMHC 54924_13	0.21942434	-0.0587624	0.03252754	-0.121747	-0.0913264	-0.1213484	-0.29263	-0.108
LACMHC 54940_13	0.20910243	-0.0594084	0.0314149	-0.125576	-0.1030638	-0.119639	-0.30759	-0.10624
LACMHC	0.17949258	-0.0527461	0.02905967	-0.1367432	-0.0956348	-0.1205718	-0.30551	-0.10754

54943_13								
LACMHC 54958_13	0.19847057	-0.0681411	0.02422887	-0.1186044	-0.1039437	-0.1266162	-0.31241	-0.0977
LACMHC 54959_13	0.20750203	-0.0603422	0.0297171	-0.1254705	-0.1001655	-0.1260301	-0.29877	-0.10771
LACMHC 54962_13	0.21279829	-0.0662858	0.02181643	-0.1315004	-0.1039627	-0.1286473	-0.29559	-0.10078
LACMHC 54975_13	0.20482351	-0.0694978	0.02962415	-0.120011	-0.1159863	-0.1141625	-0.31723	-0.09733
LACMHC 54976_13	0.21845037	-0.0527541	0.03393152	-0.1227413	-0.1009598	-0.1198275	-0.3145	-0.09983
LACMHC 54977_13	0.20856586	-0.0659287	0.03721499	-0.1302776	-0.1112361	-0.1258034	-0.30752	-0.09742
LACMHC 54983_13	0.2055719	-0.0605702	0.02769553	-0.1300029	-0.0991581	-0.1197864	-0.29829	-0.09674
LACMHC	0.21549851	-0.0585472	0.02163295	-0.1263677	-0.095443	-0.1209941	-0.3048	-0.09861

55509_61-67								
LACMHC 55513_61-67	0.20184808	-0.0607642	0.03644686	-0.1267623	-0.0951601	-0.1261243	-0.31074	-0.10036
LACMHC 55516_61-67	0.21890663	-0.066473	0.02351451	-0.1324567	-0.1068701	-0.1242553	-0.30085	-0.09961
LACMHC 55518_61-67	0.21324283	-0.0596599	0.02574826	-0.1277809	-0.1013555	-0.1217213	-0.30704	-0.09744
LACMHC 55520_61-67	0.21457838	-0.0668364	0.02304084	-0.1255505	-0.0965395	-0.1189682	-0.30552	-0.09641
LACMHC 55521_61-67	0.2167825	-0.0573961	0.03286052	-0.1285604	-0.0976716	-0.1253284	-0.30744	-0.09659
LACMHC 55660_61-67	0.2177191	-0.0598869	0.02338402	-0.1262734	-0.0960154	-0.1206396	-0.29392	-0.10082
LACMHC 55665_61-67	0.22214319	-0.0596616	0.02353792	-0.1204831	-0.0999325	-0.1097529	-0.3104	-0.09674
LACMHC	0.21339247	-0.0508533	0.01965702	-0.1353677	-0.1046837	-0.1284492	-0.30055	-0.09852

55666_61-67								
LACMHC 55667_61-67	0.2048041	-0.0557477	0.03126901	-0.1278262	-0.0975305	-0.1207772	-0.30248	-0.09681
LACMHC 55675_61-67	0.20539897	-0.0562134	0.03392291	-0.1188513	-0.0989455	-0.116834	-0.30514	-0.10197
LACMHC 55681_61-67	0.21543763	-0.0557418	0.02349046	-0.1219007	-0.1009311	-0.1171269	-0.31384	-0.09497
LACMHC 55683_61-67	0.20476503	-0.0553744	0.02107303	-0.1193489	-0.0977018	-0.1173521	-0.29217	-0.11052
LACMHC 55685_61-67	0.22643093	-0.0630976	0.02706267	-0.1245239	-0.0986359	-0.1153341	-0.30691	-0.09691
LACMHC 55691_61-67	0.22221669	-0.0518594	0.02148893	-0.1267782	-0.1026407	-0.1191789	-0.30058	-0.10295
LACMHC 55692_61-67	0.20805167	-0.056531	0.03867956	-0.1183431	-0.0949058	-0.1134057	-0.3041	-0.10309
LACMHC	0.21735781	-0.0564108	0.02179203	-0.1224168	-0.0984128	-0.1179291	-0.30034	-0.10411

