California State University, Northridge

Social Complexity at Vasquez Rocks:

A Bioarchaeological Study of a Middle Period Cemetery

A thesis submitted in partial fulfillment of the requirements
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By

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Abstract

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The Tataviam have been an under-represented and under-studied group of southern California Native Americans. Due to the existence of convoluted and oftentimes contradictory historic documentation and obscurity surrounding the Tataviam, they have been marginalized as simple bands of hunter-gatherers that occupied the mountains of the upper reaches of the Santa Clara River drainages until they were driven out of their native territory by disease and missionaries and eventually integrated into the mission system. Past research, providing preliminary and contextual information, has only begun to shed light on the Tataviam. Overshadowed by their archaeologically and ethnographically visible coastal neighbors, the Tataviam have been, for the most part, pushed to the back burner of southern California archaeology. This research, following similar studies of coastal and inland prehistoric cemeteries, sheds new light on Tataviam social complexity and completes analysis on a curated collection that was excavated four decades ago. I propose that the Tataviam were more socially complex than previously thought, much more integrated into the sphere of southern California coastal groups, and should be considered complex hunter-gatherers. Through a bioarchaeological study of a

Vasquez Rocks cemetery (CA-LAN-361), I attempt to demonstrate that the causes, consequences, correlates, and conditions for the institutionalization of new labor relationships and ascribed hierarchies, two organizational features essential to complexity (Arnold 1996), were present among the Tataviam during the Middle Period.

Section1

Research Objectives

The objective of this research is to understand more fully the degree of social complexity of the Tataviam, a southern California native group, through bioarchaeological analysis and other aspects of Tataviam lifeways, through the study of human remains recovered from CA-LAN-361 (King et al. 1974). There has been so little work conducted on this group that only the most basic inferences have been made regarding the institutionalization of labor relationships and ascribed hierarchies, which are two basic requirements for a group to be considered complex hunter-gatherers (Arnold 1996). King et al. (1974) have proposed that at CA-LAN-361 "the concentration of exotic trade items within particular areas of cemeteries has been shown to correlate with the presence of stratified societies in which positions of management are ascribed". King et al.'s study (1974) of the bead assemblages recovered during his survey of Vasquez Rocks County Park, analysis of the obsidian trade networks by Terri Lee Caruso (1988), and bioarchaeological studies by Robinson (1987), Miller et al. (2003), and Sutton et al. (2010) have provided an initial framework for a more in depth, holistic study of Tataviam social complexity. A bioarchaeological analysis should confirm or refute King et al.'s statement regarding the burial assemblages at CA-LAN-361 showing evidence of a stratified society and provide further insight into the social organization of the Tataviam. The specific research question that I hope to answer through a bioarchaeological analysis is:

1. What does the presence or absence of pathologies, mainly related to access to resources (diet) and resource production, in the individuals from CA-LAN-361 say about the general health of the community, the social and gender roles of each individual in the cemetery, and the stratification of the group as a whole?

Other research objectives for this study are as follows:

1. Document and better understand the biology of the population living at Vasquez Rocks.

2. Provide data in addition to the funerary analysis that supports the hypothesis that the Tataviam are complex hunter-gatherers which includes a synthesis of recent literature pertaining to the Tataviam, chemical analysis of the remains, and GIS analysis.

There have been many other research projects in the past that have attempted to describe social complexity using bioarchaeological data. These past studies have successfully provided detailed information on the proposed degree of complexity of past cultures, such as the Chumash (see Walker and DeNiro 1986; Lambert and Walker 1991; Gamble et al. 2001). By following a similar process the probability of this research culminating in a detailed description of the degree of Tataviam social complexity, or lack thereof, is likely through this avenue of research. There is a debate between processualists and post-processualists as to the reliability of funerary analyses for the interpretation of status within a burial population; however, until more complimentary data are available for the Tataviam this research will be a starting point for future research. The lack of research on the Tataviam, compared to other groups, makes this research so crucial and important for promoting Tataviam cultural heritage.

Section 2

Cultural Background

The Native American cultural group that we know today as the Tataviam once inhabited the upper reaches of what is today the Santa Clara River Valley in southern California. Tataviam territory expands north to Castac Lake encompassing Quail Lake (Figure 1). It extends south east along the Sawmill Mountains, bordering the Antelope Valley, encompassing La Liebre and Elizabeth Lake (Bright 1975; King and Blackburn 1978), all the way to Soledad Pass. Their territory extends south past the Santa Clara River to the San Gabriel and Santa Susana Mountains. Finally, the territory extends east, encompassing the Piru region (Johnson and Earle 1990).

Figure 1: Map of Tataviam territory (King and Blackburn 1978:535).

There is some dispute regarding the territorial boundaries of the Tataviam and their neighbors. For example there has been confusion regarding the placement of the eastern border due to convoluted and often times contradictory historic documentation and obscurity surrounding the Tataviam that have resulted in the incorrect placement of Tataviam and/or Chumash villages and place names (Johnson 1978; Hudson 1982). The Tataviam occupied a strategic position with their territory in southern California. By controlling the east-west corridor between the Los Angeles Basin and the San Joaquin Valley, and the north-south corridor between the desert and the coast they could serve as middlemen between groups who were at odds with each other (McIntyre 1979). The Tataviam are surrounded by multiple cultural groups. Figure 2 shows a generalized map of the different southern California native groups.

Figure 2: Map of southern California and the different culture groups (adapted from Timbrook 2007).

The various bordering groups with whom the Tataviam would have had varying degrees of contact, whether it was a relationship of amity or enmity, are the Gabrielino (Tongva), Kitanemuk, Serrano, and Chumash. We cannot fully understand the intergroup dynamic that was present in pre-contact southern California through the archaeological record; however, "the presence of north-south enmity and east-west amity relationships similar to those found throughout southern California in protohistoric times seems likely" (King and Blackburn 1978:536).

The Gabrielino occupied the territory to the south. Their language was part of the Takic family, which is part of the Uto-Aztecan linguistic stock (Bean and Smith 1978a). The Gabrielino were one of the wealthiest, most populous, and most powerful ethnic groups in aboriginal southern California. Their culture was partly characterized by intra- and intergroup exchange with people, goods, and ideas flowing in many directions and in some cases, for long distances (Bean and Smith 1978a). The principal trade item, both among the Gabrielino and for export to other groups, was steatite. On the mainland cremation was practiced as part of the mourning ceremony (Bean and Smith 1978a).

The Kitanemuk occupied the Antelope Valley and Mojave Desert to the north. They spoke a Serran language of the Takic family (Blackburn and Bean 1978). The data on ethnographic Kitanemuk social organization are limited; however, it must have been fairly complex as each village had a chief, a ceremonial manager, two messengers, shamans, diviners, and other ritualists (Blackburn and Bean 1978; Sutton 1980). Numerous trade items discovered at Kitanemuk sites demonstrate that trade involved groups of the Santa Barbara coast, the San Joaquin Valley, and the desert to the east (Sutton 1980). Their external relationship with the Tataviam was one of enmity (Blackburn and Bean 1978).

The Serrano populations, which is a language group in the Takic family that incorporated the Vanyume, were scattered and unified; however, very little is known in regards to their external relations with neighboring groups (Bean and Smith 1978b).

Prior to Spanish conquest the Serrano were known to practice cremation almost immediately following death with most of the deceased possessions destroyed at the same time (Bean and Smith 1978b).

Finally, the Chumash inhabited the area to the east of the Tataviam (See Figure 2). This group of complex hunter-gatherers is best known for their use of the plank canoe (*tomol*) and their use of shell bead money as a form of economic exchange (Gamble 2008). They had a complex network of economic exchange based on redistribution, free market trade, and commerce controlled by chiefs or wealthy individuals (Gamble 2008). The shell beads manufactured by the Chumash have been found throughout southern California and beyond. The Chumash language, considered to be a linguistic isolate, consists of three different branches, Northern Chumash (Obispeño), Central Chumash (Purisimeño, Ineseño, Barbareño, and Ventureño), and Island Chumash (Cruzeño) (Gamble 2008). To the north-east of the Tataviam were the Castac and Emigdiano Chumash and to the south-east were the Ventureño Chumash. Little is known about the Castac and Emigdiano Chumash; however, the rock art of the Carrizo Plain and associated artifacts point to Chumash occupation. The interior Chumash and the Tataviam most likely lived together along Pastoria Creek (Grant 1978b). The Ventureño Chumash inhabited the coastline and the interior in and around what is now present-day Ventura. The coastal Ventureño Chumash have been characterized by their complex material culture, including use of the *tomol*, fishing technology, and shell bead money, while the inland Ventureño populations were technologically inferior to their brethren on the coast (Grant 1978a).

The Tataviam were originally called *Ataplili'ish* (meaning "easterner") by Kroeber in 1915; however, this name was too general and had already been used to describe other indigenous groups (Gabrielino) therefore the language was renamed Alliklik in 1925 (Hudson 1982). J.P. Harrington used the name Pujador (grunt or groan) to refer to the Tataviam which meant 'grun-ters' or 'stammerers' in Chumash (Anderton 1991). According to King and Blackburn (1978), Francisco Garcés and Fages, two Spanish Franciscan missionaries and explorers, both considered the Tataviam similar to their southern Takic neighbors in dress, political organization, and language. The Tataviam language is a Northern Uto-Aztecan (NUA) language; however, there has been some argument that it was a Chumash dialect or even a remnant of an unknown language family (Sutton 2010). NUA is the Northern subfamily of Uto-Aztecan, a linguistic grouping that extends north from southern Mexico across much of western North America. The Takic branch of NUA (Figure 3) consists of seven languages; Kitanemuk, Serrano (including Vanyume), Gabrielino (including Fernandeño), Luiseño (including Juaneño), Cahuilla, Cupeño, and Tataviam (Sutton 2010).

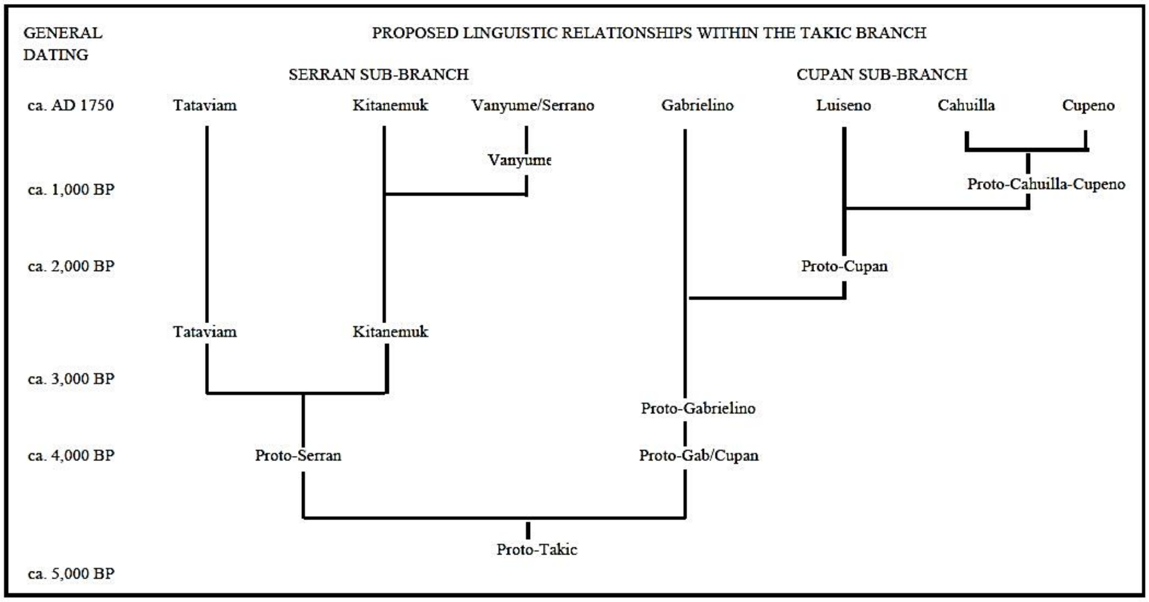

Figure 3: Takic branch of the Northern Uto-Aztecan language tree with proposed time frames for differentiation (Sutton 2009:71).

Archaeological data suggest that the Tataviam began to differentiate from other southern California Takic speakers around 1000 B.C., which is about the time that cremation as a funerary practice began to predominate in the areas occupied ethnographically by Takic-speaking groups (King and Blackburn 1978).

As an inland group, the Tataviam relied on various vegetable foods and terrestrial animals for subsistence (King and Blackburn 1978). Vegetable foods include yucca, acorns, sage seeds, juniper berries, and berries of islay. Animal foods include small mammals, deer, and perhaps antelope. There is also evidence of marine shellfish and fish at various Tataviam sites (Caruso 1988). The Tataviam probably relied more heavily on the buds of the yucca (*Yucca whipplei)* as a major staple than did neighboring groups (King and Blackburn 1978).

Archaeological and ethnohistoric information suggest that Tataviam villages varied in size from large centers with perhaps 200 people, intermediate villages containing 20-60 people, and small settlements containing 10-15 people. At the time of historic contact, the total Tataviam population was probably less than 1,000 (King and Blackburn 1978).

Before a more in-depth look of the Tataviam is taken, it is necessary to describe the general prehistoric time periods that are commonly used to differentiate between technological innovation and subsistence practices. The three commonly used time periods are the Early Period, the Middle Period, and the Late Period.

The Early Period, also known as the Millingstone Horizon, spans from approximately 7,000 to 4,000 yr B.P. (5,000 B.C. to 2,000 B.C.), and is characterized by the use of millingstones (e.g. manos and mutates) to process hard seeds (McIntyre 1979). The people that lived during this time were primarily food collectors with hunting and fishing taking a secondary role (Wallace 1955, cited in McIntyre 1979).

The Middle Period, also known as the Intermediate Horizon, spans from approximately 3,500 to 1,500 yr B.P. (1,500 B.C. to A.D. 500), and is characterized by a shift from a primarily food collecting subsistence strategy to a combination of hunting, gathering, and maritime adaptation subsistence base (McIntyre 1979). Artifacts characteristic of this period include the basket-hopper mortar, mortar, pestle, diversified stone tool implements, stemmed projectile points, bone and antler tools, personal ornaments (e.g. shell beads), and asphaltum and steatite use (Wallace 1955, cited in McIntyre 1979).

Finally, the Late Period, also known as the Late Horizon, spans from approximately 1,500 to 200 yr B.P. (A.D. 500 to A.D. 1800), and is characterized by a greater utilization of food sources with more land and sea mammal hunting and fishing along with a continued interest in seed collecting (McIntyre 1979). Also, elaborate mortuary practices with associated grave goods are noted during this time period (McIntyre 1979).

As I stated these are general time periods for southern California and they vary depending upon geographic location (e.g. coast vs. inland).

Section 3

Environmental Background

No archaeological analysis would be complete without discussing the environment of the immediate area of study and the surrounding areas. Increasingly, the environment has been seen as a major influence or hindrance to the formation of complex societies (Jones et al. 1999) and so archaeologists study the environments that prehistoric cultures lived in. It is clear that human populations modified their environments, even at the hunter-gatherer level, and the environment influenced human populations. Therefore, the rejection of the environment as a potential cause of cultural change will lead to unsuccessful characterizations of prehistoric human behavior (Jones et al. 1999). In the context of this study the environment is very important because a productive environment is seen as one of the conditions for the rise of complex hunter-gatherers. For many complex hunter-gatherer groups, the environmental conditions may include abundant subsistence resources, low risk levels, and favorable climates (Arnold 1996).

Geography

Tataviam cultural geography includes the region we know of today as the upper Santa Clara River basin or watershed (King and Blackburn 1978; Hudson 1982; Johnson and Earle 1990). This area incorporates what is now the western part of the Angeles National Forest and includes the northwest portion of Los Angeles County and part of eastern Ventura County (Johnson and Earle 1990).

The topography of the region is mountainous, characterized by complex, major ridge systems dominated by south-facing slopes which are heavily dissected by drainages

(Caruso 1988). Most of the Tataviam region lies at an elevation between 1,500 and 3,000 feet above sea level, with a minimum elevation of 600 feet near Piru on the Santa Clara River and a maximum elevation of 6,503 feet at Gleason Mountain (King and Blackburn 1978).

Geology

Vasquez Rocks is located within the Transverse Ranges, which unlike California's other geologic provinces, form an east to west trending unit and seem to incorporate a greater spectrum of rock types and structure than any other province in the state (Norris and Webb 1976). The Soledad Basin, which makes up the eastern portion of the large syncline known as the Ventura and Soledad Basins and includes the coarse clastics that make up the prominent ridges at Vasquez Rocks, is dominated by rough, hilly country drained mainly by the Santa Clara River (Norris and Webb 1976). The Santa Clara River valley, like many of the valleys in this area, is structurally a large, thick, synclinal fold (Norris and Webb 1976). "The Soledad Basin contains mostly middle and late Cenozoic nonmarine sedimentary rocks that rest on the crystalline basement of the San Gabriel Mountains to the south and the Sierra Pelona to the north" (Norris and Webb 1976:205).

Paleoclimate

It is difficult to determine what the climate was like in the Transverse Ranges during the Middle Period of the Holocene. Either the paleoclimatic data doesn't exist or most of it pertains to the southern California coast (e.g. Santa Barbara Channel) during the late Holocene. Many of the paleoclimatic studies focus on the Medieval Climatic Anomaly and how it affected sociopolitical organization (see Raab and Larson 1997).

The available paleoclimatic data does suggest fluctuating but generally declining moisture levels up to the Medieval Climatic Anomaly (ca. A.D. 800-1400) (Raab and Larson 1997). Study of a San Joaquin Marsh in coastal Orange County (Davis 1992) confirms these fluctuating moisture levels. Davis (1992:96-97) states that "after 4500 yr B.P., as sea level approached its modern position, the pollen of halyophytic and salt-marsh plants and remains of dinoflagellates and foraminifera are common in the pollen diagrams from San Joaquin Marsh" which indicates intrusion of salt water into the marsh indicating a warmer, drier climate. However, this general trend is punctuated by four periods (ca. 3800, 2800, 2300, and after 560 yr B.P.) of a cooler, wetter climate when the pollen of freshwater plants dominated the marsh (Davis 1992). The post-560 yr B.P. period that Davis (1992) defines corresponds to the Little Ice Age while the pre-560 yr B.P. warm, dry period corresponds to the Medieval Climatic Anomaly. Unfortunately, the punctuated cool, wet episodes occurred over a span of hundreds of years and a more fine grained analysis of the paleoclimate of southern California is not possible at this time.

Hydrology

The Santa Clara River watershed, one of the largest river systems along the southern California coast, has its headwaters in Los Angeles County and flows westward into Ventura County terminating at the Santa Clara River Estuary which historically encompassed 121 hectares of open water habitat but has been reduced to approximately

12 hectares in modern times (Kelley 2008). The Santa Clara River watershed is 1,600 square miles in area (Stoecker and Kelley 2005; Kelley 2008). Stream flow on the river can rise and fall quickly in response to winter rainstorms, which are variable due to the semi-arid, Mediterranean climate (Kelley 2008). The Santa Clara River tributaries include Santa Paula Creek, Sespe Creek, Pole Creek, Hopper Creek, and Piru Creek with the Sespe and Piru Creeks being the largest (Stoecker and Kelley 2005). Historically, the Santa Clara River supported one of the largest steelhead trout runs in southern California (Stoecker and Kelley 2005).

Flora/Fauna

The following table (Table 1) is a list of the floral sub-life zones and their associated flora for the Santa Clara River Valley. This table does not represent every available plant in the area but only the predominant species.

<table>
<tr><td colspan="3">Table 1</td></tr>
<tr><td colspan="3">Floral Sub-Life Zones and Associated Flora of the Upper Santa Clara River Valley</td></tr>
<tr><td>Sub-Life Zone</td><td colspan="2">Flora</td></tr>
<tr><td rowspan="4">Coastal Sage Scrub</td><td>Latin Name</td><td>Common Name</td></tr>
<tr><td>Artemesia californica</td><td>California Sagebrush</td></tr>
<tr><td>Eriogonum fasciculatum</td><td>California Buckwheat</td></tr>
<tr><td>Salvia mellifera</td><td>Black Sage</td></tr>
<tr><td rowspan="5">Chaparral</td><td>Adenostoma fasciculatum</td><td>Chamise</td></tr>
<tr><td>Quercus dumosa</td><td>Scrub Oak</td></tr>
<tr><td>Salvia apiana</td><td>White Sage</td></tr>
<tr><td>Salvia columbariae</td><td>Chia</td></tr>
<tr><td>Salvia mellifera</td><td>Black Sage</td></tr>
<tr><td rowspan="3">Valley Grassland</td><td>Bromus carinatus</td><td rowspan="3">California Biome Grass</td></tr>
<tr><td>Delphinium</td></tr>
<tr><td>Ranunculus</td></tr>
<tr><td rowspan="3">Southern Oak Woodland</td><td>Juglans californica</td><td>Walnut</td></tr>
<tr><td>Platanus racemosa</td><td>Sycamore</td></tr>
<tr><td>Quercus sp.</td><td>Oaks</td></tr>
</table>

Southern Oak Woodland Cont.	*Rhus ovata*	Sugar Bush
	Sambucus sp.	Elderberry
Montane Coniferous Forest	*Pinus coulteri*	Coulter Pine
	Pinus lambertiana	Sugar Pine
	Pinus ponderosa	Ponderosa Pine
	Pinus sabiniana	Digger Pine
	Pseudotsoga macrocarpa	Big-Cone Spruce
	Quercus kelloggii	California Black Oak
Pinyon-Juniper Woodland	*Juniperus californica*	California Juniper
	Pinus monophylla	Piñon Pine

Table 1: Floral sub-life zones and associated flora for the Santa Clara River Valley (Munz 1974; McIntyre 1979).

For a more detailed list of available plant life and their uses in the Santa Clara River watershed and surrounding areas, see King et al. (1974) and Timbrook (2007). See "Social Complexity" for a discussion on economic uses and storage potential for various plants.

The following table (Table 2) is a list of the available fauna, past and present, of the Upper Santa Clara River Valley.

Table 2		
Fauna of the Upper Santa Clara River Valley		
Fauna	Latin Name	Common Name
Mammals	*Canis latrans*	Coyote
	Canis lupus	Wolf
	Canis sp.	Dog
	Citellus beecheyi beecheyi	Ground Squirrel
	Didelphis marsupialis	Opossum
	Felis concolor	Puma
	Lepus californicus	Jackrabbit
	Lynx rufus californicus	Bobcat
	Mephitis mephitis	Striped Skunk
	Neotoma lepida	Woodrat

Mammals Cont.	*Odocoileus hemionus californicus*	California Mule Deer
	Ovis canadensis nelsoni	Big Sheep
	Peromyscus boylei	Bush Mouse
	Peromyscus californicus	California Field Mouse
	Peromyscus maniculatus gambeli	Gambel's Field Mouse
	Procyon lotor	Raccoon
	Rerthrodontomys	Harvest Mouse
	Scapanus latimanus	Broad-Footed Mole
	Spilogale gracilis	Spotted Skunk
	Sylvilagus audubonii	Cottontail
	Taxidea taxus	Badger
	Thomomys bottae neglectus	Pocket Gopher
	Urocyon cinereoargenteus	Fox
	Ursus americanus	Black Bear
	Ursus horribilis magister	California Grizzly
Birds	*Anas platyrhynchos*	Mallard
	Aphelocoma coerulescens	Scrub Jay
	Archilochus alexandi	Black-Chinned Hummingbird
	Balanosphyra formicivora	Acorn Woodpecker
	Bueto jamaicensis	Redtailed Hawk
	Calypte anna	Anna's Hummingbird
	Cathartes aura	Turkey Vulture
	Corvus corax	Raven
	Couris brachyrhynchos	Crow
	Euphagus cyanocephalus	Brewer's Blackbird
	Fulica americana	Coot (Mudhen)
	Gymnogyps californianus	California Condor
	Iceterus bullockii	Bullocks Oriole
	Lophortyx californica	California Quail
	Melospiza lincolni	Lincoln's Sparrow
	Oreortyx picta	Mountain Quail
	Otus asio	Owl
	Passerella iliaca sp.	Fox Sparrow
	Sturnella neglecta	Western Meadowlark
	Toxostoma redivivum	California Thrasher
	Zenaidura macroura	Mourning Dove
Reptiles and Amphibians	*Crotalus viridis*	Western Rattlesnake
	Lampropeltis zonata parvirubra	California Mountain King Snake
	Petuophis cantenifer	Gopher Snake

Reptiles and Amphibians Cont.	*Rana aurora*	Red-legged Frog
	Scaphiopus hammondi	Western Spadefoot Frog
	Sceloporus graciosus	Sagebrush Lizard
	Sceloporus occidentalis	Western Fence Lizard
	Thoperus agassive	Tortoise

Table 2: Fauna of the Upper Santa Clara River Valley (McIntyre 1979).

Section 4

Theoretical Background

The study of human burials and burial practices is not a new practice within the field of archaeology. Thomas Jefferson, considered by some to be the first American "archaeologist", was an avid antiquarian and recorded data on Native American burials that he excavated in Virginia in 1784 (Trigger 2006). More recent funerary studies and excavations have been much more controlled and methodical in order to better understand the spatial patterning of bodies and grave goods but also to try and understand the overarching ideologies and beliefs of a particular culture. Archaeologists have used funerary analyses to answer numerous questions such as: prehistoric and proto-historic social stratification, historical trends in socioeconomic competition, trade and alliances, territoriality, warfare, migrations, ideology, philosophical-religious beliefs and world views, patterns of social interaction, and descent (Bartel 1982; Carr 1995). The study of funerary practices in the United States came to the forefront of archaeology during the time of Lewis Binford and the New Archaeologists (Trigger 2006). The New Archaeologists or processualists focused on multiple variables of corpse disposal and they believe that the social role that a person held in life and the degree of social differentiation would be accurately reflected in the elaboration of individual burials (Binford 1971). The Binford-Saxe program of funerary studies is not without its critics. A paradigm shift came about in the 1980s led by the studies of Ian Hodder, a British archaeologist known for his work at the early Neolithic site of Çatalhöyük in Turkey, and his school of Post-Processualism (Trigger 2006). Hodder lacked faith in the Binford-Saxe program. He reacted against the rigid logico-deductive method characteristic of

New Archaeology and he rejected the idea that cross-cultural generalizations could be made through the interpretation of burial practices. The post-processualists believe that the cultural history and context of data are necessary along with knowledge of the overarching cultural ideologies and belief systems to understand variations in burial practices (Hodder 1982). This chapter attempts to outline the processual and post-processual studies of burial studies. Both these paradigms will be compared and contrasted as they pertain to the study of social identity and status differentiation within the burial context and how they pertain to the present research.

The New Archaeologists

Two important American archaeologists that contributed heavily to New Archaeology and the processual paradigm are Lewis R. Binford and Arthur A. Saxe. Both Binford and Saxe were instrumental in developing this theoretical paradigm as it pertains to funerary analyses. They have published numerous essays demonstrating their methodologies based on the processual mode of understanding past cultures. In the realm of funerary studies they have produced some of the most influential and long-lasting interpretations of social status and differentiation within the burial context. This section will discuss the contributions made by Binford and Saxe to the funerary analysis debate and it will detail the theoretical and methodological stance of what some call the Saxe-Binford Research Program (Brown 1995).

Arthur Saxe and Lewis Binford believed that variations in burials would directly reflect social organization (Binford 1971; Saxe 1971; O'Shea 1984). They proposed that the patterned segregation of bodies or variations in the size of tombs, the quantity and elaborateness of grave goods, and the treatment of dead children might provide information about the nature of status differentiation in prehistoric societies (Trigger 2006). Saxe first discussed funerary behavior and how it reflected social differentiation in his unpublished PhD which was entitled “Social Dimensions of Mortuary Practices” (1970). He used his theoretical perspective to analyze the social dimensions of a cemetery in Sudan. During this study he collected data pertaining to age, sex, pathologies, treatment of the body, and modes of internment from a Mesolithic hunting and gathering culture. From his analysis of the remains he concluded that differences in disposal of the body were attributed to differences in age, sex, and personal achievement (Saxe 1971).

Binford’s contributions to the interpretation of funerary practices are of great importance. In his essay “Mortuary Practices: Their Study and Their Potential” (1971) he discusses the concept of the social persona displayed in the funerary context. Binford states that “the basic components of the social personality, symbolized through differential burial treatment are: (1) age, (2) sex, (3) relative social status within a given social unit, and (4) social affiliation in terms of multiple membership units within the society and/or membership in the society itself” (1971:14). In understanding the social persona one would expect that the heterogeneity in funerary practice would vary directly with the social complexity of a society with regard to membership units and other forms of sodalities (Binford 1971). After these concepts have been considered there are two general components of the social situation to be evaluated when attempting to understand the social persona symbolized within the burial context. First, what is the social persona (or overall status composite) of the deceased which is a combination of the social identities maintained in life and recognized at death and second, what is the composition and size of the social unit recognizing status responsibilities to the deceased (scale of identity). We would therefore expect direct correlations between the social position held by the deceased and the number of persons having duty-status relationships with the deceased (Binford 1971; Brown 1981). Binford's essay puts forth some criticisms of past funerary studies, specifically those made by Kroeber (1927), and it details his theory of funerary analyses which is based on the direct correlation between the social role that a person held in life and the degree of social differentiation reflected in the elaboration of individual burials. It is this direct correlation that Binford (1971) proposed that allowed him to make cross-cultural comparisons that many archaeologists after him have followed and expanded upon.

There are multiple methods by which processual archaeologists have tried to determine differential status within burials in order to infer the degree of social complexity. Many of the New Archaeologist's studies have in fact been geared towards identifying the level of complexity of early societies (Parker Pearson 1999). Societies said to be complex may exhibit vertical differentiation or ranking (differential access to wealth and status) and stratification (social classes organized in unequal access to resources) (Parker Pearson 1999). Morton Fried (1967:109) defined a ranked society as "one in which positions of valued status are somehow limited so that not all those of sufficient talent to occupy such statuses actually achieve them". The methods utilized to determine social rank have had varying degrees of success and oftentimes the incorporation of multiple lines of evidence have been used to gain a deeper insight into burial practices and the overall degree of social complexity of a culture. Some of the different variables that archaeologists have studied to determine status are the analysis of the differentiation and elaboration of grave goods (Tainter 1978; Parker Pearson 1999), dietary and health studies (Chapman and Randsborg 1981; Cook 1981; Parker Pearson 1999), labor investment in graves (Tainter 1978) and funerary patterning, analysis of skeletal data (bioarchaeology), and demographic analyses (Brown 1981; Konigsberg and Buikstra 1995; Härke 2000).

The amount and type of grave goods found within the burial context has been the focus of many studies concerned with status. The general consensus among the New Archaeologists is that graves containing “prestige” goods are of higher rank and those without or with only a few goods are of lesser rank; both egalitarian and ranked societies will be characterized by burial differentiation in *both* quantity and quality of material associations (Tainter 1978). Hereditary leadership and ascribed status within a society can also be identified across age and sex differences by the identification of infant and child burials containing wealth and prestige goods. Grave goods with a high labor investment can also be indicators of high status. The incorporation of non-local artifacts within a burial embodies not only the labor involved in their manufacture but also the time and labor required for acquisition and transport (Parker Pearson 1999).

The popularity of cultural ecological models and systemic perspectives in archaeology has encouraged attempts to relate pathological data to information about variables such as population density and structure, subsistence, settlement patterns, social organization, and trade (Chapman and Randsborg 1981). Cultural ecology has been another key concept for the New Archaeologists. One aspect of cultural ecology that they have applied to the funerary context is that of identifying a society’s adaptive efficiency through the fitness of its population as evidenced by the level of health indicated from stress indicators in bones and teeth. The dietary and health studies from human remains have significant potential for opening up new avenues of research into differential social status (Parker Pearson 1999). For example, the disturbances of enamel development, such as hypoplastic lines and pits, microscopic alterations of internal structure, and pronounced striae of Retzius and prism defects, provide an ideal stress indicator for use in archaeological studies. An examination of the frequency of enamel defects can help archaeologists understand the relationship between status and dietary stress (Cook 1981). Stable isotope analysis of carbon and nitrogen have also been used to answer questions about the introduction of vegetable products, the variable reliance on animal or vegetable proteins, and the reliance on terrestrial as opposed to marine food resources (Parker Pearson 1999). Also, pathologies related to dietary stress and nutritional deficiencies due to iron deficiency anemia (osteoporotic pitting, spongy hyperostosis, and cribra orbitalia) can also be used as indicators of rank (Chapman and Randsborg 1981). However, as of late the, the systematic link of cribra orbitalia and hyperostosis with iron deficiency related to dietary stress has been challenged (Walker et al. 2009). Access to specific dietary resources is often based on rank or social position. A person of high rank would not only have greater access to food in times of dietary stress but they would more than likely have access to the more exotic food resources (marine vs. terrestrial resources). Both of these variables occurring within a ranked society can be studied and understood through the use of dietary and health studies.

The study of grave size and labor investment have been explored by various authors whose analyses were based on the premise that labor investment in a burial is just as good of an indicator of social status as grave goods (Tainter 1978; Larsen 1995; Härke 2000). Rank may be expressed in only one of several loci including grave furnishings or superstructures, internal spatial arrangements, locus of grave in relation to other graves, settlements or sacred places (Trinkaus 1995). Robert Chapman (1995) has shown that the placement of West European megalithic tombs acted as symbols of territoriality among agricultural communities and Larsen (1995) believes that the placement of cemeteries and funerary architecture is not random but is in fact related to resource territories. Unfortunately, patterning suggestive of social differentiation pervades much of the archaeological record but it can be used as a related chain of inference for the complexity debate (Trinkaus 1995).

Demographic analyses, through the use of sex ratios, age estimation, and nonmetric traits (dental, cranial, and infracranial) have allowed researchers to calculate the biological relationship between individuals, population origins and relationships (Brown 1981; Konigsberg and Buikstra 1995). These calculations provide archaeologists with information regarding kinship and descent within burials. The analysis of discrete traits, although more time consuming, appears to be a realistic alternative to DNA analysis (Härke 2000). Theoretically, a natural population is said to have approximately equal sex ratios and a "normal" mortality profile. Any statistically significant deviation from these "normal" age/sex expectations points to differential burial treatment based on age and sex (Brown 1981). The causes of most nonmetric traits are still unknown but some have been found to be genetically inherited to varying degrees, most notably cranial features. However, problematic for archaeologists studying kinship is the consensus that certain traits are widely dispersed among populations and are rarely limited to a single genetic line (Parker Pearson 1999). The identification of discrete traits within a burial population is one factor leading to the identification of possible ascribed status and/or rank based on kinship.

Post-Processualism

Post-processual archaeologists generally disapprove of positivist approaches to the analysis of archaeological data (Trigger 2006). The post-processualists support a contextual or cultural archaeology. They believe that human actions and intelligent adaptation must be understood as historically and contextually specific, and the uniqueness of cultural forms must be explained. And "it is only by the accepting of the historical and cultural nature of data that archaeologists can contribute positively to anthropology" (Hodder 1982:13). Therefore, the structuralist approach was revived in archaeology as an alternative to processualism. This approach was championed largely by Ian Hodder. He proposed a detailed study of intricate forms of patterning of material culture in the archaeological record of specific cultures that had been ignored by cultural-historical and processualist archaeologists (Trigger 2006). His most influential application and the best case study for the structuralist approach to interpreting prehistoric archaeological data was his book "The Domestication of Europe" (1990). The post-processualists have critiqued the use of processual archaeology within the burial context based on the demonstration by Hodder that material culture is used as an active element in social interaction and that the relative elaboration of individual graves within a society does not necessarily mirror the degree of social differentiation (Trigger 2006). Also, the post-processualists, opposed to the processualists, have often raised objection to the search for features of social organization in the archaeological manifestations of ritually dominated practices (Brown 1995). Post-processual archaeological perspectives brought two critical reformulations to funerary analyses. These were the recognition that funerary practices may embody and reveal workings of power and ideology, and the identification of funerary rites as legitimizing events when rank and power might be disassociated (Parker Pearson 1999).

The post-processualists believe that funerary behavior is a highly sensitive indicator of belief systems and ideology and because of this they have focused on symbolism and ideology as the overarching determinant of funerary ritual. The powerful influence of ideology certainly played a key role in the determination of inhumation practices (Larsen 1995). According to Shanks and Tilley (1982) the interpretation of funerary ritual is a particular case of the wider issue of ideological legitimation of the social order. They define ideology as “practice which operates to secure the reproduction of relations of dominance and to conceal contradictions between the structural principles orientating the actions of individuals and groups within the social formation” and “ideologies are both material and ideational constructs whose form is governed by their articulation within the social totality” (Shanks and Tilley 1982:130). The study of ideology and symbolism is at odds with the New Archaeologists’ theoretical stance in regards to the relationship between funerary practices and social organization. The idea that funerary ritual acts to reaffirm the social order does not in itself explain anything of the specific content or context of the ritual. The ritual fails to explain why certain items should be repeatedly chosen as grave furniture, their specific arrangement, or why other elements of material culture should be considered unsuitable for this purpose. It is necessary to understand the structuring principles of the society in question in order to understand form and content (Shanks and Tilley 1982). Ideology can therefore account for the overarching influences and implications for the funerary practice of societies if the structuring processes are known. Ideology directly influences ritual and symbolism within the funerary context.

Michael Parker Pearson (1982) believes that the context of death is one of ritual action and communication as opposed to everyday practical communication. Therefore funerary remains have to be interpreted as ritual communication if we assume the existence of ritual in all societies. The past, especially through ritual communication, is often used to naturalize and legitimize hierarchies of power and inequality which would otherwise be unstable (Parker Pearson 1982). Therefore, the funerary practices by which a deceased household or community member is processed and buried are not really about the dead but about the *living* and how they cope with separation, loss, and new opportunities. Residential burials, possibly seen as a form of inalienable wealth, have been proposed as a way in which the living group maintained identity, longevity, and future possibilities (McAnany 2010).

Post-processualists propose the following approaches and guidelines to the study of funerary remains: First, finer-grained cross-cultural studies are necessary for specific forms of beliefs and their correlates in funerary practices; second, it is necessary to move away from middle range statistical generalizations to true, middle range theory which links burial forms to their philosophical-religious causes through emic and etic logic; third, a broad contextual approach is necessary when interpreting the cultural meanings of funerary practice as symbol; fourth, a careful selection of the grain of ideas sought (e.g. fine grained beliefs vs. broader world-views); and fifth, familiarization with the systematic organization, themes, and contents of world views, and their cultural and bio-psychological causes and constraints (Carr 1995). It is apparent that the post-processualists prefer to view the disposal of the dead within the context of "intangible" religious beliefs (Chapman and Randsborg 1981).

Critiques of Processualism

Funerary studies have seen changes in the approach from role theory and evolutionary social complexity, utilized by the New Archaeologists, to theories of practice and concerns with the historical and political situations of funerary events such as political acts in which the living use the dead as resource, vision, and representation (Parker Pearson 1982, 1999; Adams and King 2010). One of the major critiques of the processualist mode of funerary studies is the direct use of grave associations to determine social status. Emergence of more socially complex societies will not always be reflected in a direct and linear fashion in disposal methods (Chapman and Randsborg 1981). Often, recoverable funerary remains do not reflect the associated ritual behaviors that also contain social information. The amount and quality of social information in funerary ritual changes as the scale of societies and local social units diverge (Trinkaus 1984). Grave goods are interpreted as not just elements of the social persona but they are the culmination of a series of actions by the mourners, or participants, to express their relationship to the deceased as well as to portray the identity of the deceased (Parker Pearson 1999). Also, some complex societies illustrate a divergence of the funerary remains from the funerary ritual showing an inverse situation where ritual opposes the social order of the living to that of the dead. The emphasis, therefore, is heavily shifted from funerary remains to funerary ritual (Trinkaus 1984) which processual archaeologists may be unaware of through their studies of the remains themselves; funerary ritual and the role of the participants may not always manifest itself within the burial context.

At the root of the New Archaeologists' approach to the social dimensions of funerary practices is the acceptance of the concept of social evolution which developed from the unilinear and multilinear evolutionary approaches of Steward (1963), White (1959), Fried (1967), Service (1975), and Sahlins (1960). It is the use of these social evolutionary schemes by New Archaeologists that has brought on sustained criticism from the post-processual archaeologists (Parker Pearson 1999). This narrow focus on social organization, outside the context of beliefs, is seen as the primary reason that over the past decade, little progress has been made within this "American" tradition and for the slowdown in theory building (Carr 1995).

Rooted in the processual paradigm of funerary analyses is the anthropological philosophy of functionalism. Hodder (1982:3) states that "the functionalist and processual emphasis in archaeology aimed objectively to identify relationships between variables in cultural systems" and that "there was a natural link to an empirical and positivist concept of science". However, the post-processualists have encouraged the New Archaeologists to get away from functionalism and embrace a structuralist philosophy (see Hodder 1982) because it has great potential for developing into a new methodology related to funerary practice in particular. "While the functionalist approach has been valuable in showing that societies previously considered as "primitive" were in fact well adapted to their environments, it presents human agency, and especially ritual action, as driven by ecological concerns rather than social relationships" (Parker Pearson 1999:86). Basically, the issues of agency, tradition, and power are ignored and social phenomena are explained away by environmental adaptation. Structuralists have historically concentrated on linguistics and myth, since these are subjects that are believed to be part of "deep structure", but Lévi-Strauss, Rousseau, and later Durkheim contributed to what was to be the harmonious correlation of humans as part of nature (Bartel 1982).

Another weakness of the processual approach is the uncritical use of ethnographic data, often secondhand or based on few observations and not fully documenting possible variability, potentially resulting in misleading generalizations. The processualists treat the ethnographic record as a static present or recent past when in fact ethnographies often record periods of radical and often disastrous change (Parker Pearson 1999). Even Gamble et al. (2001:186) state that "using ethnographic analogy to reconstruct the behavior of prehistoric people is a hazardous adventure that can easily lead to interpretations that are little more than projections of the images we have of the ethnographic present onto earlier populations".

It is clear that the post-processualists, many of them British, have followed in the footsteps of their European predecessors and relied on pseudopsychological principles when explaining funerary ritual. Also, the role of the participant has taken the paramount focus over the principal within the context of the funerary ritual. However, just like any other theoretical position there are limitations to the post-processual paradigm. These limitations are most evident in its effort to study prehistoric material and they have resulted in attempts to justify inferences regarding habits and beliefs that are based largely on speculation and intuition. Formulating hypotheses for advancing a scientific understanding of the past is of the utmost importance but if it is to be useful then it must be accompanied with a manner in which to test such formulations (Trigger 2006). If one thing is clear it is the fact that "a holistic and balanced view of the causes of mortuary practices, rather than a paradigmatic approach, is required" (Carr 1995:189).

Conclusions

Even though Hodder lacked faith in the Binford-Saxe program, at times it is the only option for examining funerary remains. The post-processualists believe that the cultural history and context of data is necessary along with knowledge of the overarching cultural ideologies and belief systems to understand variations in burial practices (Hodder 1982); however, oftentimes, when studying prehistoric remains as opposed to historic remains, there are no data available on the culture history or the cultural ideologies. For the present research there is little to no ethnographic data available. Most of the ethnographies that were recorded by J.P. Harrington in southern California are for the Chumash. There are only brief notes pertaining to the Tataviam but no detailed ethnographies. All that remains for the Tataviam is the archaeological record. Therefore, the study of the Tataviam requires a materialist perspective. The processual paradigm has worked very well for the Chumash case and it will be applied to the present research. Perhaps after further research the post-processual paradigm can be utilized to interpret the funerary practices among the Tataviam in a testable manner; one that isn't simply conjecture.

Regardless of each archaeologist's theoretical perspective one thing is clear and that is that each perspective has something to contribute to the debate of funerary analyses but none of which is sufficient by itself to do all that can be done (Trigger

2006). There is an apparent interdependence of a society's funerary practices with the other aspects of the total cultural system, and no aspect of the funerary behavior exists in isolation from the adaptive priorities and necessities of the society at large (O'Shea 1981). Hodder says that it would be incorrect to suggest that a single viewpoint should be espoused (1982); even the staunchest supporters of a single paradigm have conceded that Binford's middle-range theory is applicable in certain contexts. The important point to remember is the necessity of using a broader regional emphasis in funerary analyses. Social behavior is complex and we should not expect to see a simple, straightforward archaeological record revealed within individual funerary sites (Larsen 1995).

Section 5

Social Complexity

Since King et al.'s (1974) proposal that CA-LAN-361 was a cemetery reserved for high ranking individuals with ascribed managerial positions, new information related to Tataviam social complexity has come to light. One cannot rely solely on one body of data (i.e. funerary analysis) when discussing the presence or absence of a socially complex society. If archaeologists have learned anything from the archaeological record it is that a holistic approach is often the best for gaining a more complete understanding of past cultures. Therefore, it is my goal to include some other lines of evidence in addition to the funerary analysis that will support my proposal that the Tataviam were more socially complex than previously thought and should be considered complex hunter-gatherers. Since this is a bioarchaeological study it is only fitting to include archaeological evidence along with the funerary study.

In this discussion of social complexity I have relied heavily on Jeanne E. Arnold's definition of complex hunter-gatherers (1996). Much of Arnold's work is focused on the simple chiefdom society of the Chumash of southern and central California. I have decided to utilize Arnold's hypotheses regarding complex hunter-gatherers for multiple reasons: geographically speaking, the Tataviam and the Chumash were neighbors and presence of trade and interaction is undeniable (Grant 1978b; Caruso 1988); archaeologically speaking the two groups are very similar (King et al. 1974; Caruso 1988); and the Tataviam had similar subsistence practices as the inland Chumash (Vance 2009). Arnold's definition of complexity serves well the Chumash case, allowing researchers to work back from the ethnographic present to locate the events and processes leading to institutionalized labor relations and hereditary inequality however, it does not necessarily apply to researchers seeking conceptual guidance on the emergence of complexity outside of California (Sassaman 2004:234). Arnold (1996) has discussed the nature of complex hunter-gatherers and states that complexity in these societies relies on two organizational features:

"Complexity, then, relates most fundamentally to two organizational features: (1) some people must perform work for others under the direction of persons outside of their kin group, and (2) some people, including leaders, are higher ranking at birth than others" [Arnold 1996:78].

therefore:

"Complexity, I argue, is most parsimoniously and correctly expressed in terms of these two simple features: labor relationships and ascribed ranking and leadership […]" [Arnold 1996:79].

Arnold wants archaeologists to get away from the checklist of specific attributes that so often has been used to define the complexity of a society. Rather, archaeologists should try to understand societies and their organizational matters through time (i.e. diachronically) (Arnold 1996). Simply because one or more of the following attributes are present does not necessarily mean that a society is more complex than another: sedentism, new technologies, changes in burial styles, elaboration in storage facilities, population growth and/or aggregation, increased warfare, more exotic goods, increasing differentiation in residences, more artwork, and the like (Arnold 1996). Arnold outlines that the study of complex hunter-gatherers requires the analysis of the interrelatedness of the causes, consequences, correlates, and conditions of complexity, which include the attributes listed above, and if they brought about the institutionalization of new labor relationships and ascribed hierarchies among people (Arnold 1996). It is not enough to simply check off the presence of some of these attributes in a specific moment in time and call a society complex.

Storage and Sedentism

The presence of storage and sedentism has been described by Arnold (1996) as being one of the causes, consequences, correlates, and/or conditions of complexity (see above). Therefore, storage and sedentism within Tataviam territory during the Middle Period is an important factor when discussing social complexity. Evidence of storage and sedentism in Tataviam territory follows.

Storage

Southern California and the native groups inhabiting the region did not witness agriculture or ceramic technology until after historic contact. Therefore, traditional storage devices of an agricultural society such as granaries and clay vessels are not present in the prehistoric California archaeological record. What archaeologists do find in this region, as far as storage technology is concerned, are earth ovens, subsurface features generally associated with the cooking of yucca, that were utilized by the Tataviam, other native California groups, and groups in the Great Basin and the Greater Southwest (King et al.1974; Love 1990; Robinson 2005; Milburn et al. 2009; Vance 2009). One possible explanation for such a wide distribution of earth ovens is that heated rocks provide fuel-saving capacities in fuel-poor arid environments (Milburn et al. 2009).