55693_61-67								
LACMHC 55694_61-67	0.23203567	-0.0558633	0.03589798	-0.1299165	-0.0956476	-0.1202583	-0.31915	-0.09698
LACMHC 55695_61-67	0.21627887	-0.053387	0.03418901	-0.1135626	-0.0944828	-0.1104394	-0.32046	-0.0967
LACMHC 675_61-67	0.22219083	-0.0622356	0.02083875	-0.1271642	-0.0997287	-0.1191266	-0.30156	-0.09333
LACMHC 676_61-67	0.22399074	-0.0574709	0.01881299	-0.1260945	-0.1009053	-0.1198265	-0.29879	-0.10179
LACMHC 680_61-67	0.21395221	-0.0589153	0.03453449	-0.1207891	-0.0982915	-0.1208507	-0.2984	-0.10422
LACMHC 681_61-67	0.21918311	-0.0575118	0.04241668	-0.1158222	-0.0894073	-0.1146374	-0.30166	-0.10665
LACMHC 682_61-67	0.21537975	-0.0633219	0.03494128	-0.1328173	-0.0963827	-0.1230406	-0.2922	-0.10781
LACMHC	0.22363763	-0.0559902	0.02901215	-0.126144	-0.0949696	-0.1232598	-0.30326	-0.09443

683_61-67								
R17460_91	0.22937392	-0.0575741	0.02984277	-0.1308728	-0.0942833	-0.1281024	-0.31071	-0.10521
R17488_91	0.2335724	-0.050908	0.03129084	-0.1157896	-0.0945567	-0.1203266	-0.30784	-0.103
R17928_91	0.19073514	-0.0607616	0.0407928	-0.1277328	-0.0937851	-0.125649	-0.29881	-0.10179
R18664_91	0.20921755	-0.0645244	0.02666788	-0.12179	-0.1015748	-0.1161877	-0.30682	-0.10243
R27246_91	0.24085001	-0.0545213	0.0276723	-0.1302922	-0.1040738	-0.1334478	-0.30634	-0.09395
R28351_91	0.21552272	-0.0642668	0.0286465	-0.130945	-0.1042516	-0.1230647	-0.30047	-0.09307
R28379_91	0.22036666	-0.0577093	0.0285301	-0.1292518	-0.0954505	-0.1296129	-0.30405	-0.09867
R28913_91	0.22027489	-0.0583885	0.02769219	-0.1199766	-0.1051457	-0.1187683	-0.30103	-0.10422
R30721_91	0.22613917	-0.0600346	0.02380592	-0.1194716	-0.0990738	-0.1148493	-0.31108	-0.09893
R30746_91	0.21539559	-0.0597424	0.03176028	-0.1279582	-0.1015433	-0.1230106	-0.3083	-0.09658
R31305_91	0.23019179	-0.0541329	0.03185509	-0.1267772	-0.0904368	-0.120057	-0.32287	-0.08855
R34526_91	0.23512915	-0.059327	0.02316256	-0.1274947	-0.0984077	-0.1208271	-0.30812	-0.08943
R34706_91	0.21840288	-0.0509811	0.03177256	-0.1278179	-0.093695	-0.1270473	-0.30352	-0.10368
R38491_91	0.21964533	-0.0457986	0.02848407	-0.1130926	-0.0953923	-0.1152598	-0.30496	-0.09274
R39009_91	0.22532219	-0.0544489	0.05198065	-0.1241002	-0.0914188	-0.1225571	-0.30766	-0.0955

R39376_91	0.22859354	-0.0568167	0.02572678	-0.1246418	-0.0974995	-0.1249872	-0.29767	-0.10409
R39566_91	0.22251989	-0.0551317	0.01597488	-0.1173247	-0.1004674	-0.1186552	-0.30867	-0.10001
R39965_91	0.22328563	-0.0520773	0.0286767	-0.1252399	-0.0994882	-0.1177305	-0.3101	-0.09594
R40942_91	0.23157538	-0.0586736	0.02310049	-0.1222713	-0.0971669	-0.1230712	-0.29904	-0.10751
R52965_91	0.22290463	-0.0541984	0.04193235	-0.1235007	-0.1088528	-0.122769	-0.31544	-0.10384
R53460_91	0.21099863	-0.0607053	0.02925311	-0.1202589	-0.1023811	-0.1150579	-0.30827	-0.09936
R53878_91	0.21607024	-0.0579991	0.02737683	-0.1225555	-0.0997464	-0.1190021	-0.31264	-0.10272