Chaparral Yucca (*Yucca whipplei*), also known as Spanish Bayonet, and Maguey, Mescal, or Quiote in Spanish (Timbrook 2007), is prevalent in the area inhabited by the

Tataviam (see "Environmental Background"). The majority of the Tataviam region was comprised of south facing slopes which were exposed to longer periods of sunlight and ideal for the growth of yucca (King and Blackburn 1978). They were also heavily dissected by drainages providing greater access to water (Caruso 1988). Yucca was heavily utilized as a source of food and as a source of raw materials to make utilitarian items. Practically the entire developmental sequence of the plant had uses for the Tataviam. For example, the fibers from the leaves were woven for cordage and sandal manufacture, and could be pounded for the production of a cleansing soap. The flower stalk, when dried, could be used for a hearth for the fire starting kit (Wessel 1986, cited in Vance 2009). The consumption of yucca entailed processing by roasting over a fire or in an earth oven (King et al. 1974; Vance 2009). The baking of stalks converted the pithy material to a rich molasses-like food and the leafy basal rosette of the plant could also be roasted. Most importantly, after roasting the plant it could apparently be stored for over a year (King et al. 1974; Wessel 1986, cited in Vance 2009).

During the Middle Period facilities such as earth ovens became important for transforming previously low value or unpalatable plant foods into digestible and nutritious food (King et al. 1974). This is apparent by studying the increase in the temporal and spatial distribution of earth ovens (Figure 4).

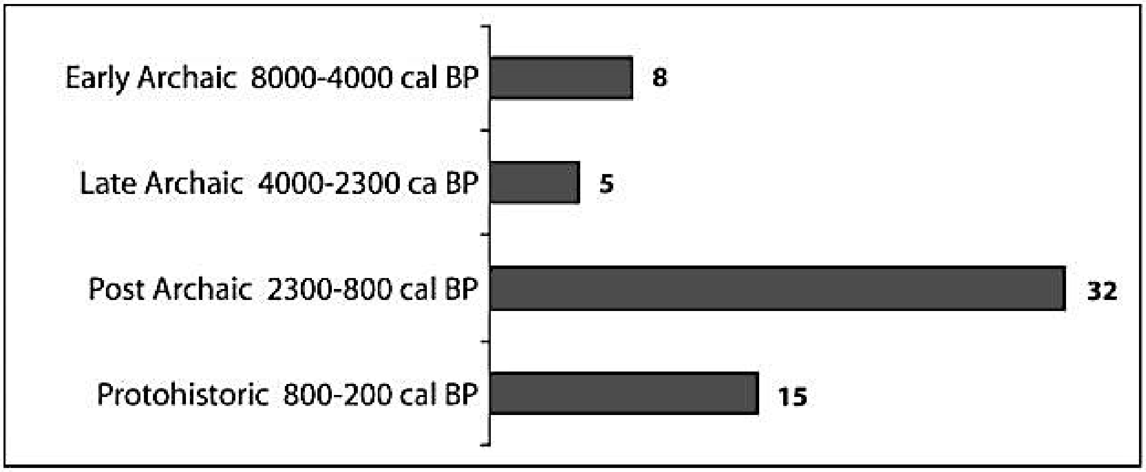

Figure 4: Temporal distribution of earth ovens in the Transverse Ranges (Milburn et al. 2009).

Milburn et al.'s (2009) time periods are organized within broad temporal divisions reflecting cultural developments at desert and coastal areas; they do not correspond to the traditional Early, Middle, and Late Period designations. The Middle Holocene, which spans from 1400 B.C. – A.D. 1150, corresponds best with the second half of the Late Archaic and all of the Post Archaic sequence. The evidence from the ^{14}C dates received from multiple earth ovens show that during the second half of the Middle Period there was an increase in the need and utilization of roasted, storable plant products in the Transverse Ranges (Milburn et al. 2009). Also, this period-by-period distribution of earth ovens across the regional landscape is indicative of a long-term trend towards resource intensification (Milburn et al. 2009) which appears to have been related to more logistical land-use systems by greater numbers of people (Milburn et al. 2009). The increase in the use of earth ovens for food preparation could be one reason for the high rate of tooth wear present in the individuals from CA-LAN-361. Cooking with earth ovens would have introduced a lot of grit into the food resulting in a higher rate of tooth wear. Also, the spatial distribution of these earth ovens has implications for sedentism (see below).

Other plant resources that were local to the Tataviam and also had storage potential were the acorn (*Quercus* spp.), pine nut (*Pinus* spp.), Holly-Leaved Cherry (*Prunus ilicifolia*), Chia (*Salvia columbariae*), California Juniper (*Juniperus californica*), and Red Maids (*Calandrinia ciliata*).

The acorn, or bellota in Spanish, was the single most important plant food for many native Californian groups due to its abundance, reliability, and storability. Once the acorns were pounded into flour, leached of their bitter tannic acid, they were consumed principally in the form of cooked mush or soup (Timbrook 2007).

The One-Leaf Pinyon, Piñón in Spanish, produced very nutritious nuts (technically, seeds) that were typically roasted in earth ovens (Milburn et al. 2009) or toasted in baskets using hot coals (Timbrook 2007). The nuts could then be shelled, pounded into a fine, dry flour or toasted again and eaten whole. Tree-ripened nuts were also utilized. They were parboiled to soften them and then strung on a line for storage (Timbrook 2007).

The Holly-Leaved Cherry, Islay in Spanish, produces a cherrylike fruit. The mesocarp was consumed but the inner kernel or seed was of far greater importance. The pits of the cherry would be immersed in hot water. Once softened, the pit would be cracked open and the inner kernel removed. The dry kernel could be stored indefinitely (Timbrook 2007).

Chia produces small, oily seeds that were highly valued and nutritious and could be stored in baskets. The dried seeds were usually toasted, ground into fine flour, and then poured into water to make a kind of gruel. A thicker mixture could also be allowed to dry into cakes or loaves (Timbrook 2007).

California Juniper, Guata in Spanish, produced berrylike seed cones which were ground up into bright yellow meal which had a sweet but resinous flavor. The meal could be molded into dry, crumbly cakes (Timbrook 2007).

Red Maids, Pil in Spanish, produce quantities of small, shiny, black seeds that could be harvested and stored in large baskets in houses. The seeds could be toasted or ground for food. Other groups, such as the Kitanemuk, considered the seeds to be a delicious food and possibly used them as offerings (Timbrook 2007).

The list of storable plant foods above is in no way exhaustive of the plethora of food resources available to the Tataviam. It is merely presented, in conjunction with earth oven roasting technology, to demonstrate the availability of some major storable plant foods which inevitably would have allowed some groups of Tataviam to settle in an area (e.g. Agua Dulce) for extended periods of time, perhaps year round. Storable food items are most important to a population during poor hunting and gathering seasons. They not only act as a supplement to normal, daily subsistence but they can also alleviate food stress on a population during seasonal shortages (Vance 2009). The significant expansion of heated-rock cooking is reflective of increased populations and more sedentary patterns of resource intensification (Milburn et al. 2009).

Sedentism

In southern California complex hunter-gatherers, as opposed to mobile hunter-gatherers, have been shown to be semi-sedentary to sedentary throughout most of the year, such as the Chumash (Arnold 1996). Within Tataviam territory, the upper Santa Clara River valley, a whole range of Middle Period archaeological sites have been found from villages to rock shelters, single-component workshops to multicomponent workshops, and permanent camps to temporary activity loci (McIntyre 1990). According to Binford (1996), sites are not equal and can be expected to vary in relation to the organizational roles within a system. Some earth oven excavations have yielded no artifactual materials and have been located in association with light habitation and/or special usage (Robinson 2005) which suggests earth oven sites were temporary operational centers for task groups. These task groups would eat, sleep, and otherwise maintain themselves while away from the residential base. These logistically organized producer parties are generally seeking products for social groups far larger than themselves (Binford 1996). Therefore, most earth oven sites are temporary camps and the final, roasted products would have been transported back to the residential base where they were consumed. The Tataviam, similar to the Chumash although not to the same degree, had permanent village sites (King and Blackburn 1978). As stated in the "Cultural Background" section, archaeological and ethnohistoric information suggests that Tataviam villages varied in size from large centers with perhaps 200 people, intermediate villages containing 20-60 people, and small settlements containing 10-15 people (King and Blackburn 1978). Figure 5 shows mission period villages, post-mission settlements, and other placenames that could have been utilized during the pre-contact era as well.

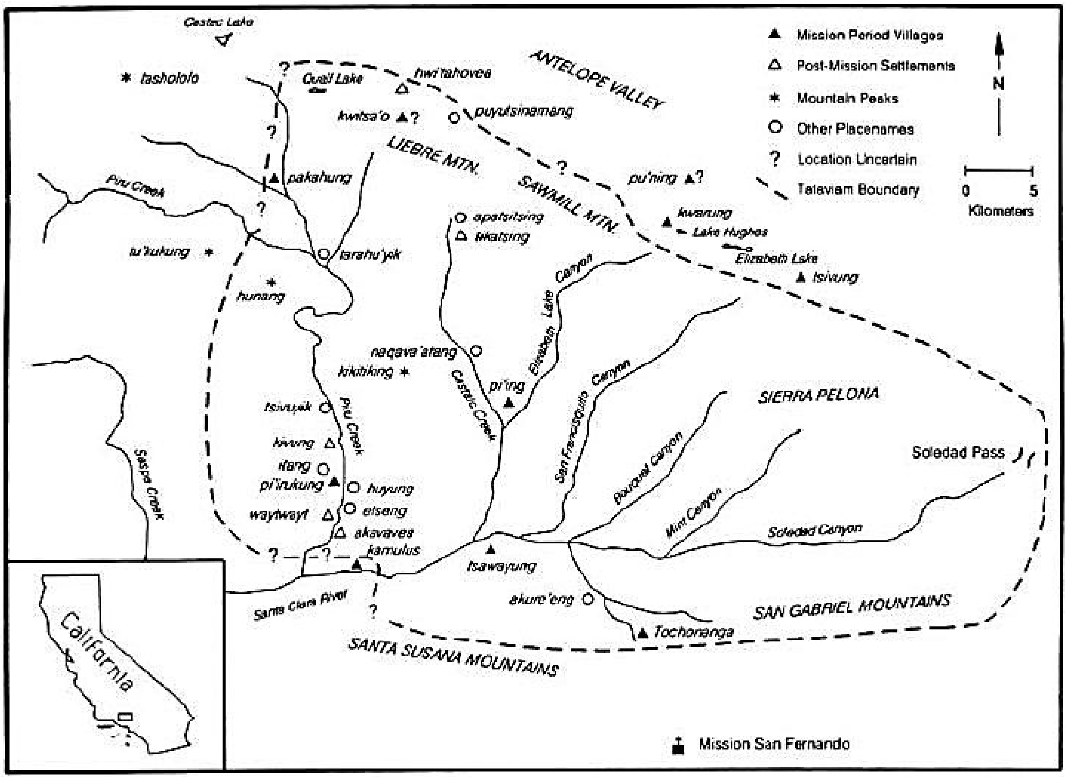

Figure 5: Map of Tataviam territory and village sites (Johnson and Earle 1990).

One of the Middle Period village sites was at Agua Dulce (see Figure 1). Based on the artifact analysis by King et al. (1974) and the concentrations of exotic items in certain cemetery areas (CA-LAN-361) of the Agua Dulce village site, there appeared to be the presence of stratified societies based on hereditary or ascribed status during the Middle Period (McIntyre 1990). Also, the village at Agua Dulce was undoubtedly a major economic center and probably a political center (King et al. 1974).

Trade and Interaction

Trade and interaction is an integral part of any aboriginal culture and was usually based on geographical and cultural factors, e.g. alliances (McIntyre 1979). "Most trade relationships cut across different environmental zones, maximizing benefits to groups with different resource bases" (McIntyre 1979:62). A trade network consists of a series of elements linked by specified exchanges of goods, behavior, and information (Plog 1977). For example, the shell beads manufactured by the Chumash on the Channel Islands have been found throughout California and even into the Great Basin of North America (Porcasi 1998). The Tataviam being a neighboring group to the Chumash and the Tongva (and other inland groups) were no strangers to trade. The presence of numerous exotic goods, such as fused shale, obsidian, other exotic stone, and shell beads, within Tataviam territory during the Middle Period indicates extensive outside contact (Love 1990). A discussion about the different exotic goods present at CA-LAN-361 and Tataviam sites in general follows. Table 3 shows a breakdown of the number of sites within Tataviam territory containing exotic materials.

Table 3			
Exotic Elements Within Each Site			
Element	Number of Sites	% of Total Sites with Exotics	% of Total Sites
Obsidian	43	65.2	12.8
Fused Shale	26	39.4	7.8
Beads	21	31.8	6.3
Desert Chert	8	12.1	2.4
Shellfish	10	15.2	3.0
Steatite	26	39.4	7.8

Table 3: Type of exotics found within Tataviam sites (Caruso 1988:132).

Lithic Materials

Two of the most critical exotic materials for the Tataviam, obsidian and fused shale, have not been located in any formations within the area inhabited by the Tataviam (Caruso 1988). Analysis of obsidian trade networks and chemical sourcing of obsidian recovered from CA-LAN-361 by Caruso (1988) has shed light on an important aspect of Tataviam lifeways during the Middle Period; trade for exotic lithic materials. Obsidian has been recovered from a number of Tataviam sites including the cemetery at CA-LAN-361 in the form of debitage and complete and broken tools such as projectile points and knives (King et al. 1974). All of the obsidian recovered from the site that was subject to chemical analysis has been sourced to the Coso Range with the exception of one piece originating from Casa Diablo (Caruso 1988). The Coso Range source is located approximately 200 km (120 miles) to the northeast of Vasquez Rocks. The Casa Diablo source is located south of Mono Lake approximately 350 km (225 miles) to the north of Vasquez Rocks (Figure 6).

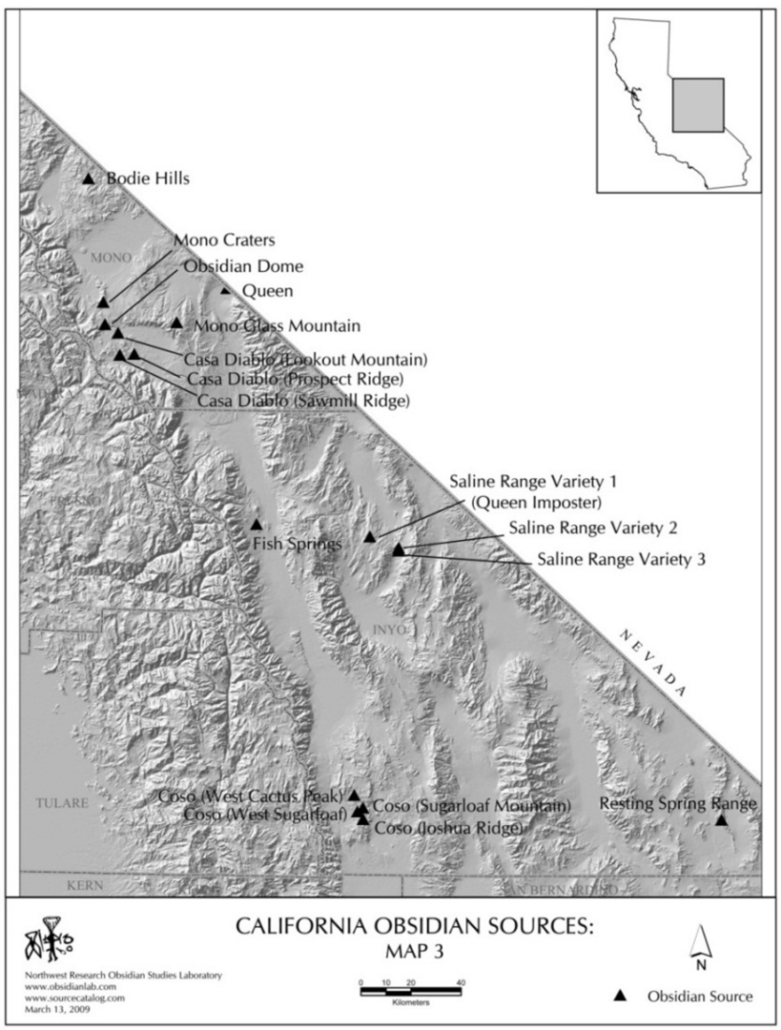

Figure 6: Coso and Casa Diablo obsidian sources (Northwest Research Obsidian Studies Laboratory 2009)

These distances are the shortest routes between Vasquez Rocks and the obsidian sources. It is no doubt that prehistoric traders would have had to travel an even farther distance in order to bypass mountain ranges and other natural obstacles. It is unclear if the Tataviam exploited this resource at its source or if it was brought to them by traders, as nuclei, cores, and/or finished pieces. One thing is clear and that is the Tataviam in and around Vasquez Rocks purposefully sought out this highly valuable material. The organization of trade and labor for obtaining this material may have been delegated to individuals in managerial positions.

Fused shale is a natural glass which occurs in the Oak Ridge area of the Transverse Ranges of southern California (Singer 1986). For about 9,000 years fused shale was used by native Californians for the manufacture of small, chipped stone tools and implements, primarily projectile points (Singer 1986). One of the two sources of fused shale, Grimes Canyon, is located just south of the Santa Clara River, opposite the present town of Fillmore, about 35 km (22 miles) from the Pacific Ocean (Singer 1986). Fused shale has been recovered from not only the burial mound but from the larger Vasquez Rocks village complex (King et al. 1974; Caruso 1988); however, in less frequency compared to obsidian which is typical of Middle Period sites (Caruso 1988). It wasn't until the Late Period that fused shale frequencies increase with a corresponding decrease in obsidian frequencies (Caruso 1988). The presence of fused shale at Tataviam sites and the fact that fused shale probably became a valuable material and entered a developing exchange system which linked the interior and coastal regions of southern California (Singer 1986) could indicate Tataviam inclusion in the trade networks and possible exploitation of labor by elites to obtain this material.

Schist (soapstone, also known as steatite) has been recovered from CA-LAN-361 in the form of beads, pipes, and plaques (King et al. 1974). There are multiple sources in southern California from which the Tataviam could have obtained raw schist materials including Sierra Pelona, Santa Cruz Island, Catalina Island, Mt. Laguna, Cuyamaca, and Jacumba (Eddy n.d.). Large (>4.6mm) and small (<4.6mm) hard schist disc beads dominated the bead assemblage at Vasquez Rocks during the Middle Period (King et al. 1974; Eddy n.d.). King (1990) states that east of the Santa Barbara Channel chlorite schist beads were used more frequently than shell beads and that the center of distribution of schist beads appears to be in an area occupied by Uto Aztecan speakers. King has argued that Sierra Pelona schist was heavily utilized by surrounding southern California groups (Eddy n.d.). Eddy (n.d.) has stated that more studies involving chemical analysis on schist beads from numerous areas within the southern California region are needed to better understand the exchange and networks of trade of schist artifacts. The fact that the Sierra Pelona source lies within Tataviam territory and is approximately 10 km (6 miles) to Vasquez Rocks could have implications for the Tataviam maintaining control of trade interactions with outside groups. If indeed Sierra Pelona was the dominant source of schist for the manufacture of stone beads during the Middle Period then the Tataviam would have been heavily integrated into the trade networks and interaction spheres which would have required individuals in managerial positions to oversee the trade and procurement of this resource by outside groups. Figure 7 shows the different southern California stone bead types present during the late Early Period (Ez) and the Middle Period (M1 and M2a).

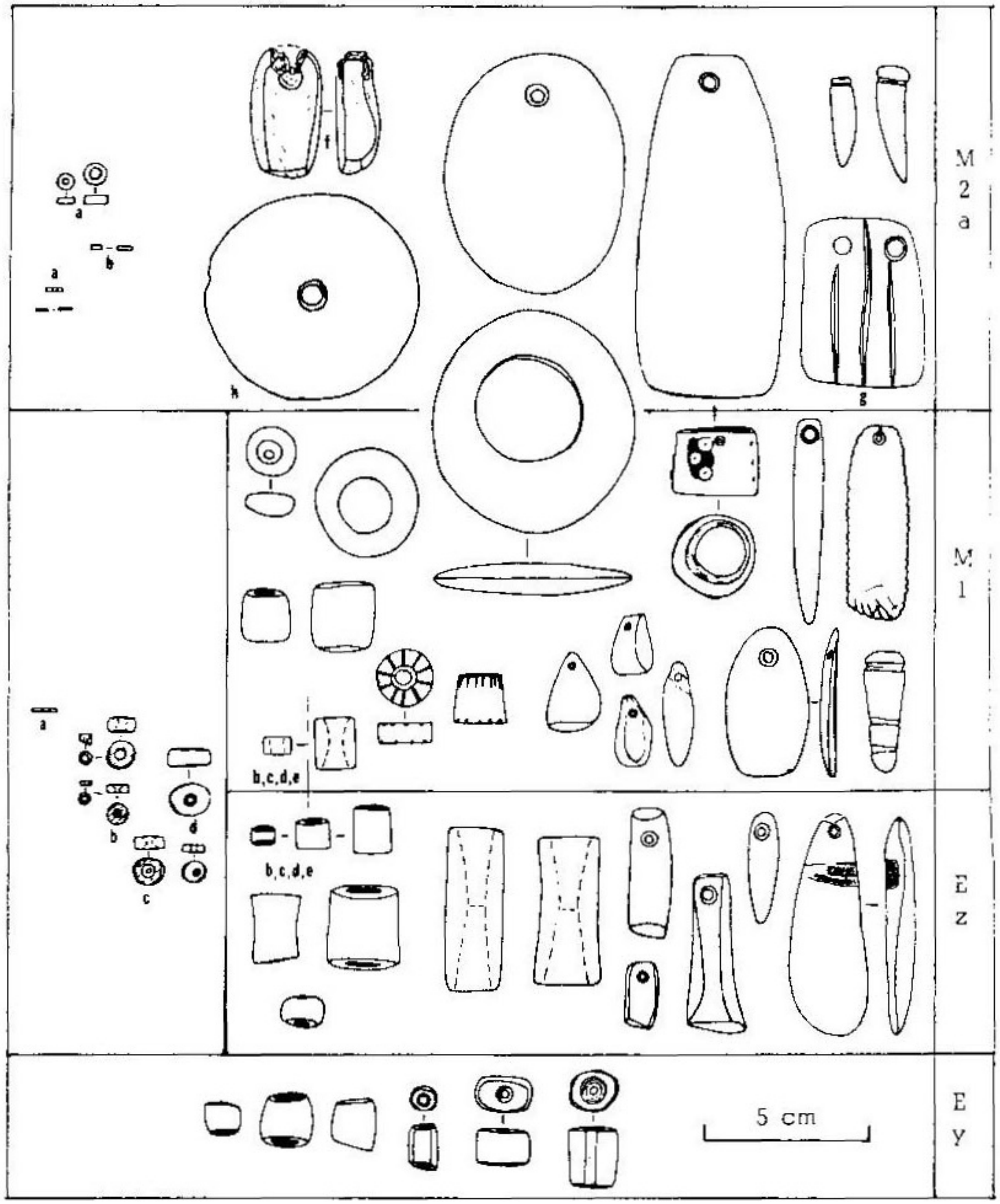

Figure 7: Diagram of stone bead types from southern California (King 1990). The late Early Period (Ez) and the Middle Period (M1 and M2a) is when hard schist disc beads, like those recovered from CA-LAN-361, were utilized.

Shell Beads

Shell beads have been found at numerous sites in Tataviam territory. A total of 21 sites (6.3%) from Caruso's (1988) research contained beads (shell and/or stone; see Table 3). Shell beads were imported from the Chumash (Caruso 1988) and possibly from the Tongva. Figure 8 shows the different southern California shell bead types and materials from throughout the Holocene. Most important to this research are the *Olivella biplicata* shell bead types from the late Early Period and the early Middle Period.

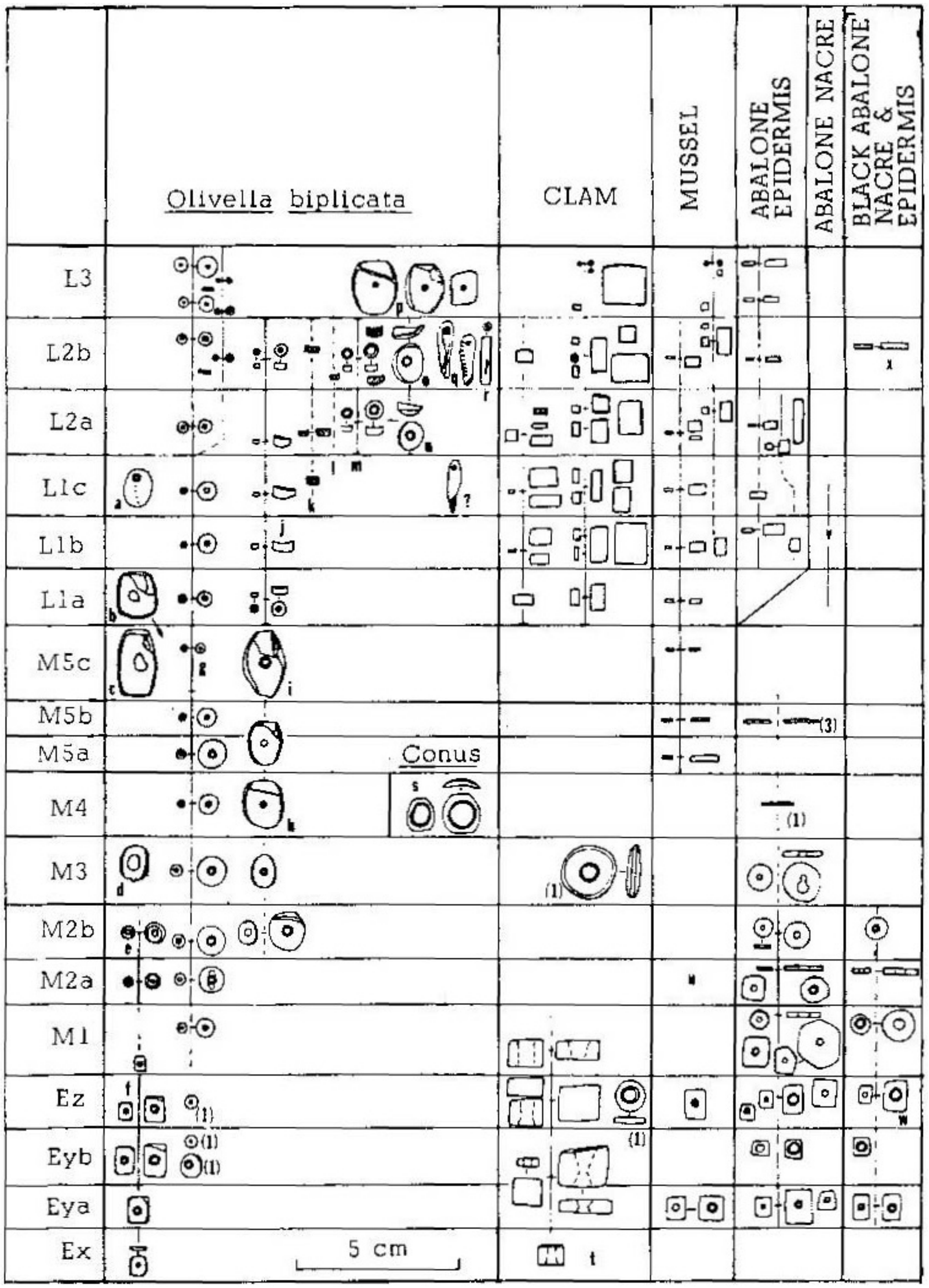

Figure 8: Diagram of shell bead types from the Chumash of southern California (King 1990). The late Early Period (Eyb and Ez) and the early Middle Period (M1) is when rectangular *Olivella biplicata* beads (N class) were most common.

King (1990) mentions the presence of rectangular *Olivella biplicata* shell beads (N class) at CA-LAN-361. Porcasi (1998) also reported grooved rectangular beads recovered from Little Harbor, Catalina, similar to those found in association with fired clay objects dating from the Early Period to the beginning of the Middle Period present at CA-LAN-361 (King et al. 1974). King (1990) states that rectangular *Olivella biplicata* shell beads were more common in the Early Period and continued to be used at the beginning of the Middle Period as a rare type. Shell beads have also been found at sites within the Agua Dulce village complex and other sites within its vicinity (King et al. 1974). The presence of shell beads, as well as other items, indicates extensive outside contact (Love 1990). The presence of shell beads at various sites within the Agua Dulce village complex, and other Tataviam sites, could have broader socioeconomic implications for the population living there. The organization and maintenance of the trade for shell beads would have required individuals holding managerial positions.

Marine Resources

Shellfish and fish remains have been discovered at only a few sites within Tataviam territory including CA-LAN-361 (Caruso 1988). The dominant type of shellfish recovered from CA-LAN-361 was *Haliotis* (abalone) (King et al. 1974). The presence of marine resources at this inland site has implications for trade, labor relationships, and ascribed leadership. The presence of shellfish at so few sites within Tataviam territory makes their presence at CA-LAN-361 that much more important. It is commonly assumed that differences in socioeconomic status ought to be reflected in differential access to food resources (Crabtree 1990) along with other lines of evidence supporting the case for ranked societies. A fundamental problem to be addressed in attempting to identify status differences from faunal remains, in this case fish and shellfish, is determining what kinds of faunal data are most likely to reflect socioeconomic status (Crabtree 1990). It is assumed that the more exotic and costly it is to obtain a resource, the higher the amount of value is placed on that item. Marine fish and shellfish would have been very costly to obtain for the Tataviam. The shortest overland, straight line route from Vasquez Rocks to the Pacific Ocean is at best 50 km (34 miles). The Tataviam would have had to traverse mountain ranges and other natural obstacles making the journey to the coast even farther. They also would have had to pass through foreign territory in order to gain access to the coast (see "GIS Analysis of Tataviam Coastal Trade Route"). It is unclear whether marine resources were brought to them by the Chumash or Tongva or if they procured the resources themselves. Organizing parties to the coast in order to harvest marine resources would have required careful planning by people in ranked positions and the access to these marine resources, once harvested, may have been limited to members of the upper classes (Crabtree 1990).

Clay Artifacts

Fired clay artifacts have been discovered at CA-LAN-361 which could be linked to similar fired clay objects from Little Harbor, Santa Catalina Island (Porcasi 1998). These fired clay objects appear to be linked to a similar ceramic technology coming to light at some southern California mainland coastal sites, especially in Orange and Riverside counties directly east of Santa Catalina Island (Porcasi 1998). If this is indeed the situation then the Little Harbor collection of fired clay artifacts supports the concept of a dynamic Middle Holocene socioeconomic interaction sphere connecting the southern Channel Islands and the mainland (Porcasi 1998). The geographical and temporal relationships of the sites yielding Middle Holocene ceramics generate questions as to where the crafts originated and whether a single but widespread cultural group produced the artifacts, or if the presence of these artifacts reflects interaction between neighboring but unrelated peoples (Porcasi 1998). The presence of these fired clay objects within the burial context suggests that these items were exotic, valuable items possibly having some political, religious, or ideological significance. It is impossible to know the true meaning or significance of these baked clay effigies pending further research but for now it is clear that they are clearly associated within the burial context. These clay artifacts along with the rest of the artifact assemblage promote the idea that this cemetery was indeed reserved for high ranking individuals.

Rock Art

Vasquez Rocks and the surrounding Tataviam region are home to numerous pictographs, petroglyphs, and cupule sites. This discussion of Tataviam rock art is not meant to provide any new interpretation to the meaning or significance of rock art but rather to provide examples of Tataviam rock art in and around the Vasquez Rocks area as it pertains to increasing social complexity. Figure 9a-d are examples of rock art at Vasquez Rocks.


Figure 9a: Red ochre fingerprint designs.


Figure 9b: Red ochre sun.

Figure 9c: Red ochre anthropomorphic figure.

Figure 9d: Black and red ochre anthropomorphic figure.

Two distinct styles of rock art are present at Vasquez Rocks: one is incised into a red-ochred surface and the other is painted. This style of rock art is not unique; there are similar examples in Kawaiisu and Chumash territory (Lee and Hyder 1991). The stylistic similarity in rock art between southern California native groups, and the evidence of inter-group trade, could indicate a sphere of similar religious or ideological beliefs. The majority of the rock art in the Vasquez Rocks area has been found within the Agua Dulce village complex (King 1981) which could have implications for labor relations. The locations of rock art could have been used to signify a person's claim to a particular resource (e.g. water, plant resources, etc.). Whether these claims were based on lineage or not is unknown but rock art could be property markers indicating the control of resources by high status individuals or families. Also, the implications of the rock art at Agua Dulce being associated with the summer and winter solstice (Rafter 1994) could indicate shamanistic ritual. These rituals could have been associated with a high status religious cult or lineage that had spiritual powers and/or knowledge of the universe.

Conclusions

From this synthesis of recent literature I have tried to demonstrate that at least some of the conditions, consequences, correlates, and causes for the institutionalization of labor and ascribed hierarchies (see Arnold 1996) were present in and around Vasquez Rocks. Clearly, the need for more research exists and perhaps no formal conclusion can be drawn from the examples I have provided in this chapter; however, this information complements the funerary study and not only draws a bigger, more detailed picture of Tataviam lifeways but it also helps to support the claim that CA-LAN-361 was indeed a cemetery reserved for high ranking individuals with managerial positions of power.

Section 6

GIS Analysis of Tataviam Coastal Trade Route

One of the research objectives for this study was to propose a route to the coast from which the Tataviam could access the coastal, rocky shore environments to harvest shellfish and through which group's territory they would have had to pass. Through the use of Geographic Information Systems (GIS) I propose a trade route to the coast based on a path of least resistance (elevation). To this day archaeologists mainly use GIS to create basic maps and conduct basic data manipulation; however, there are few examples of archaeologists using GIS to its fullest potential (see Kantner 1997) despite the huge number of analytical tools incorporated into the software and the growing user ability of the software. This is an attempt to not only incorporate some GIS analysis into this research but to also show that GIS can be used in archaeological analysis and not just for creating maps.

Methodologies

The analysis was conducted using ArcGIS Desktop 10© and included both raster and vector data. Various steps including data collection, data preparation, and data analysis, incorporating numerous tools, were conducted in order to complete this analysis.

Before any analysis could be conducted the appropriate data had to be collected. Raster Digital Elevation Models (DEM's) appropriate to the study area (Santa Clara River watershed and coastal southern California) were downloaded from the USGS Seamless Server. Next, rocky shore data were downloaded from the U.S. Fish and

Wildlife's National Wetland Inventory. The final step in data collection was to obtain UTM coordinates for Vasquez Rocks at Agua Dulce from Google Earth.

Next, the data had to be prepared before the actual analysis could occur. The DEM's were combined using the "Mosaic" tool so there was only one DEM as opposed to two which would make analysis easier. Next, the "Clip" tool was run to remove the ocean from the DEM's. This would exclude the ocean when the "Cost Path" tool was executed. Then, the "Slope" tool was run on the mosaiced DEM's to create a new raster based on slope which would be used in the final analysis. Next, the UTM coordinates of Agua Dulce were plotted on the DEM. Finally, the "Select by Attributes" tool was used to select out the rocky shore zones from the rest of the wetland data along the southern California coastline. Six different zones of exploitable rocky shore habitat were created based on clustering as final destinations of the trade routes.

Finally, with the data collected and prepared analysis could begin. The "Cost Path" tool requires two additional raster layers: (1) the Cost-Distance Raster and (2) the Cost Back Link Raster. These rasters were created using the slope raster. Next, using the Cost-Distance Raster and the Cost Back Link Raster, the "Cost Path" tool was run from the source (Agua Dulce) to each rocky shore destination (a total of six times) in order to determine the most likely route to the ocean based on slope. Finally, the "Hillshade" tool was run on the DEM and the six different paths to the ocean were symbolized. Figure 10 is the generated map showing the possible utilized routes to the coast.

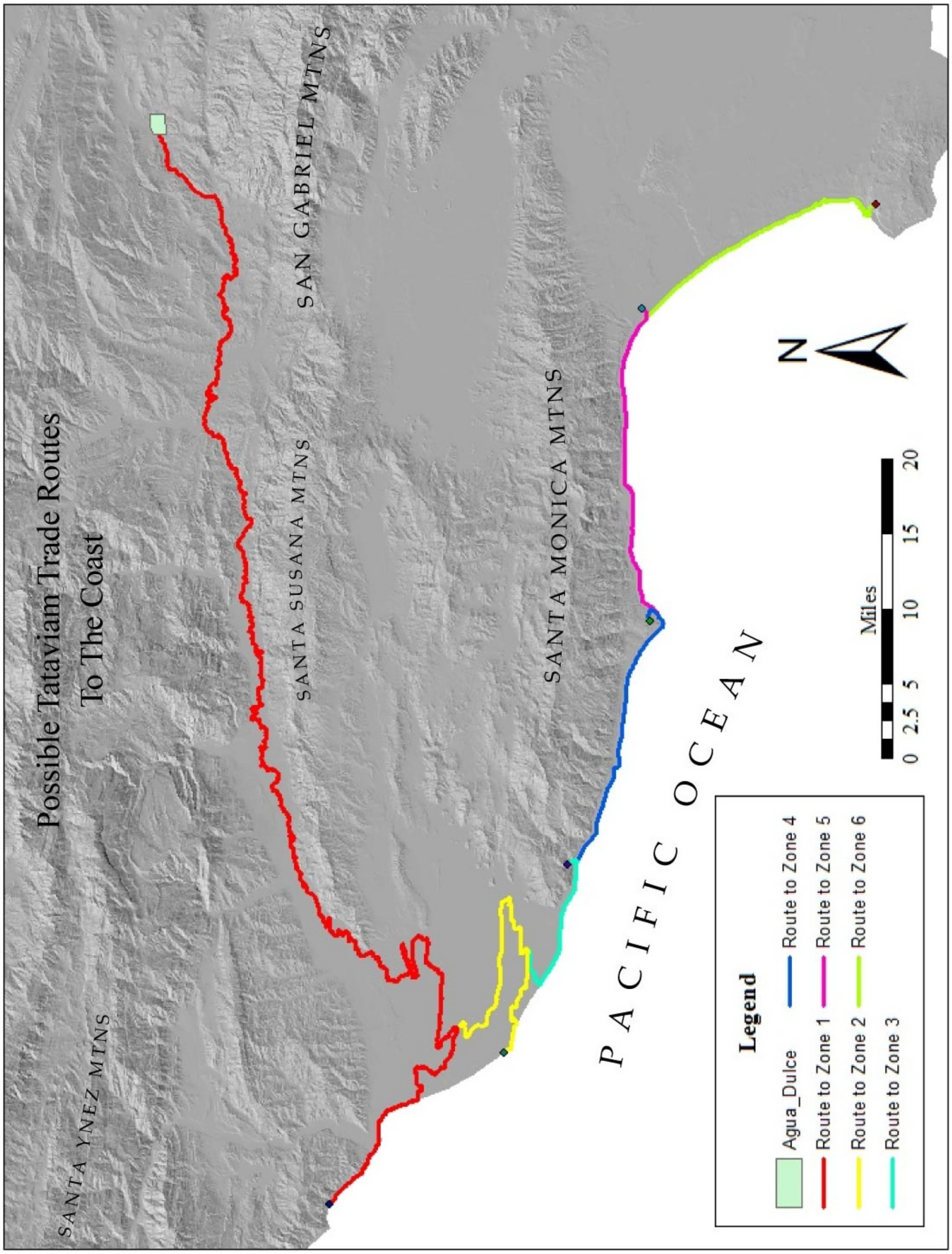

Figure 10: Least Cost Path analysis of possible trade routes to the coast utilized by the Tataviam.

Discussion

It is possible that the Tataviam might have utilized a more direct southern route to the coast that went up and over the San Gabriel Mountains and the Santa Monica Mountains in order to save a little bit of distance on their round trip. However, one must consider intergroup relations, territorial boundaries, and natural barriers and not just the shortest distance to an exploitable resource when discussing trade routes. If this map is accurate then the Tataviam would have made their way down, what is now, the Santa Clara River leading them out of the San Gabriel Mountains, bypassing the Santa Susana and Santa Monica Mountains, and into the alluvial floodplain of the river. From here the Tataviam could have fanned out and gone north or south to the different areas of rocky shore habitat along the Pacific coastline.

It seems appropriate to suggest that trade routes would have been influenced somewhat by the intergroup relationships of neighboring tribes. For the Tataviam "the presence of north-south enmity and east-west amity relationships similar to those found throughout southern California in protohistoric times seems likely" (King and Blackburn 1978:536). These relationships may have influenced the Tataviam to capitalize on their east-west trade routes and abandon the use of any north-south routes. The proposed route from this GIS analysis supports the east-west amity and north-south enmity relationships. Traveling through Chumash territory would have presented fewer risks than going south through the mountains through Tongva territory.

A possible source of error that needs to be addressed in this analysis is the use of current data in the analysis of prehistoric behavior. The DEM's that were obtained were from recent satellite imagery and probably do not reflect what the landscape, in regards to slope, looked like back during the Middle Period. Historically humans have changed and shaped the landscape in order to better suit their needs and southern California is no exception. Another thing to consider are the rocky shore data. Some of the rocky shore habitat data was excluded because clearly it had been recently formed with the construction of jetties. Basically, the rocky shore habitat that was used for this analysis may not reflect the same habitats that were present during the Middle Period. Finally, it is impossible to perfectly model prehistoric human behavior with a computer program. Regardless of how many variables one uses in an analysis, GIS will not produce perfect models. It is possible that the Tataviam utilized a completely different route to the coast that we cannot determine through the archaeological record let alone GIS.

Conclusions

From this analysis one can see that the Tataviam might have utilized what is now the Santa Clara River as a route to the Pacific Ocean. Traveling downstream of a perennial river into friendly territory would have provided many benefits as opposed to traveling up over the mountains into potentially hostile territory. Clearly, this analysis of Tataviam trade routes was based on one variable, the path of least resistance (slope) and in order to gain an even better insight into trade routes it would be best to incorporate numerous variables. Possible variables to be included in a more in-depth analysis could be: productivity of each rocky shore zone, shortest path as opposed to easiest path, water and food resources available along different routes, etc.

This analysis of Tataviam trade routes to the southern California coastline is a good example of how GIS can be utilized in the field of archaeology in a way that involves more than just producing maps. It is important and in my opinion the responsibility of cultural resource managers and academics to utilize current technology and resources in order to keep archaeological methods from becoming stagnant and esoteric. GIS is an important and growing field and by training archaeologists in this program we can hopefully provide a more holistic approach to archaeology.

Section 7

The Site

CA-LAN-361 is located in what is now Vasquez Rocks County Park in Agua Dulce, California. The site lies within what is regarded as the Agua Dulce village complex and directly west from the famous Vasquez Rocks formation that has been the backdrop for many Hollywood features throughout the years. The town of Agua Dulce itself has a population of around 3,500 and lies at an elevation of 770 m (2,526 feet).

CA-LAN-361 was recorded in 1969 by Herrick E. Hanks. The original site record can be found in Appendix A. It was designated as a cremation-burial site on top of a knoll (Figure 11) with possibly two levels of burials; the first level supposedly consisting of cremations and the second level consisting of primary and secondary internments. The site record does not explicitly say if level 1 was above level 2 or vice versa.

Image Redacted

The land was originally owned by Dr. Ascher and his children spent many years digging through the site until 1966 when it was bulldozed by vandals (King et al. 1974). Apparently there have been many episodes of looting and vandalism at Vasquez Rocks throughout the years. An example of the degree of looting that has occurred is a documented case where a man with a bulldozer who said he was Dr. Charles Rozaire (who had been excavating sites in the area with the California State University, Northridge Archaeological Field Class) bulldozed CA-LAN-361 looking for artifacts, practically destroying the site in the process (Wessel 1977, cited in McIntyre 1979). Figure 12 shows the extent of the bulldozer damage to the site.

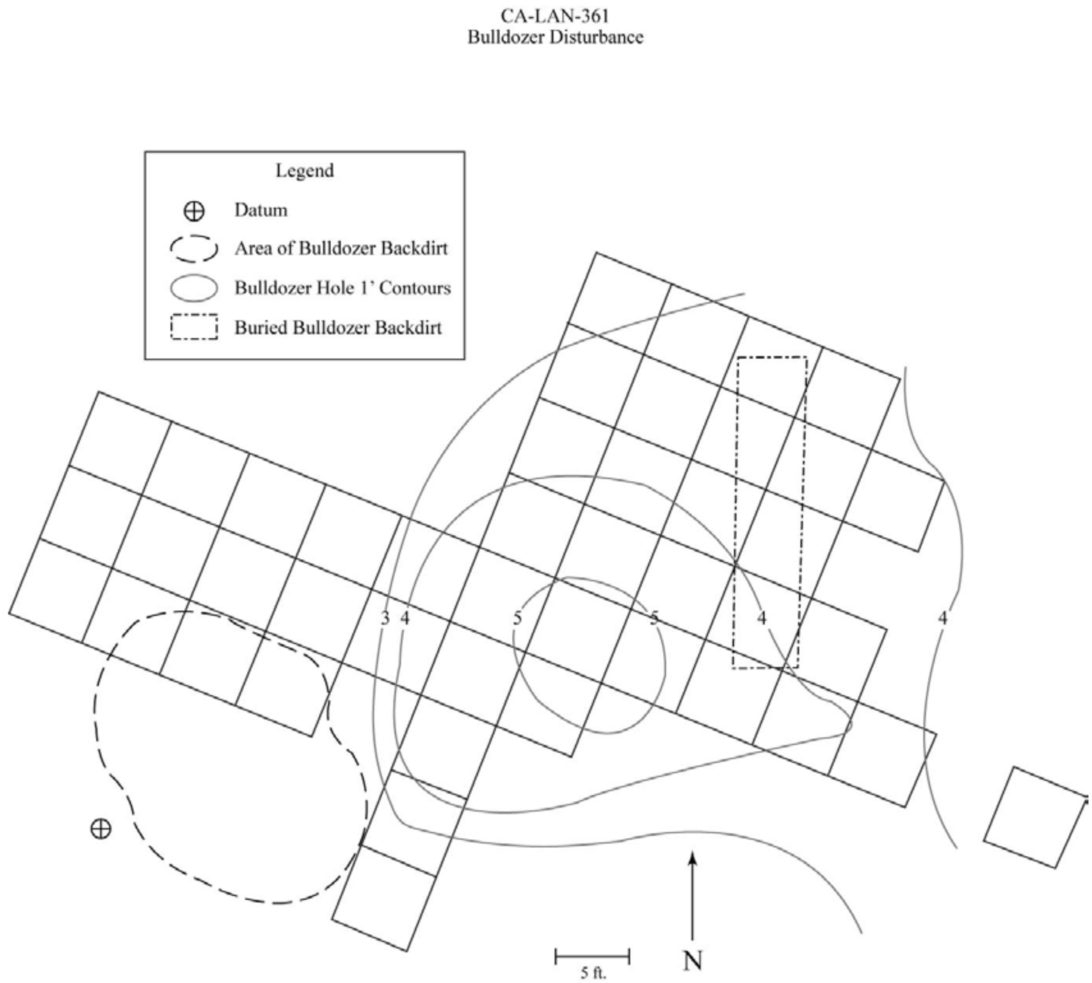

Figure 12: Bulldozer disturbance at CA-LAN-361 (adapted from King et al. 1974).

Following the bulldozer disturbance multiple field schools from 1967-1970 lead by the aforementioned Dr. Charles Rozaire excavated the site and recovered multiple burials. Unfortunately, due to the damage done by the bulldozer and the inexperience of the students working at the site, many artifacts, including human remains, were discarded, field notes were poorly written, and proveniences were recorded incorrectly or lost completely (King et al. 1974). Much of the unearthed material is presently curated at the Natural History Museum of Los Angeles (NHMLA) and the California State University Northridge Curation Facility.

A grid system of excavation units was laid out over the knoll with an apparently arbitrary x-axis interval designation of E through M and a y-axis interval designation of 99 through 111 (e.g Unit 105J). A total of 44 units were excavated to a maximum depth of 42".

Most of the information regarding the artifact assemblages at CA-LAN-361 and the overall social organization of the area is found in the "Archaeological Report Related to the Interpretation of Archaeological Resources Present at Vasquez Rocks County Park" by Chester D. King et al. (1974) and will be discussed and expanded upon in a later section.

Date Range

According to King et al. (1974), CA-LAN-361 represents a cemetery that was utilized during the Middle Period of the Holocene. The date range for the Middle Period spans from approximately 1400 B.C. – A.D. 1150. This conclusion was drawn from the artifact assemblage typologies (King et al. 1974), dates from obsidian hydration readings (Caruso 1988; see Table 4), and one radiocarbon date (1,390 ± 60 yr B.P.) from a human bone collagen sample (Berger and Protsch 1989; Breschini et al. 1990) from the site. However, some of the Late Early Period artifacts present (e.g. rectangular shell beads, hard schist beads, clay artifacts) and two obsidian hydration readings dating to the Early Period, it is possible that this cemetery was utilized as early as the Early/Middle Period transition.

Table 4					
Date Ranges Obtained From Obsidian Hydration					
Site	Date Range	# of Samples Per Period	Source	Microns	Date
CA-LAN-361	2315 B.C. - A.D. 506	1 Unknown	Coso	4.3	A.D. 506
		6 Middle Period	Coso	6.0	79 B.C.
			Coso	8.0	767 B.C.
			Coso	6.9	389 B.C.
			Coso	6.2	148 B.C.
			Casa Diablo	6.0	1424 B.C.
			Coso	9.0	1111 B.C.
		2 Early Period	Coso	10.3	1558 B.C.
			Coso	12.5	2315 B.C.

Table 4: Date ranges obtained from obsidian hydration analysis (Caruso 1988).

Non-Human Artifact Assemblage

According to King et al. (1974), CA-LAN-361 contains many artifacts that are representative of Middle Period sites in California. The artifacts found at the site include but are not limited to, stone tools including projectile points and knives, lithic debitage, manos, metates, shaped mortar fragments, shell and stone beads, baked clay effigies, plaques, stone pipes, quartz crystals, terrestrial and marine faunal remains, etc. Examples from the artifact assemblage recorded by King et al. (1974) can be found in Appendix B.

The presence of various ornaments (stone beads), religious objects (baked clay effigies and quartz crystals), and utilitarian objects (projectile points, knives, manos, matates, mortars, and pestles) within the context of the cemetery have wider implications for possible high status burials and greater social organization (Gamble et al. 2001).

The classification of religious objects is based on Chumash ethnographic evidence; that the use of these objects was confined to religious activities whose goal was to mobilize and control supernatural powers or natural forces (Gamble et al. 2001).

Because CA-LAN-361 was not fully excavated and was badly damaged by vandalism, King et al. (1974) use a related, contemporaneous, high status burial site, CA-LAN-324 (see Loetzerich 1998), to describe the internal organization present at CA-LAN-361. Based on similar artifact assemblages and distributions between the two contemporaneous sites, King et al. (1974) believe CA-LAN-361 represents a high status burial ground where managerial positions were ascribed.

Faunal remains are not discussed in any great detail in King et al.'s 1974 report; however, along with the human remains in the CSUN curation facility were multiple bags containing a large number of burned and unburned bone fragments from the site (see Figure 13a). Whether or not the faunal remains were in direct association with the burials is unknown. Among the faunal remains present, the only identifiable pieces were bear metapodials of unknown species (Figure 13b). Present among the burned and unburned bones were small, medium, and large mammals. King et al. (1974) state that "burned bone was more common than unburned bone in all excavation units". What implications this has for human cremation or some type of mourning ceremony cannot be inferred from the burned mammal bone lacking proveniences. Most of the burned bone is grey-blue to white in color meaning that it was most likely exposed to a temperature of 600-1100°C, depending on the cremation environment (Walker and Miller 2005).

Some marine resources were present with the human remains as well. Multiple fish bones and marine shell fragments were present with the curated burials (Figures 13c and 13d). Identification of the marine shell to the species level is outside the scope of this project; however, they are most likely resources obtained from the rocky shore areas found throughout coastal southern California. The only marine shell identified by King et al. (1974) was *Haliotis* which was highly utilized by prehistoric California coastal groups. Also present were saltwater fish vertebrae of an unknown species and size.

Figure 13a: Assorted burned and unburned faunal remains.

Figure 13b: Medium to large mammal (bear) metapodials.

Figure 13c: Fish remains.

Figure 13d: Shellfish remains.

Human Remains

As mentioned above, multiple burials were recovered during the field school excavations. All the spatial and depositional information regarding the burials has been deduced from Map 21 of King et al.'s (1974) report and reproduced in Figure 14. It is unclear whether King et al. drew the map after reading Rozaire's field notes or if King et al. were present during the excavations. According to the map, some of the burials could be primary deposition, in a flexed position, or they were secondary deposition. Primary deposition is defined as the deposit of the body in the site where the decay will take place. Secondary deposition is defined as bones being brought to the spot where they have been discovered (Duday and Guillon 2006). The fact that some of the burials contain small bones (e.g. phalanges, hyoid, etc.) that more often wouldn't be present in the secondary burial context and that other burials consist of only a few larger, long bones may indicate that the site consists of both primary and secondary burials.

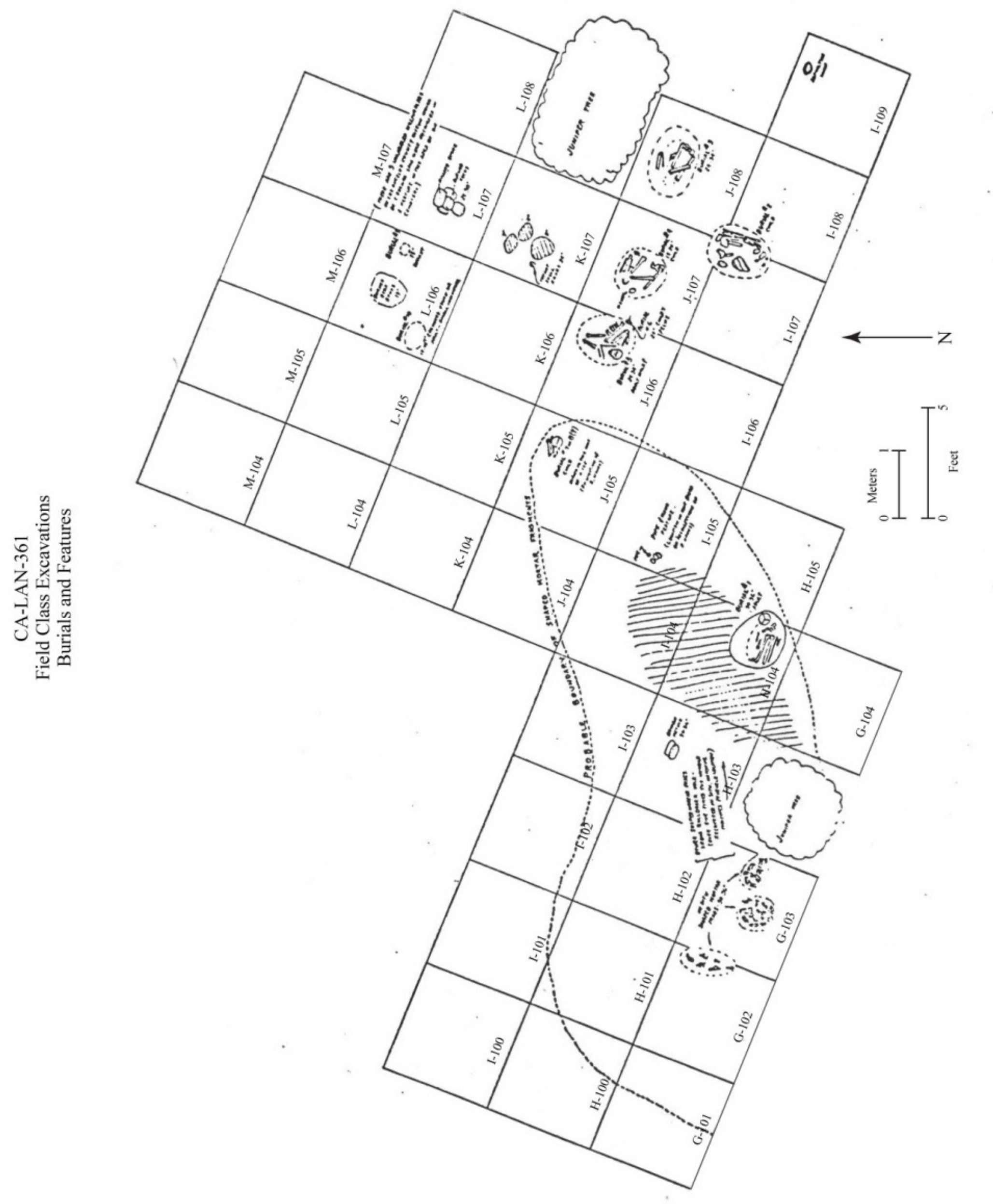

Figure 14: Map of human burials and features (adapted from King et al. 1974).

As stated before, many of the proveniences for the burials were lost or incorrectly recorded on the burial forms. Table 5 shows the known provenience and depth for each individual (Individuals are designated according to the present study; see below).

Table 5		
Known Proveniences and Depths		
Individual	Provenience	Depth (Inches)
Neonate #1	106J	24-30
Neonate #2	107K	24-30
Neonate #3	Unknown	Unknown
Juvenile #1	107I/108I	Unknown
Juvenile #2	107J	Unknown
Juvenile #3	Unknown	Unknown
Juvenile #4	Unknown	Unknown
Juvenile #5	Unknown	Unknown
Juvenile #6	Unknown	Unknown
Juvenile #7	Unknown	Unknown
Juvenile #8	105J	24-30
Juvenile #9	106J	24-30
Juvenile #10	Unknown	Unknown
Juvenile #11	Unknown	Unknown
Adult #1	108J	Unknown
Adult #2	Unknown	Unknown
Adult #3	106J	24-30
Adult #4	104H	30-36
Adult #5	Unknown	Unknown
Adult #6	Unknown	Unknown

Table 5: Known proveniences and depths as inferred from King et al.'s (1974) burials and features map (Figure 14).

According to Caruso (1988), a pattern of secondary interments, cremated with offerings of material items such as broken or "killed" bowls, millingstones, stone beads and other items was commonplace during the Middle Period (1400 B.C. – A.D. 1150). If this is true then secondary burials and the associated artifacts should be present at this Middle Period cemetery. However, the absence of cremated, secondary interments at the cemetery could challenge this statement or it may mean that in fact the site consists of two levels of burials.

Other than King et al.'s (1974) report, a few burial forms accompanying the remains, and some field notes at the NHMLA, I was unable to track down any other available information regarding the site. There are neither data on artifact assemblages for each unit or data on any bioarchaeological analysis conducted on the remains.

Section 8

The Curated Collection

The curated collection from CA-LAN-361 is currently housed in two separate locations. Both the Natural History Museum of Los Angeles County and California State University Northridge have parts of the collection. The Natural History Museum of Los Angeles (NHMLA) is in possession of all the non-human artifacts including grave goods and field records from the various excavations conducted in the late sixties and early seventies while California State University Northridge (CSUN) has in its possession all of the human remains exhumed from the site with little to no records accompanying the remains. The reason for having the remains housed at two different facilities is unknown.

The collection housed in the CSUN Curation Facility consists of seven boxes of human remains. Each box contained at least one individual and oftentimes two or more. Upon a primary inspection of the boxes it was noted that the remains were very poorly curated and in a state of disorder, much of the original provenience information for each burial was missing, and many of the individuals from different burials were mixed together. Accompanying many of the bags of bones is a Burial Record Form from the Center for Public Archaeology at CSUN [currently the Anthropological Research Institute (ARI)].

Unfortunately, these forms were not completed and/or lack even basic provenience information. It is unclear whether these forms were completed upon discovery of each burial or if they were filled out after the fact. What is clear is that the forms are of little to no help and the information they do provide is oftentimes incorrect.

For example some of the forms have identical burial numbers and it is not noted when two or more individuals were present in one burial or excavation unit. Upon further inspection it was obvious that poor excavation techniques, recording, and boxing of the remains were partially to blame for the poor state of the remains. Also, it was noted that an initial analysis of the bones was conducted at one point (some of the bones had been glued together and have proveniences written on them) but was obviously abandoned before completion. It is important to consider the excavation methods and the treatment and retention of this collection when assessing and interpreting the collected data (Delaney-Rivera 2001). The NHMLA supposedly took all the non-human artifacts for their Vasquez Rocks display. However, a few artifacts were discovered in small plastic bags with some of the skeletons. Accompanying some of the human remains are lithic materials and faunal and marine remains of unidentified species.

After the initial inspection of the collection I was rather disheartened to find the remains in such a poor state of preservation and the daunting task of organizing and inventorying the bones seemed overwhelming. Trying to piece together a collection that had been sitting on the shelves of the curation facility for over 30 years seemed like a daunting task. However, this project has proved beneficial for several reasons.

First, this collection has vastly increased my knowledge of the processes of bone identification (whole and partial bones), age estimation, discrete traits, and taphonomy. As opposed to researchers working with properly curated collections containing complete skeletons with proper identification, plenty of written records, and who are able to immediately focus on their topic of interest (e.g. tooth wear analysis, paleopathologies, nonmetric traits, etc.), I have had to piece back together a collection of poorly curated, mixed up, partially decomposed remains, lacking proper documentation before any form of analysis could even begin. Although stressful at times the exercise has proven to be worthwhile.

Second, the analysis of this collection and the possible repatriation of the remains to the Fernandeño Tataviam Band of Mission Indians will help alleviate the curation crisis. CSUN is experiencing a shortage of space in their curation facility just like many other facilities around the U.S. (Bawaya 2007). The curation crisis is not new, but the problem has been exacerbated by the sheer volume of collections and documents generated by government-funded archaeology (Marquardt et al. 1982). And as researchers we have an ongoing professional obligation to follow through with the scientific study of human remains that have been curated during this NAGPRA era (Arnold and Green 2002). NAGPRA not only helped to create government-funded archaeology but it also gave previously disenfranchised groups a say in what happens to the human remains of their ancestors (Larsen and Walker 2004). Also, analyzing repository collections can add to more recent collections to help address contemporary research questions (Delaney-Rivera 2001). The simple fact of the matter is that there has been very little research conducted on the Tataviam, as opposed to their coastal neighbors the Chumash. The data set that will be created from these remains will add to the small amount of data already available for this group and will also be available for future research.

It should also be noted that the housing and study of Native American remains is a contentious issue. The study and holding of human remains by archaeologists is often viewed by Native American communities as sacrilege and a way in which native groups are still oppressed by the white man (Walker 2004). NAGPRA has opened up the possibility for increased communication between Native American groups and museums and oftentimes common ground has been reached that benefit both parties. This further opens up the possibility of developing mutually beneficial relationships in which gaining information about our shared interests of the past and all the while maintaining respect for the dead are not mutually exclusive goals. Consultation with indigenous groups and tribal leaders can enrich the knowledge of everyone involved (Walker 2004).

At the time that this thesis was written the Fernandeño Tataviam Band of Mission Indians was not a federally recognized tribe which gives them no legal claim to the human remains in CSUN's possession through NAGPRA. Consultation with the tribe will still be conducted regarding the use of destructive analysis techniques, namely stable isotope analysis, in order to improve tribal relations and hopefully build up a mutually beneficial relationship.

Section 9

Methodology

Minimum Number of Individuals (MNI)

As I stated in "The Curated Collection" section, the curated state of the human remains from the CA-LAN-361 cemetery was poor. This made obtaining an MNI more difficult than if the collection had been preserved better. Many of the bundles of remains contained one or more individuals. Upon my first inspection of the remains it was apparent that each bundle of bones did not necessarily represent a single individual from a single burial. This was discovered after opening the bundles and finding two or more of the same bone from the same side, sometimes from individuals of the same age and sometimes from individuals of differing ages. The simple fact that remains from multiple individuals were mixed together made it necessary to piece together individuals that may or may not have been in multiple bundles or boxes. This was a slow process due to the fact that there were multiple boxes of remains and it was possible for one individual to be spread between them.

First, skeletal remains were removed from each bundle, identified, and sided. Skeletal remains from different individuals were identified by their difference in size and robustness, duplicate bones, stage of ossification and/or fusion or mineralization (teeth), and aspect (appearance) of the bone e.g. apparent taphonomic history, color, surface state, etc. Once a new individual was identified from the current bundle it was bagged separately, given an approximate age based on stage of maturation, and set aside for possible future inclusion with other remains from other boxes. In some cases the approximate age of a bone could be determined by using a comparative collection. The casts of the human remains that were used for this identification process are from Bone Clones Osteological Reproductions©. For each individual a skeletal inventory form was completed showing which bones (complete or incomplete) were present (Appendix C). Some of the individual bones, cranial and infracranial, had been broken during excavation or during curation. The bones that could be pieced back together were taped together with 3M© Micropore 1" tape, as opposed to gluing them, in order to not damage the bones any further and so accurate measurements could be taken when the time came.

Each box of remains was worked through in this fashion identifying how many individuals were present in each box, what their approximate ages were, and taping together any broken bones. Once all the boxes were complete a final step was taken, which involved laying out each individual on the tables of the lab in order to have access to all the remains, out of their bags, at once to ensure that none of the remains could be combined into a single individual making it possible to get a final MNI.

Measurements

Once the MNI was determined and each individual was identified with its proper elements, measurements for the crania and most of the infracranial remains were taken. The individual measurements of each bone would not necessarily aid in proving my hypothesis; however, measurements were taken in order to provide data for future studies. There has not been much research conducted for this particular native group and even fewer osteological studies so one of my goals (ethical obligations) was to provide data for future osteological studies. The remains, if repatriated to the tribe, would most likely be re-buried and the possibility for any future study would be lost. Key measurements that helped in my study were the length of the juvenile bones for age estimation (see *Age Estimation*). The majority of measurements taken were from "Human Osteology" (2011) by White et al. Some other essential cranial measurements that weren't included in White et al.'s list of measurements where added from the Martin system (Bräuer 1988). For a complete list of measurements taken and their descriptions, see Appendix D. Measurements were taken using an assortment of tools from Paleo-Tech Concepts©. The tools utilized in this study include: an osteometric board, mandibulometer, spreading caliper, digital sliding caliper, and flexible measuring tape.

As one may realize after examining the bone measurements tables there may be some discrepancies. First, not all measurements were taken for juveniles even when those bones were present. More often than not the juvenile long bones were represented by only the shaft; the epiphyses were often unrepresented or un-fused. Most of the measurements were obviously developed for fully developed individuals (fused and ossified bones) and therefore many measurements relied on the presence of the epiphyses. Therefore, rather than make assumptions regarding the nature of the epiphyses that were not present in many of the juvenile specimens, measurements that required the presence of the epiphyses (such as the biomechanical lengths) were excluded for juveniles. Instead measurements involving the diaphyses only from Scheuer and Black (2000) were taken. Regarding the crania from this collection, there was not a single complete cranium! Every cranium was incomplete and oftentimes highly fragmented. This was most likely due to natural decay, destruction by pot-hunters, and/or poor excavation/curation techniques. As many cranial measurements as possible were taken for each cranium present. Some of the measurements in the table have an "*" accompanying them. This designation represents an estimated measurement. For example, I used this designation when a measurement lacked one of its diagnostic points by a minuscule amount but enough of the bone remained for the measurement to be estimated. Therefore, the measurement was slightly estimated. Other measurements include a ">" designation. As I stated before, one of my goals for this research was to provide as much quantitative data as possible for these remains. Oftentimes a represented bone was broken. Regardless of this situation I still wanted to include a minimum measurement for these broken remains in order to give a better description of the preservation of the bones. As with most research, not everyone will be satisfied with the measurements included or excluded in this study but after consulting numerous resources and direction from my advisor the present list was devised.

Age Estimation

Age is one of the most basic components of the social personality (Binford 1971); therefore, it was important to acquire an age range for as many individuals as possible. For the subadults, the teeth were used, in every possible case, to estimate the age of the individual because averaging the formation of the crown and root for different teeth provides the best estimate for rating the age at death of a specimen (Moorrees et al. 1963a). Methods of age estimation using teeth were taken from "Formation and Resorption of Three Deciduous Teeth In Children" (Moorrees et al. 1963a) and "Age Variation of Formation Stages for Ten Permanent Teeth" (Moorrees et al. 1963b). Age ranges from teeth development were obtained by taking two standard deviations (95% confidence) away from the mean. Unfortunately, the teeth are only useful for providing an approximate age up to 23 (AlQahtani et al. 2010) because at this stage of development all the deciduous teeth have fallen out and the permanent teeth have formed (the 3rd molar is sometimes an exception).

In some of the sudadults, no teeth were represented. When this was the case age was estimated from the long bone length (White and Folkens 2005). If no long bones were present, or they were broken, the age of fusion of the epiphyses was used to to give a rough age estimate (given the high variation in ages of fusion of epiphyses). The long bone length was taken using an osteometric board and then compared to the data tables in "Developmental Juvenile Osteology" (Scheuer and Black 2000). The tables in this book provide mean ages for male and female juveniles based on the length of the long bones; an evaluation of the age at death of an individual. Age ranges obtained from long bone lengths were obtained by taking 2.58 standard deviations (99% confidence) away from the mean.

The age ranges were then grouped together into classes for analysis, see "*Demographics*" below. The age classes used are as follows: Class 1: Neonate 0-1, Class 2: Juvenile 1-4, Class 3: Juvenile 5-9, Class 4: Juvenile 10-14, Class 5: Juvenile 15-19, and Class 6: Adult 20+.

Sex Determination

The sex of each individual was determined, when possible, through the use of the Probabilistic Sex Diagnosis (DSP) technique (Murail et al. 2005) which utilizes measurements from the os coxae to determine sex. The os coxae is by far the best non-population-specific indicator for reliable sex determination for adults (Murail et al. 2005).

DSP is based on a worldwide os coxae metrical database and applicable to well-preserved or poorly-preserved bones. At least four variables or measurements from the specimen are chosen from a total of ten proposed, compared to a database, and then individual probability of being male or female is computed (Murail et al. 2005). When the os coxae was not present, as was the case for most of the individuals in this collection, sex determination, even a tentative sex proposal using a combination of morphological traits from cranial and infracranial remains and discrete traits, was not proposed.

Bones of Special Concern

Some of the most difficult bones to identify and position are the phalanges of the hand and foot. Most often only a few of the phalanges were present in each burial thus increasing the likelihood of identifying the phalanges incorrectly. "When one or more phalanges are missing from a bone row, positioning accuracy may decline substantially. Missing bones are most likely to affect positioning of PP3 and PP4, IP2 and IP4, and DP2, and DP3 and DP4" (Case and Heilman 2006:345). In order to decrease this likelihood, techniques from "New Siding Techniques for the Manual Phalanges: A Blind Test" (Case and Heilman 2006) were used to place the manual phalanges from this collection in the correct anatomical position.

A second bone of special concern was the hyoid bone. Only one hyoid bone was recorded in all the burials from this collection. This is not surprising since the hyoid is a small, fairly delicate bone. And it is the only bone in the body that does not articulate with another bone (White et al. 2011). If any of these burials were cremations or secondary burials the likelihood of the hyoid being consumed during cremation or lost during transport of the remains would be great thus decreasing the chances of finding it during excavation. The hyoid was recorded with an adult burial. Upon further inspection of the hyoid it was observed that the greater horn was articulated but not fused to the body. Ossification of the greater horns (greater cornua) occurs shortly after birth, sometimes as soon as three weeks (Parsons 1909). Progressive ossification of the body and the greater cornua occurs throughout childhood and into adolescence (approximately 15 years of age); however, in some people these parts of the hyoid may never ossify (Reed 1993). There is little information available about hyoid ossification in adulthood, but the body and the greater cornua do not usually fuse until the 35th to the 45th year, and they may never do so (Reed 1993).

Cranial Profiles

Cranial profiles were taken using a Microscribe G2X Digitizer. For each individual with a cranium represented, the full sagittal profile was taken or whatever portion was preserved on each cranium. The 3-D profiles were then projected in a 2-D plane. All the cranial profiles were aligned along the bregma/lambda chord or the nasion/lambda chord depending on the landmarks preserved on the crania. The profiles were then size adjusted so all the crania were proportional and any deformities or outlying features could be distinguished. The size-adjusted profiles were aligned along the bregma/lambda or nasion/lambda chord being equal to 100 mm.

Demographics

A demographic profile was created using the formulas from Ledermann (1969) and Bocquentin (2003). A life table was created for the population from the cemetery at

CA-LAN-361 by separating the population into age groups and computing various variables for each age group. The following variables were calculated for each age group: number of individuals, number of deceased, the 95% confidence interval, and the minimum and maximum theoretical number of deceased. The demographic profile was compared to normal mortality rates of a natural, historical population and possible interpretations for the demographic profile present were explored including the numerous filtering processes present in archaeological collections (O'Shea 1981) .

Pathologies

Data pertaining to paleopathologies were collected by visual inspection of the cranial and infracranial remains. The resource "Identification of Pathological Conditions in Human Skeletal Remains" (1981) by Donald J. Ortner and Walter G. J. Putschar was used to identify pathologies in this collection. Osteoarthritis was the most prevalent pathology to observe and record and can help determine gender and social roles (Rogers and Waldron 1995). Arthritis was scored on a scale of none/slight, moderate, or severe (Jurmain and Kilgore 1995). Dental hypoplasias and opacities were the primary dental defects being considered as an indicator of social status through the access to resources (Walker and Hewlett 1990). The diseases and injuries of teeth and jaws are among the most common conditions observed in human remains and their pattern of progression within a population is strongly indicative of the nature of the diet, the mode of subsistence, and daily tasks (Hillson 2008).

Discrete Traits

Discrete traits can aid in determining cultural affiliation and descent groups (Hanihara and Ishida 2001a, 2001b). The presence of discrete traits helps define the horizontal social divisions i.e. high status burials all from one descent group. Due to the highly fragmentary nature of the burials only certain discrete traits were observed. Discrete traits of the crania were observed using the resource "The Evolution of Modern Human Diversity: A Study of Cranial Variation" (Lahr 1996). The observed list of discrete traits of the infracrania was adapted from the resource "Non-Metric Variation of the Infracranial Structure" (Finnegan 1978) and "The Development and Distribution of Discontinuous Morphological Variation of the Human Infracranial Skeleton" (Saunders 1978). Only the discrete traits from bones that were present in two or more adult individuals were observed and recorded. Unless specified otherwise, discrete traits of the crania and infracrania were scored as present (+), absent (-), or indeterminate (0). Dental discrete traits were recorded and scored using the "Scoring Procedures for Key Morphological Traits of the Permanent Dentition: The Arizona State University Dental Anthropology System" (Turner II et al. 1991). Dental traits were scored as indeterminate (0) when the teeth present were too badly worn or broken to score the specific trait. For the juveniles only discrete traits of the crania and teeth were noted due to the varying degree of development in the infracrania collection.

Violence

Any evidence of cranial or infracranial violence resulting in trauma was observed and noted. "Trauma refers to injury to living tissue that is caused by a force or mechanism extrinsic to the body, whether incidental or intentional" (Lovell 2008:341). Trauma in the form of punctures, fractures, and/or breaks will be recorded. It is often difficult to understand if skeletal trauma is a result of violence or just personal injury due to accidents. Extreme care was taken when making these distinctions regarding the evidence of interpersonal violence. When no evidence of violence was observed for an individual the designation “None Observed” was used.

Taphonomy

Taphonomy is the study of the physical and chemical processes (human, animal, or natural) that alter an organism after its death and through which it is incorporated into geological deposits (Stodder 2008). “Taphonomy provides the framework in which we can investigate the multiple processes and events that cumulatively determine the content and condition of skeletal assemblages from archaeological sites” (Stodder 2008:71). Particular taphonomic alterations of the bones such as burning, gnawing, weathering, discoloration, polish, cutmarks, or other cultural modifications were recorded if and when they were observed. When the taphonomic processes listed above were not observed on an individual the designation “None Observed” was used.

Diet

Data on prehistoric diet was originally to be collected from teeth samples (canines and molars) from each individual by the Institute for Integrated Research in Materials, Environments, and Society at California State University Long Beach. The marine and terrestrial foods consumed by Native Americans differed significantly in their $^{15}N/^{14}N$ and $^{13}C/^{12}C$ ratios and the isotopic differences associated with these different types of food are reflected in the chemical composition of ancient human skeletal remains (Walker 2006). The concentration of ^{15}N to ^{14}N and ^{13}C to ^{12}C tend to be higher in marine than in terrestrial organisms. Therefore, the concentration of these isotopes in human bone collagen can be used to make inferences about the contribution of marine and terrestrial resources to prehistoric diets (Walker and DeNiro 1986). The stable isotope data would have been analyzed and a comparitive analysis between the individuals buried at CA-LAN-361 conducted to ascertain if there was any differential access to resources. If possible the data were to be compared to previous stable isotope data from groups in the surrounding areas, possibly the Chumash). At the time this research project was finished the stable isotope analysis had not yet been approved. The stable isotope data, if collected, will at the least be available for future comparative research.

Social Complexity

Information pertaining to Tataviam social complexity including trade networks and artifact types and materials has been collected from previous excavations and studies of the Tataviam (e.g. Caruso 1988). Literature pertaining to southern California trade networks and interaction spheres was also utilized in this research (e.g. Caruso 1988; Porcasi 1998). The background information on storage and sedentism, trade and interaction, and rock art is presented in previous sections and will be integrated to discuss social complexity among this southern California group. ArcGIS Desktop 10© was used to analyze geographic data and propose a most likely trade route to the Pacific Coast using the Cost Path tool (Esri©). Data on storage and sedentism has also been collected from the available literature on the Tataviam (e.g. Milburn et al. 2009; Vance 2009). Information pertaining to rock art will be discussed; however, only in the manner in which it pertains to the development of social complexity at the Agua Dulce village complex. No hypotheses or information will necessarily be refuted or supported during the general discussion of rock art as it pertains to social complexity. All this information was combined with the skeletal data to better determine the degree of social complexity of this southern California group.

Section 10

Data and Interpretation

The nature of this collection (i.e. its highly fragmented state, poor condition of the remains, and incomplete skeletons) makes it difficult to propose any absolute specifics pertaining to status and daily activities on the individual level. Basically, the lack of documentation for each burial makes it difficult to propose any rank differentiation of an individual within this cemetery. However, a general interpretation of the data obtained related to the general health of the people from the Vasquez Rocks cemetery can be made and inferences regarding social complexity and the presence of a ranked society can be proposed based on these observations.

MNI, Age Distribution, Sex, Taphonomy, Violence, and Cranial Profiles

The MNI for this collection is 20 individuals; three neonates (0-1 year excluded), eleven children and adolescents (1-19 years), and six adults (20+ years). Sex could not be determined for any individuals using the DSP method (Murail et al. 2005). All the adult individuals do not preserve the os coxae or it is too fragmentary to be used to determine their sex. The presence of a few discrete traits that have been found to be more frequent in females (i.e., the Third Trochanter and the Septal Aperture; Finnegan 1978; Saunders 1978) was noted on Adults #1 and 4. Also, the infracranial remains of Adults #2, 3, and 5 appear to be particularly robust and rugose. See Appendix E for the age and sex table of the twenty individuals identified in the Vasquez Rocks collection. Particular taphonomic processes were observed on some of the juvenile and adult skeletons. Observed taphonomic processes included weathering (Neonate #3, Adult #5), burning

(Juvenile #8, Adult #2), and rodent gnawing (Adult #3, Adult #4). Minor blunt force trauma was recorded on the left parietal of Adult #2; however, it is not clear whether this was a result of interpersonal violence or due to personal accident. Cranial profiles were taken on every adult except Adult #6. The images from the digitizer (Appendix F) show that the adult crania from this collection are predominantly brachycephalic or hyperbrachycephalic. In the case of hyperbrachycephalic individuals (Adult #2 and Adult #5), further deformation could have been caused by cradle boarding at a young age.

Dental Health and Diet

All of the adults with teeth present had moderate to heavy wear that exposed the pulp chamber on many of the teeth (See “Status/Wear” in Appendix G: Tables G1-G8). The high dental wear rates of this Middle Period cemetery suggest a grit laden diet and a diet consisting of much more abrasive foods requiring heavy mastication (Walker 1985, Walker et al. 1996). This is a plausible explanation for the high degree of enamel wear and exposed pulp chambers on the adult specimens. However, it must be taken into consideration that this collection could only contain very old adults therefore making the high degree of enamel wear normal. Grit occurring in the food of the population at Vasquez Rocks would have been commonplace. The use of earth ovens for roasting vegetable products would have contaminated palatable food with dirt or sand. Also, the presence of grinding implements, such as mortars and matates, at CA-LAN-361 indicate that the Middle Period population was grinding foodstuffs which would have introduced a high degree of grit into their diet through the breakdown and wear of sandstone grinding tools. It is possible that the heavily worn teeth indicate a diet consisting of mostly processed vegetable and plant foods and that terrestrial meat and to an even lesser extent marine food resources were supplement to their diet. The heavy dental wear and the presence of dental caries could also account for the subsequent tooth loss in most of the adults and the presence of an abscess on the mandible of Adult #5. Enamel dysplasia, dental caries, and hypoplasia pits were present in most of the individuals with teeth. A relationship has been shown to exist between diet and dental caries as well as biological stress and developmental defects in teeth such as enamel hypoplasia (Ortner and Putschar 1981). The presence of dental caries suggests that the individuals did experience some slight to moderate dietary stress. And the presence of enamel dysplasia and hypoplasia pits suggests that the individuals also experienced some biological and developmental stress. Whether or not these biological and developmental stresses that caused dental abnormalities were directly related to dietary stress is unknown. The absence of severe dental caries and hypoplastic pitting and lines suggests that the general health of the population could have been much worse. The lack of severe and extreme dental pathological conditions (e.g. dental hypoplasia expressed as hypoplastic transverse lines) in the individuals with teeth suggests that they did not experience the worst subsistence stress possible.

Comparative data for pathological conditions of the teeth exist from three Tataviam cemeteries (see Robinson 1987; Miller et al. 2003; Sutton et al. 2010). First, molar abscesses were recorded in three of the fifteen individuals from the Green Valley cemetery (CA-LAN-487) (Robinson 1987). Unfortunately, the summary of the burial data are very scant and there is no record of other dental pathologies present such as hypoplasia pitting and/or lines, enamel dysplasia, or wear. Second, the frequency of caries and abscesses in the individuals from CA-LAN-2233, a Middle Period cemetery, is very low; however, the frequency of antemortem tooth loss in those individuals was high, especially among females. The extremely heavy tooth wear in this population was probably an important contributor to tooth loss (Miller et al. 2003). Hypoplastic teeth were present in 25% of the burials. Dental pathologies were absent in both children (age 1-11) and the single juvenile (age 12-19) recovered from CA-LAN-2233. In conclusion, Miller et al. (2003) determined that the tooth wear rates from this inland site are greater than Malibu coastal populations. This is attributed to differing diets and food preparation techniques consistent with contrasting ecological conditions (e.g. marine oriented vs. terrestrial oriented). Also, the sex differences in dental health from CA-LAN-2233 suggest sexual differences in diet (Miller et al. 2003). Finally, the presence of dental abscesses in three individuals, mandibular remodeling due to tooth loss in one individual, and heavy tooth wear in at least four adult individuals of the eleven total burials were recorded from the Lazy T Cemetery Site (CA-LAN-767) (Sutton et al. 2010). Unfortunately, there is no discussion comparing tooth wear rates and diet, food preparation techniques, or elite access to resources.

If indeed CA-LAN-361 represents a high status burial ground then the individuals would be expected to have a lesser frequency of dental defects, due to greater access to resources, compared to the general population. Also, stable isotope analysis should reveal a proportionally higher consumption of meat products (terrestrial and/or marine) compared with the rest of the general population (Walker and Hewlett 1990).

Pathological Conditions and Activity Patterns

The frequency of osteoarthritis in the form of bone growth (osteophytosis), pitting, and/or eburnation (dense shiny surface; from the Latin word *eburnea,* meaning ivory) (Rogers and Waldron 1995) on all of the adult individuals suggests that the residents of this cemetery experienced strenuous physical activities resulting in injury and the development of osteoarthritis in multiple locations throughout the skeletal remains. Osteoarthritis was recorded on all six of the adult specimens in multiple locations including: the vertebrae, the humerus, the ulna and radius, the carpals, and the metatarsals. Unfortunately, the fragmentary nature of each individual and the impossibility of sex determination makes it impossible to isolate any of the pathologies and declare them due to a specific gender based, economic activity. For example, osteoarthritis only present on the right or left hand and arm of an individual might suggest repetitive motion related to food production (e.g. grinding or pounding), typically a female activity, or it could indicate damage to joints from tool production, generally a male activity. This conundrum makes it impossible to propose that any of the osteoarthritis present in these individuals is related to a specific economic activity related to male or female gender roles. If the sex of each individual could be confidently determined then the presence of osteoarthritis in each individual could give us better clues to the daily activities of each individual. One thing is worth noting and that is if the society living at Vasquez Rocks were complex hunter-gatherers and the cemetery was reserved for high-status individuals then one thing might be expected as far as the presence of osteoarthritis: The increasing formalization of rank differences should be accompanied by decreasing participation of high-ranking individuals in the primary productive labor of the society therefore decreasing the frequency of osteoarthritis in these individuals (Fried 1967). However, as we have seen there is a high frequency of osteoarthritis in these supposedly high-ranking individuals. Fried explains this phenomenon:

> "Conversely, there is an expectation that this withdrawal from the crude labor process is related to a development of managerial responsibility for larger-scale productive enterprises and for management of important parts of the distributional system… In societies which blend emergent ranking systems with substantial egalitarianism the persons holding the rank positions may be the hardest working people in the system. This is a foreseeable concomitant of the fact that their positions rest upon generosity, with the bulk of things that must be given away being their own in the sense of resulting from their own labor and that of their households" [Fried 1967:131].

This may be an acceptable explanation for the high frequency of osteoarthritis in the form of eburnation and/or bone growth in these individuals. The number and type of artifacts seem to point to high status burials (King et al. 1974); however, the pathological conditions indicate that the individuals still suffered from health-related problems and were not exempt from participating in daily activities related to resource procurement.

Comparative data for pathological conditions related to resource procurement exist from two Tataviam cemeteries (see Robinson 1987; Miller et al. 2003). First, the only pathological condition recorded from the Green Valley cemetery was a severe bone lesion involving the right orbit and temporal bones and the right margin of the frontal bone (Robinson 1987). It is not clear if this lesion is an extreme form of cribra orbitalia associated with anemia. Second, cribra orbitalia was recorded in two of the individuals from CA-LAN-2233; however, due to the poor cranial preservation, it is possible that more individuals were affected by cribra orbitalia. In all the burials, osteoarthritis was observed in all of the major joints with marked sex differences; however, when compared to the Malibu cemeteries the frequency of osteoarthritis was not very high indicating less strenuous physical activity undertaken by the population at CA-LAN-2233 (Miller et al. 2003). Miller et al. (2003) conclude that the distribution of arthritis among male and female suggests sex differences in patterns of behavior possibly related to different types of subsistence activities. Unfortunately, there are no data on pathological conditions related to activity patterns for the individuals from the Lazy T Cemetery. Sutton et al. (2010) don't rule out the possibility of an acute disease being the cause for the demise of the individuals from the cemetery but it is unknown whether that disease could have been related to dietary stress.

Precaution must be taken when comparing the pathological conditions of these three cemeteries to CA-LAN-361: (1) the three cemeteries may represent non-elite burials which could influence what pathological conditions exist; (2) the Green Valley cemetery (CA-LAN-487) and the Lazy T Cemetery (CA-LAN-767) are Late Period (post Medieval Climatic Anomaly) cemeteries which would also influence pathological conditions due to environmental differences; and (3) differing levels of sociopolitical organization through time would influence pathological data related to resource procurement.

Discrete Traits: Cranial and Infracranial

"The intensely studied variations within and between populations suggest that the occurrence of discrete cranial traits may result from a process of adaptation to various environmental and subsistence patterns as well as random drift by population size, network, isolation and edge factors, resulting in the development of regional frequency patterns" (Hanihara and Ishida 2001b: 273). The study of these modern human variations can shed light on the geographical distribution of discrete traits relating to the process of modern human diversity (Hanihara and Ishida 2001a, 2001b). The presence of certain cranial discrete traits can help distinguish within-population variations. For example, a patent condylar canal and the supraorbital foramen appear to be more frequent in females and the accessory infraorbital foramen in males (Hanihara and Ishida 2001b). The results presented in the studies by Hanihara and Ishida (2001a, 2001b) demonstrate that the patterns of side difference, intertrait associations, and sex differences are not consistent among population groups. The interregional variations in cranial discrete traits may allow researchers to hypothesize that founder effects, genetic drift, and population structure are at least in part the underlying cause (Hanihara and Ishida 2001a, 2001b). Understanding that discrete traits are not necessarily indicators of intra- and inter-population variations and the fact that multiple variations can occur within the same genetic line makes studying these traits seem futile. However, even though variations occur within individuals that are genetically related the study of these traits is worthwhile. In this collection many of the cranial and infracranial discrete traits that were recorded were indeterminate due to the fragmentary nature of the collection. For a complete list of cranial and infracranial discrete traits that were recorded, see Appendix G: Tables G9-G10. The traits whose frequencies have been noted to vary with geographic origin are presented below in Table 6.

As I stated above, the recording of these traits may aid future researchers in the study of variations among human populations from different parts of the continent or the world. The documenting of discrete traits forms one part of the whole battery of biological variables which should be employed in the reconstruction of a total population profile (Saunders 1978).

Table 6				
Summary of Cranial Discrete Traits from NW America				
Trait	Frequency	Geographic Location	Present	Absent
Supraorbital Foramen	40-60%	NW America	Adult #1, #2, #3, #5, Juvenile #8, #9	Juvenile #10
Asterionic Bone	20-40%	NW America	Adult #3	Adult #1, #2, #4, #5
Occipitomastoid Bone	20-40%	NW America		Adult #1, #3, #4
Parietal Notch Bone	<20%	NW America		Adult #1, #2, #3, #4, #5
Lambdoid Ossicle	10-20%	NW America	Adult #2, #5, Juvenile #2	Adult #4, Juvenile #9
Accessory Mental Foramen	10-20%	NW America	Juvenile #2, #10	Adult #3, #5, Juvenile #6, #7

Table 6: Cranial discrete traits and their frequencies in populations from northwest America (Hanihara and Ishida 2001a, 2001b).

Discrete Traits: Dental

There has been much evidence that has accumulated over the past century that proposes that dental development is regulated to a significant degree by the action of genes (Scott and Turner II 1997:1). Dental discrete trait expression has been found to vary between the sexes and within different geographic regions. Of particular interest to me was the dental trait Uto-Aztecan premolar (UAP) (also known as the Distosagittal Ridge). UAP was initially believed to only occur in those groups representing the Uto-Aztecan language family; however, new evidence shows the presence of this trait in a variety of New World populations (Johnson et al. 2011:474). The presence or absence of this trait in the collection could have added more credence to the proposition that the Tataviam are from the Uto-Aztecan language stock since this is where the highest frequencies of the UAP have been observed. Unfortunately, the upper first premolar in the adults was too worn to make a definitive determination of the presence or absence of the trait. As far as sexual dimorphism is concerned, the only crown trait that has been found to date to have consistent sexual dimorphism is the distal accessory ridge of the upper and lower canines (Scott and Turner II 1997). Carabelli's trait and shoveling of the incisors have also been shown to have male-female differences but there is not a consensus on the matter (Scott and Turner II 1997). When there are significant male-female differences in trait expression it is typically the males that show the highest frequency and degree of expression (Scott and Turner II 1997).

Variations in crown and root morphology have also been shown to have geographic signatures and thus providing insight into determining population movements (Scott and Turner II 1997). The world has been subdivided into five major geographic areas that are used for organizing data on world dental morphological variation. The five geographic regions are Sino-Americas, Western Eurasia, Sub-Saharan Africa, Sunda-Pacific, and Sahul-Pacific (Scott and Turner II 1997). The data set for this work comes from a site located within the Sino-Americas. For a comparison of the traits recorded and the frequencies of those traits for the Sino-Americas, see Table 7.

Due to the small sample size of this collection and the distribution of the frequencies of certain traits that are known to occur within the Sino-Americas, it is difficult to confirm or deny the origin of these remains as Sino-American. The inclusion of the dental characteristics of these teeth with a larger data set from the area may help determine the movement of the Uto-Aztecan language family through space and time. Any other fine-grained distinction with such a small sample of poorly preserved teeth is not possible at this time.

Table 7						
Summary of Dental Discrete Traits From the Sino-Americas						
Trait	Breakpoint for Deriving Trait Frequency (Grades)	Frequency		Geographic Location	Present	Absent
Shoveling	3-6	High	60-90%	Americas	Adult #2, Juvenile #10	
Double Shoveling	2-6	High	55-70%	Americas	Juvenile #10	Adult #2
Interruption Grooves	1	High	45-65%	Sino-Americas		Adult #2, Juvenile #10
Lower Second Molar Root Number (1)	1-rooted LM2	High	>30%	Americas		Adult #2
Enamel Extensions	2-3	High	40-60%	Americas		Adult #1, #2, #3, #5, Juvenile #6, #7, #10
Deflecting Wrinkle	3	High	35-55%	Americas		Juvenile #10
Cusp 6	1-5	High-Intermediate	30-50%	Americas	Juvenile #10	Adult #2, #3
Tome's Root	4-7	High-Intermediate	15-25%	Americas		
Hypocone	0-1	Intermediate	10-20%	Americas	Adult #1, Juvenile #6, #10	
Lower First Molar Root Number (3)	3-rooted LM1	Intermediate	5-15%	Americas	Adult #3	Juvenile #6
Upper Second Molar Root Number (3)	3-rooted UM2	Low-Intermediate	50-70%	Americas	Adult #1	Adult #2
Cusp 5	1-5	Low	10-25%	Sino-Americas	Adult #2, #3, Juvenile #10	
Upper Premolar Root Number (2)	2-rooted UP1	Low	5-15%	Americas		Adult #2

Carabelli's Trait	5-7	Low	0-10%	Americas		Adult #1, Juvenile #10
Lower Canine Root Number (2)	2-rooted LC	Low	0-1%	Sino-Americas		Adult #5
Odontomes	1	Rare	4-7%	Americas		Adult #2
Mesial Canine Ridge	1-3	Very Rare	0-3%	Sino-Americas		

Table 7: Dental discrete traits recorded using the Arizona State University Dental Anthropology System (Turner II et al. 1991). The grades, frequencies, and geographic locations are taken from Scott and Turner II (1997).

Demographics

Paleodemography provides two kinds of population estimates for archaeological reconstructions: (1) estimates of the size of the population and (2) estimates of its structure (Hall 1978:715-716). Following Bocquentin (2003), the mortality rates that were calculated for the CA-LAN-361 cemetery were compared to the maximum and minimum mortality rates calculated for a population with a life expectancy at birth of 30 years (data from Ledermann 1969) in order to check for any deviation from a traditional population. By looking at the demographic profile of this collection (Table 8 and Figure 15) one can see that an abnormal distribution of individuals is present.

Table 8					
Age Class	Nb of Deceased	95% Conf. Interval		Min & Max Theoretical Nb of Deceased	
0	3	0	6	4	8
1-4	2-3	0	6	3	8
5-9	5-8	1	12	1	1
10-14	1-3	0	6	0	0
15-19	0	0	0	0	0
20+	6	2	10	3	12

Table 8: Demographic profile of CA-LAN-361. The “95% Conf. Interval” corresponds to the 95% confidence intervals of the numbers of deceased (N total = 20). The

theoretical numbers of deceased are those for a population with a life expectancy at birth of 30 years

These results correspond to a compilation of different scenarios for individuals who fell into two different age classes.

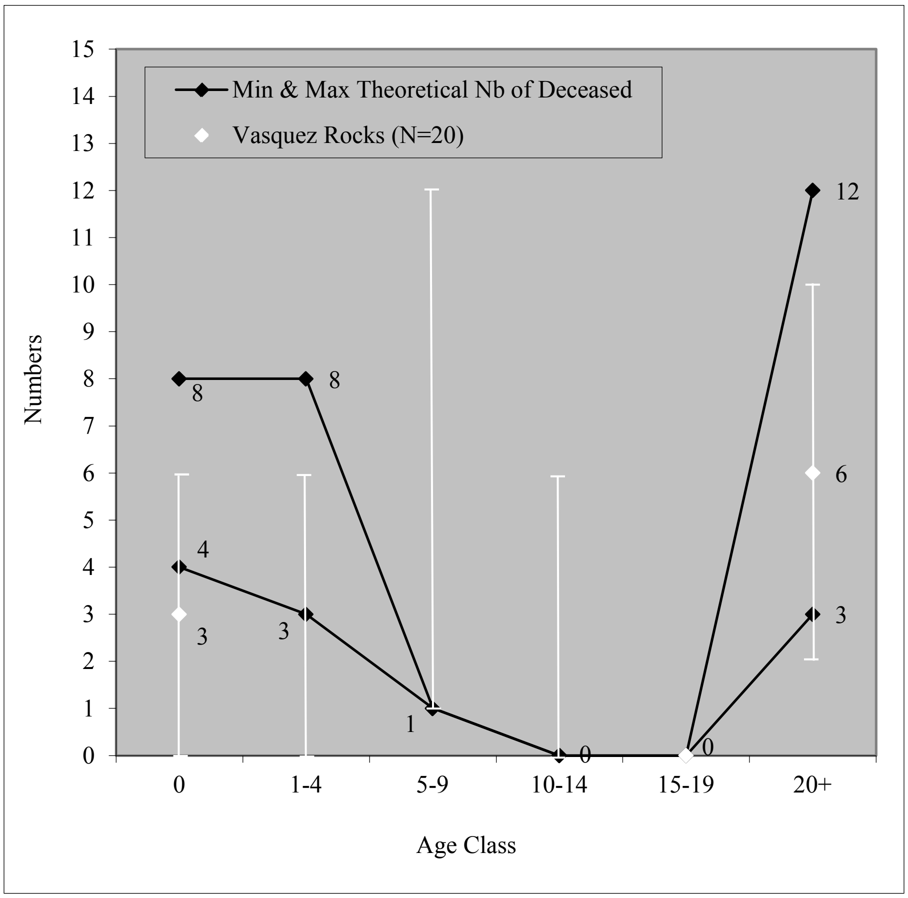

Figure 15: Demographic profile of CA-LAN-361 (in white, including the 95% confidence intervals of the numbers of deceased) compared to a normal population with a life expectancy at birth of 30 (in black).

A traditional demographic profile will show high mortality rates for infants with decreasing mortality rates as children grow and maturate and a slowly increasing mortality rate as individuals grow older. The demographic profile of CA-LAN-361 uncovers a few discrepancies in the population: (1) Age class 0 may be slightly underrepresented; (2) age class 1-4 may be slightly underrepresented; (3) age class 5-9 may be over represented; and (4) age class 10-14 may be over represented. There are a few reasons why this may be the case with this collection. First, the most obvious explanation could be that the entire cemetery was not excavated. If this is the case and there are still more individuals buried at the site that weren't recovered by excavations then this would skew the demographic profile. Second, it is possible that certain age groups are not represented due to filtering processes that occur within cemeteries. The following filters will skew funerary evidence: (1) differential aspects of the social system, (2) those aspects of the social system being symbolized in the funerary context, (3) and those aspects symbolized in a way to produce physical change in the disposal unit, (4) post-depositional effects, and finally (5) isolatable archaeological patterning (O'Shea 1981:40). It is no wonder why it is often difficult to gain insight into the overall social systems of societies from the archaeological record, especially human remains. The filtering processes described above have definitely altered this collection and subsequently the demographic profile. The final explanation for a skewed demographic profile is the presence of an elite cemetery and the differential treatment of individuals in burial. The grave goods that were present at the cemetery seem to point towards high status burials. Archaeologists have equated infant and juvenile burials containing exotic or high status grave goods with a society that has ascribed status (Gamble et al. 2001). If indeed the concentration of exotic trade items within particular areas of the cemetery correlates with the presence of stratified societies in which managerial positions are ascribed (King et al. 1974) then the presence of juvenile burials containing these high status objects would confirm ascribed status within the population at Vasquez Rocks. In short, the demographic profile from this cemetery could indicate the presence of differential burial treatment due to a ranked society based on ascribed status and this collection is a good example of how filtering processes can skew and confound the demographic profile. See Appendix H for a summary of all the data collected from each individual from the CA-LAN-361 cemetery.

Section 11

Conclusions

This study of the human remains from CA-LAN-361 has proven worthwhile as the data collected ads to the relatively small amount of current data available for the Tataviam. The data from this funerary study along with a review of the causes, consequences, correlates, and conditions for the institutionalization of new labor relationships and ascribed hierarchies (Arnold 1996) among the Tataviam is compatible with King et al.'s (1974) proposal that the cemetery at CA-LAN-361 was reserved for people holding managerial positions. However, these data does not permit any generalizations regarding Tataviam complexity diachronically. Still more data are needed from different time periods throughout the Holocene in order for the bioarchaeological data to be utilized to its fullest potential as it has been for the Chumash around the Santa Barbara Channel.

The original intent of this research was to provide a detailed discussion of status and social complexity, following previous Chumash bioarchaeological studies, using the data collected from the burials. The biological data would have been used to compliment the archaeological data; however, the archaeological data for the site was insufficient and after reviewing the condition of the collection it was not possible to gather the data originally proposed. This research then shifted focus to a more biological study of the population living at Vasquez Rocks. Basically, the only source of data available was the bones themselves.

Repository collections can't always provide the data that a researcher desires; however, despite the poor condition of this collection it still had research value. Also, federal repositories for archaeological materials are experiencing a curation crisis which made this study of a curated collection that much more important. Many collections, especially those excavated prior to the mid 1970's, have no accompanying documentation and are in a state of neglect and deterioration. The collection from CA-LAN-361 is a perfect example of a collection that was in a state of neglect.

With the introduction of the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, which helps protect Native American ancestral human remains, the availability and opportunity to study skeletal remains from Native American cemeteries are dwindling. Utilizing repository collections, especially human remains, is a valuable data source that should not be overlooked. Also, working with human remains is serious; respect for the cultures represented in the collections is necessary and Native American collaboration is an integral aspect of research. This research took one small step towards alleviating the curation crisis. The collection is now in better shape, identified, well sorted, and stored in better conditions. This research is a first step towards knowing more about the Tataviam since the original data have been recorded following today's standards and these data are now available for comparison.

The Tataviam, being an inland group, was most likely decimated by the Medieval Climatic Anomaly (MCA) (A.D. 800 – 1350), which was punctuated by droughts and episodes of increased temperatures. The MCA had direct effects on terrestrial ecosystems by impacting water sources and reducing primary production and, therefore, harvestable biomass (Jones et al. 1999). These climatic anomalies and the resulting impacts on the Tataviam may have led King and Blackburn (1978) to their conclusions regarding the total Tataviam population of 1,000 at historic contact. The MCA affected those groups residing inland more so than it did the coastal groups. The Tataviam quite possibly moved to areas of greater resource abundance (e.g. the coast or perennial water supplies) and integrated with the local populations.

The reduction in harvestable biomass during the MCA could be the reason for the scarcity of heated-rock-associated radiocarbon dates after about 400 cal BP which suggests that the intensity of food cooking in these kinds of features may have decreased prior to the arrival of Europeans; however, it might also relate to less resource utilization due to a reduction in native populations (Milburn 2009:15).

The MCA could also be responsible for the breakdown of trade networks. This is evident in the artifact assemblages at Tataviam sites. Prior to the MCA obsidian was highly utilized even though it was an exotic resource. However, after the MCA there is a decrease in obsidian (extra local) and the increase of fused shale (local) which could suggest the breakdown of trade networks and socio political organization (Robinson 1987) among inland groups.

At the time that this research was completed, the stable isotope analysis that was originally part of this research had still not been approved.

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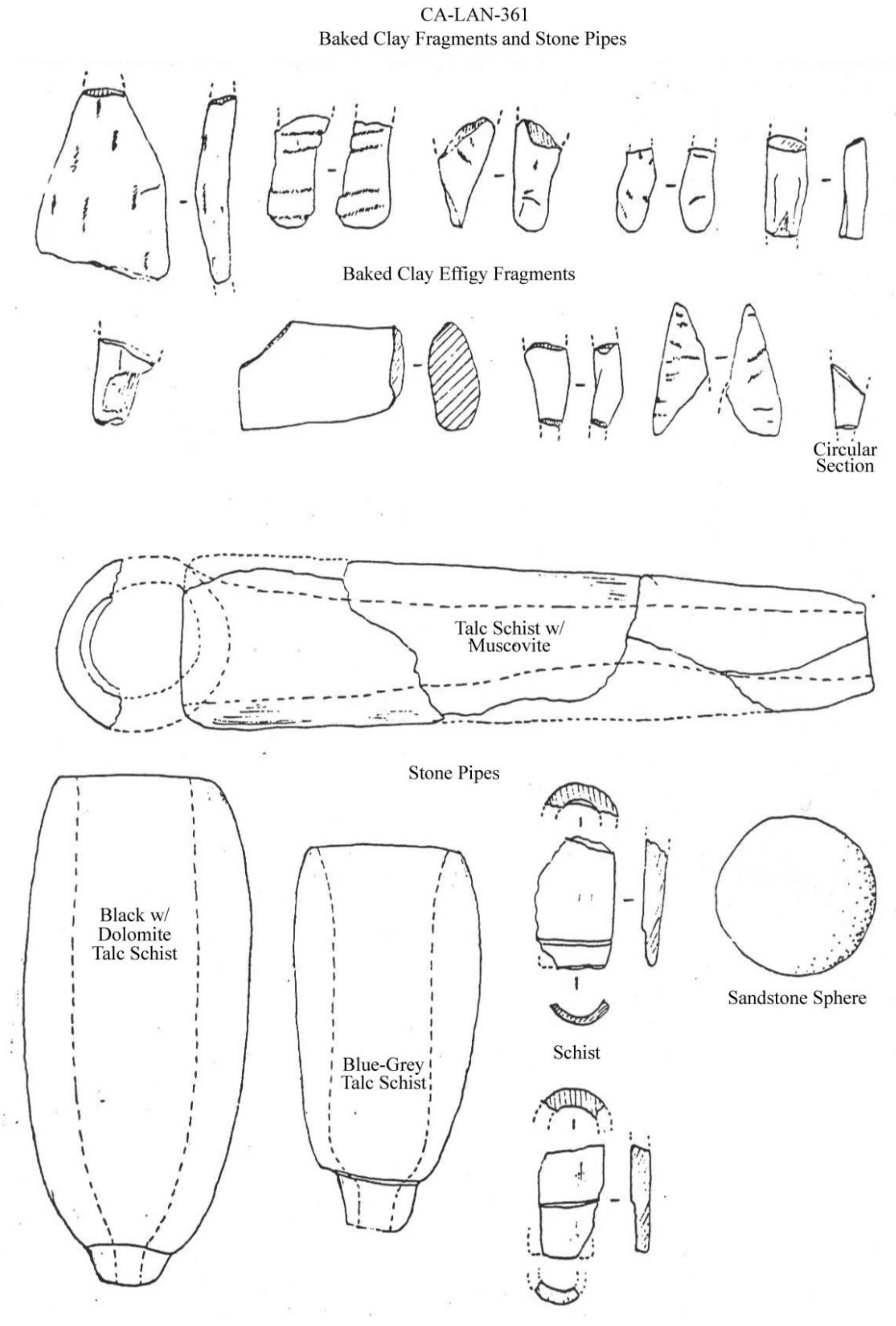
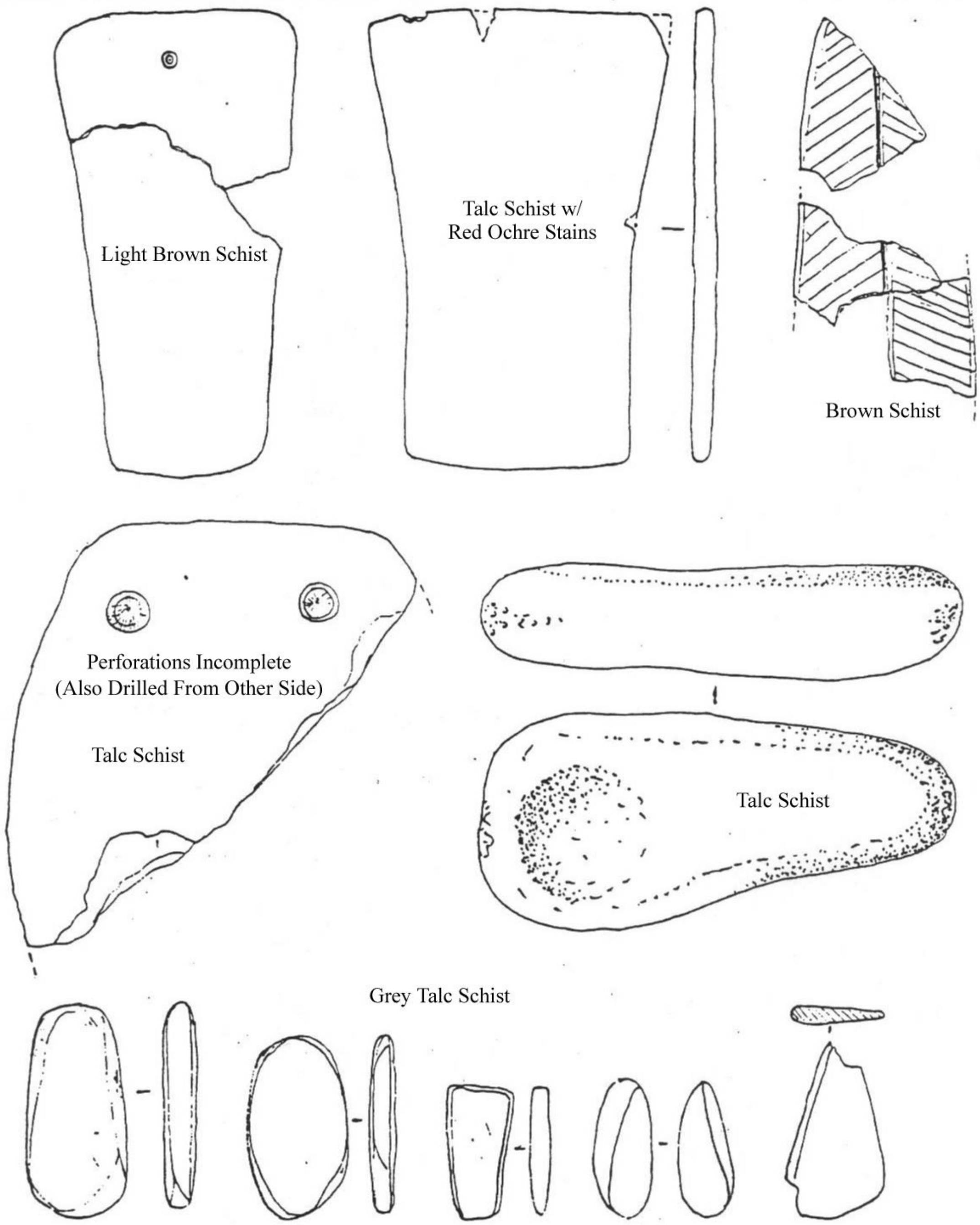
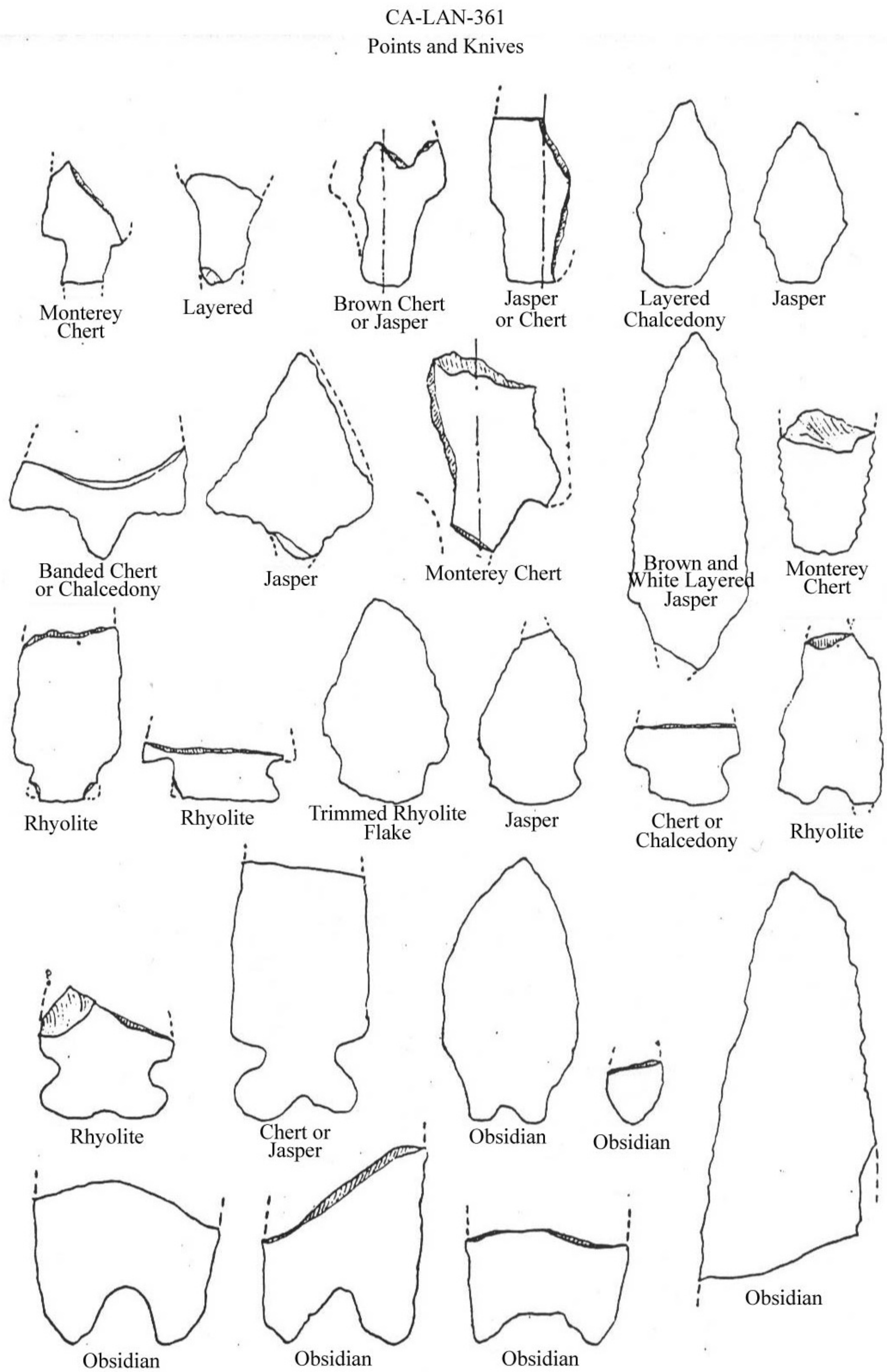
Appendix B: Artifact Assemblages



CA-LAN-361
Plaques





(Adapted from King et al. 1974)

Appendix C: Skeletal Inventory Forms

Preservation Form: Neonate

Year: 2012

SITE: CA-LAN-361

Skeleton #: Neonate #1

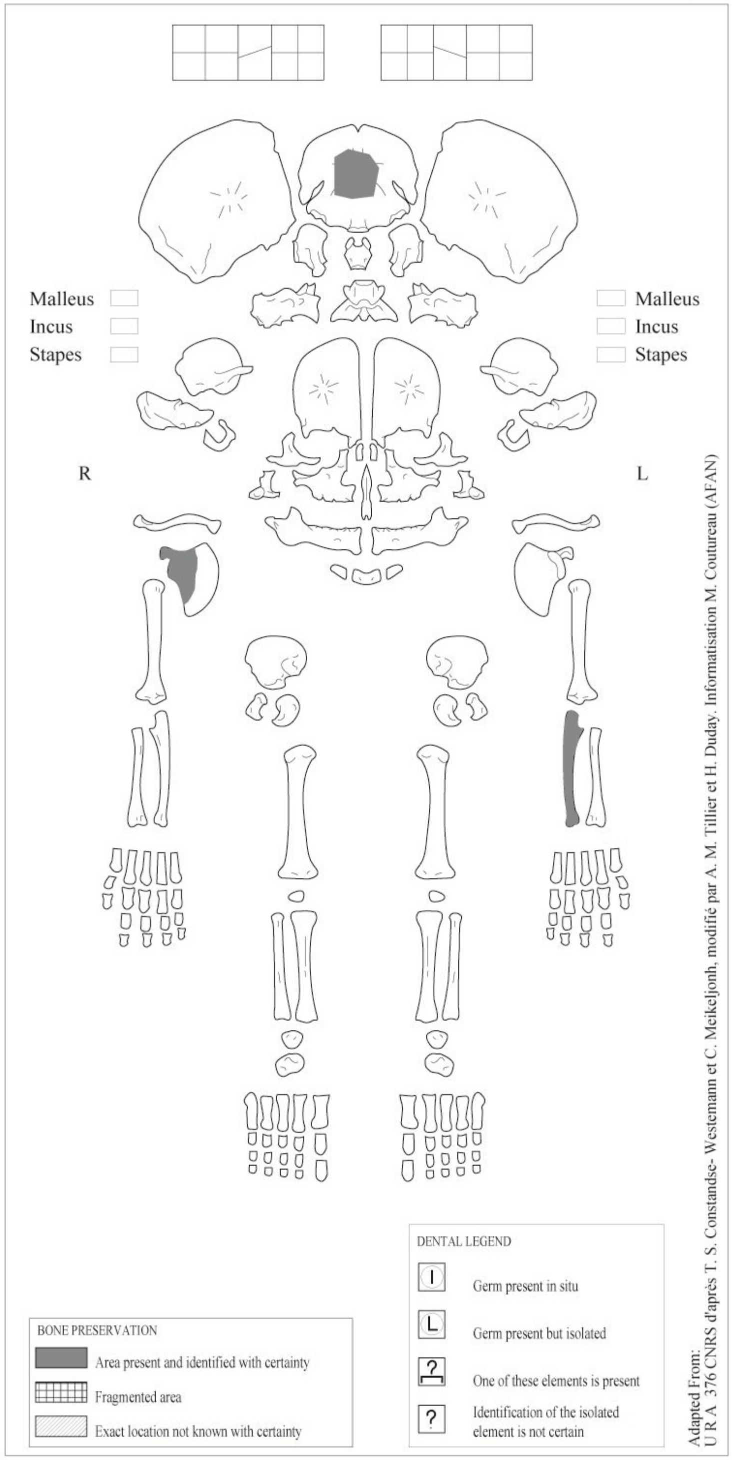
Provenience: 106J

VERTEBRAE		right arch	centrum	left arch
CERVICAL	C 1			
	C 2			
	C 3			
	C 4			
	C 5			
	C 6			
	C 7			
	indeterminate rank			
THORACIC	T 1			
	T 2			
	T 3			
	T 4			
	T 5			
	T 6			
	T 7			
	T 8			
	T 9			
	T 10			
	T 11			
	T 12			
	indeterminate rank	X		
LUMBAR	L 1			
	L 2			
	L 3			
	L 4			
	L 5			
	indeterminate rank			

		R. lat. element	right arch	centrum	left arch	L. lat. element
SACRUM	S 1					
	S 2					
	S 3					
	S 4					
	S 5					
	indeterminate rank					

RIBS	right	left
T 1		
T 2		
T 3		
T 4		
T 5		
T 6		
T 7		
T 8		
T 9		
T 10		
T 11		
T 12		
indeterminate rank		
indeterminate side		

STERNUM	
manubrium	
sternebrae	



Adapted From:
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Preservation Form: Neonate

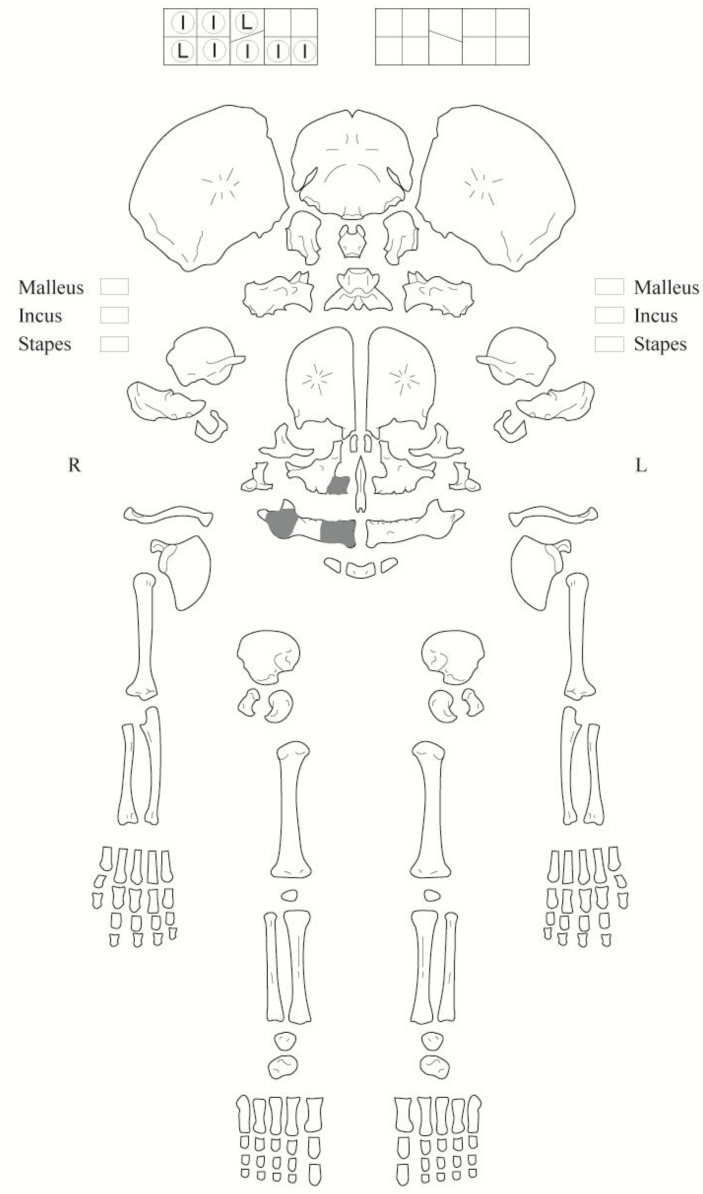
Year: 2012	SITE: CA-LAN-361	Skeleton #: Neonate #2
		Provenience: 107K

	VERTEBRAE	right arch	centrum	left arch
CERVICAL	C 1			
	C 2			
	C 3			
	C 4			
	C 5			
	C 6			
	C 7			
	indeterminate rank			
THORACIC	T 1			
	T 2			
	T 3			
	T 4			
	T 5			
	T 6			
	T 7			
	T 8			
	T 9			
	T 10			
	T 11			
	T 12			
	indeterminate rank			
LUMBAR	L 1			
	L 2			
	L 3			
	L 4			
	L 5			
	indeterminate rank			

		R. lat. element	right arch	centrum	left arch	L. lat. element
SACRUM	S 1					
	S 2					
	S 3					
	S 4					
	S 5					
	indeterminate rank					

RIBS	right	left
T 1		
T 2		
T 3		
T 4		
T 5		
T 6		
T 7		
T 8		
T 9		
T 10		
T 11		
T 12		
indeterminate rank		
indeterminate side		

STERNUM	
manubrium	
sternebrae	



BONE PRESERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty

DENTAL LEGEND

- I Germ present in situ
- L Germ present but isolated
- ? One of these elements is present
- ? Identification of the isolated element is not certain

Adapted From:
U R A 376 CNRS d'après T. S. Constandse- Westemann et C. Meikeljonh, modifié par A. M. Tillier et H. Duday. Informatisation M. Coutureau (AFAN)

Preservation Form: Neonate

Year: 2012

SITE: CA-LAN-361

Skeleton #: Neonate #3

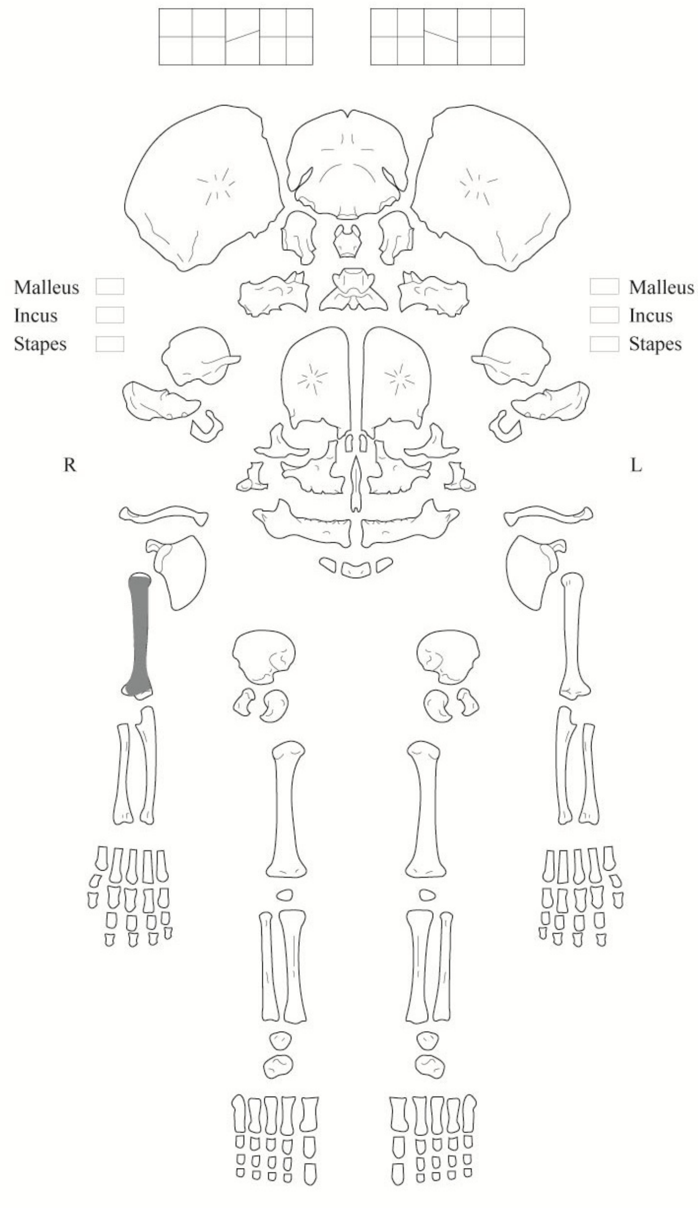
Provenience: Unknown

	VERTEBRAE	right arch	centrum	left arch
CERVICAL	C 1			
	C 2			
	C 3			
	C 4			
	C 5			
	C 6			
	C 7			
	indeterminate rank			
THORACIC	T 1			
	T 2			
	T 3			
	T 4			
	T 5			
	T 6			
	T 7			
	T 8			
	T 9			
	T 10			
	T 11			
	T 12			
	indeterminate rank			
LUMBAR	L 1			
	L 2			
	L 3			
	L 4			
	L 5			
	indeterminate rank			

		R. lat. element	right arch	centrum	left arch	L. lat. element
SACRUM	S 1					
	S 2					
	S 3					
	S 4					
	S 5					
	indeterminate rank					

RIBS	right	left
T 1		
T 2		
T 3		
T 4		
T 5		
T 6		
T 7		
T 8		
T 9		
T 10		
T 11		
T 12		
indeterminate rank		
indeterminate side		

STERNUM	
manubrium	
sternebrae	



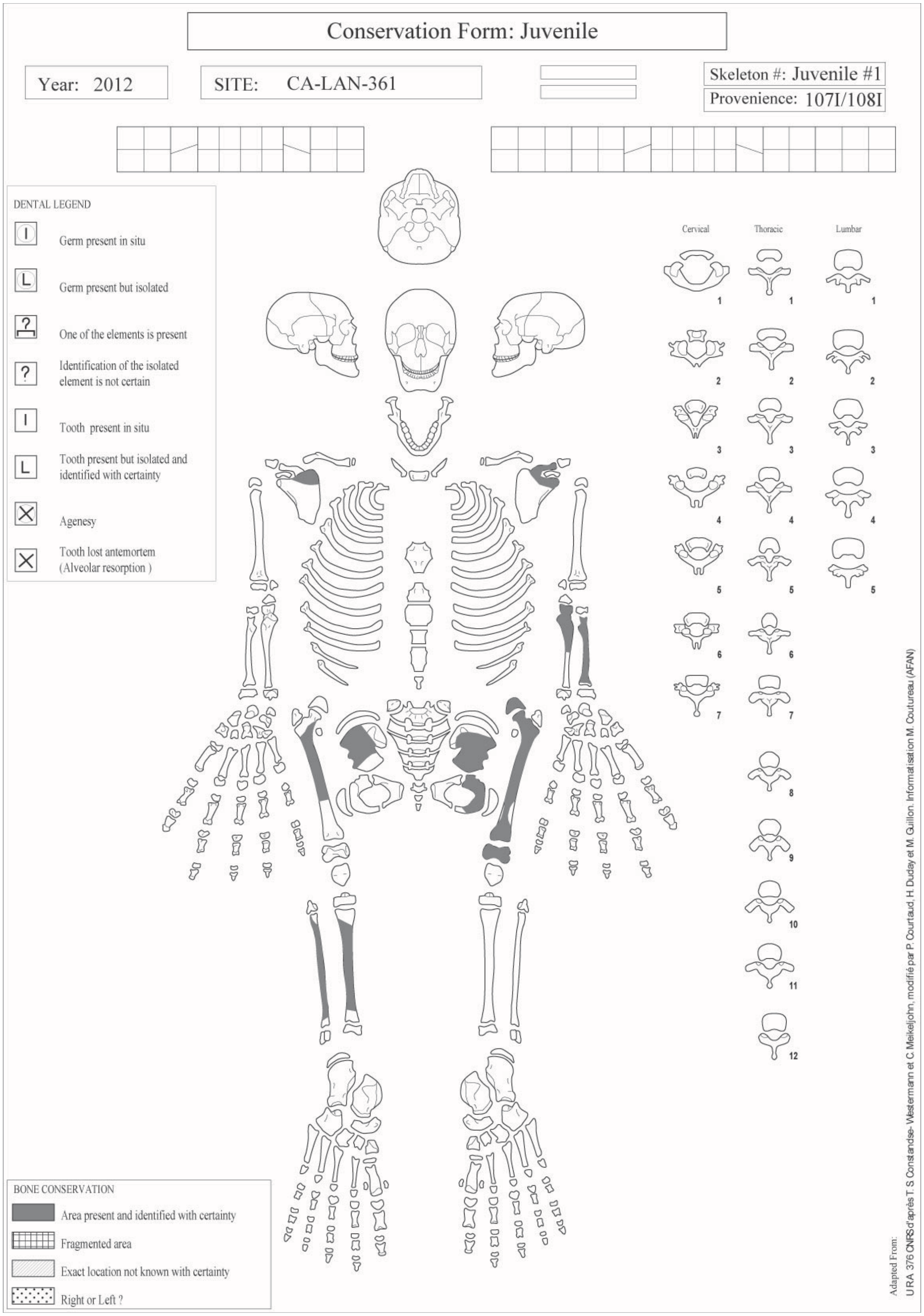
DENTAL LEGEND

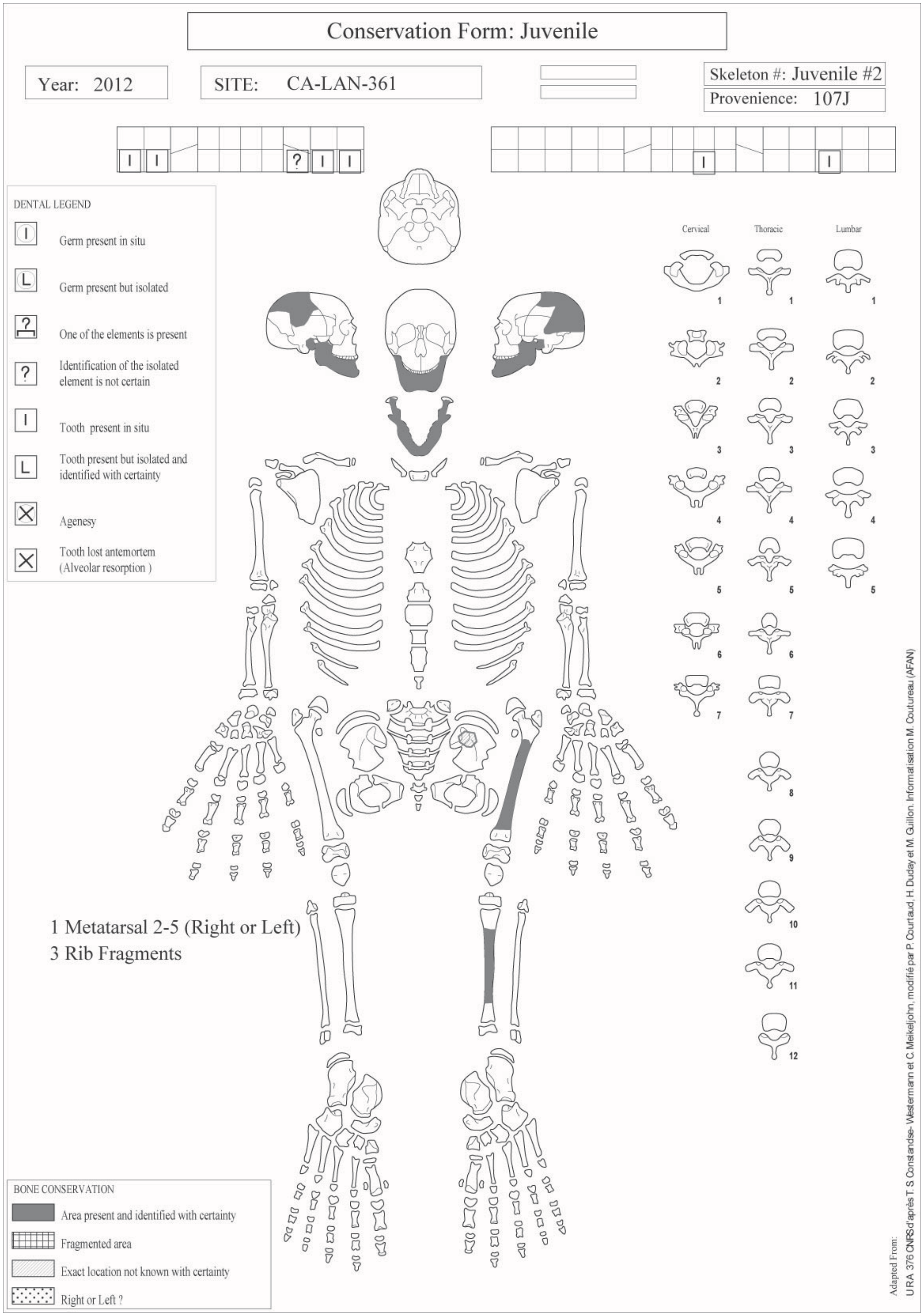
- Germ present in situ
- Germ present but isolated
- One of these elements is present
- Identification of the isolated element is not certain

BONE PRESERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty

Adapted From:
U R A 376 CNRS d'après T. S. Constandse- Westemann et C. Meikeljonh, modifié par A. M. Tillier et H. Duday. Informatisation M. Coutureau (AFAN)


Conservation Form: Juvenile
Year: 2012
SITE: CA-LAN-361
Skeleton #: Juvenile #1
Provenience: 107I/108I
DENTAL LEGEND
Germ present in situ
Germ present but isolated
One of the elements is present
Identification of the isolated element is not certain
Tooth present in situ
Tooth present but isolated and identified with certainty
Agenesy
Tooth lost antemortem (Alveolar resorption)
Cervical
Thoracic
Lumbar
BONE CONSERVATION
Area present and identified with certainty
Fragmented area
Exact location not known with certainty
Right or Left ?
Adapted From:
URA 376 CNRS d'après T. S Constandse- Westermann et C Meikeljohn, modifié par P. Courtaud, H. Duday et M. Guillon. Informatisation M. Coutureau (AFAN)


Conservation Form: Juvenile
Year: 2012
SITE: CA-LAN-361
Skeleton #: Juvenile #2
Provenience: 107J
DENTAL LEGEND
Germ present in situ
Germ present but isolated
One of the elements is present
Identification of the isolated element is not certain
Tooth present in situ
Tooth present but isolated and identified with certainty
Agenesy
Tooth lost antemortem (Alveolar resorption)
Cervical
Thoracic
Lumbar
1 Metatarsal 2-5 (Right or Left)
3 Rib Fragments
BONE CONSERVATION
Area present and identified with certainty
Fragmented area
Exact location not known with certainty
Right or Left ?
Adapted From:
URA 376 CNRS d'après T. S Constandse-Westermann et C Meikeljohn, modifié par P. Courtaud, H Duday et M. Guillon. Informatisation M. Coutureau (AFAN)

Conservation Form: Juvenile

Year: 2012

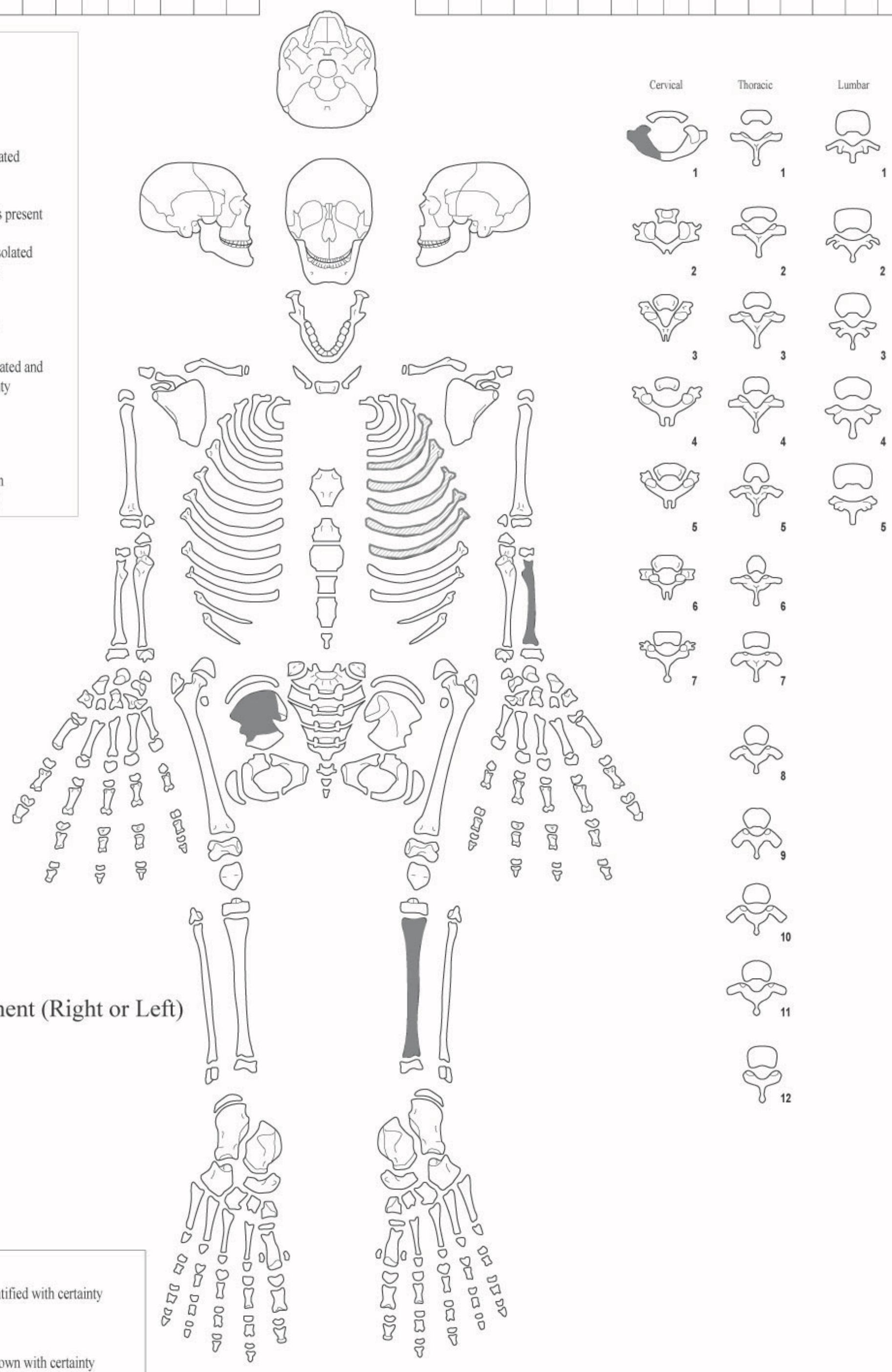
SITE: CA-LAN-361

Skeleton #: Juvenile #3

Provenience: Unknown

DENTAL LEGEND

- Germ present in situ
- Germ present but isolated
- One of the elements is present
- Identification of the isolated element is not certain
- Tooth present in situ
- Tooth present but isolated and identified with certainty
- Agenesy
- Tooth lost antemortem (Alveolar resorption)

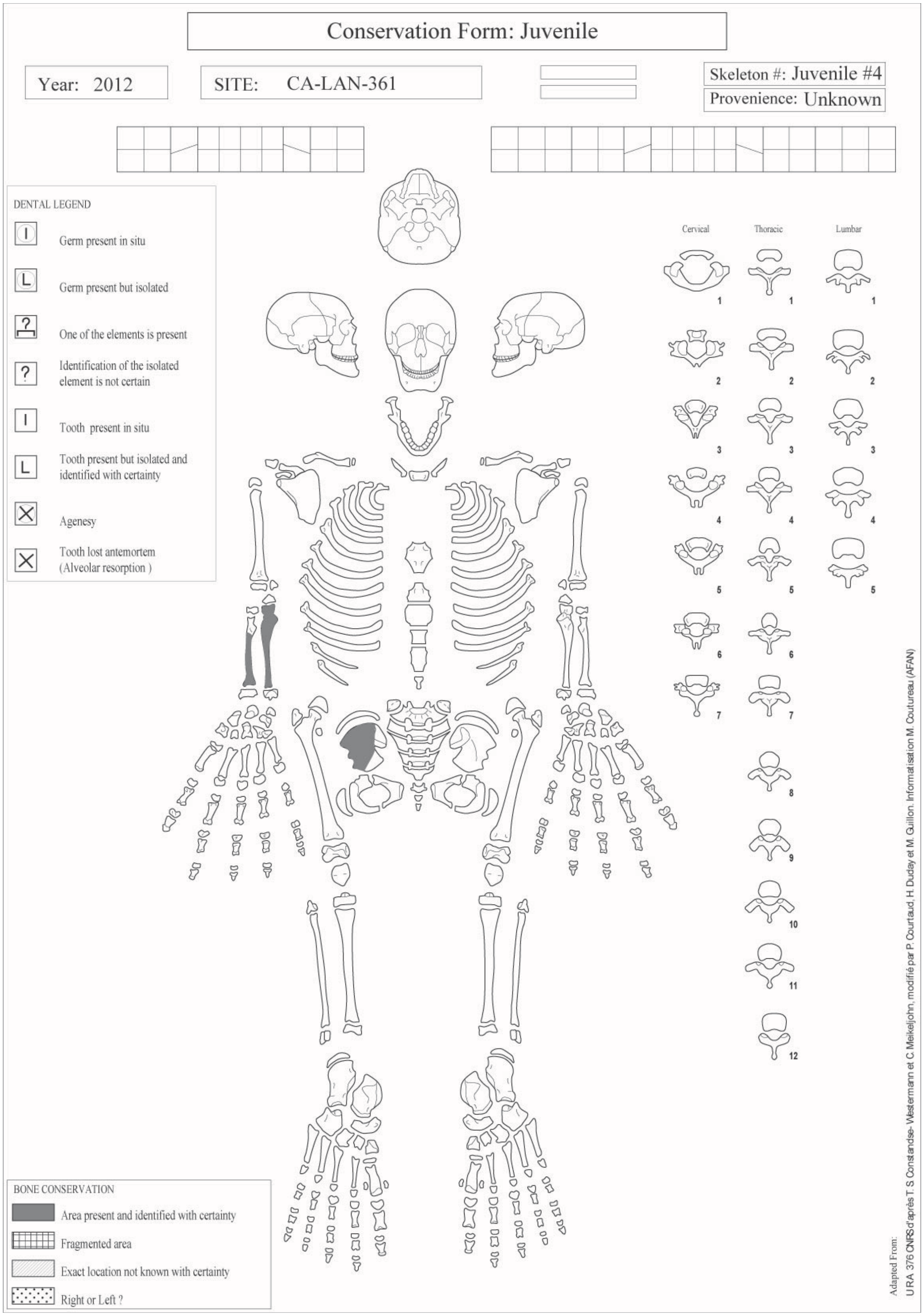


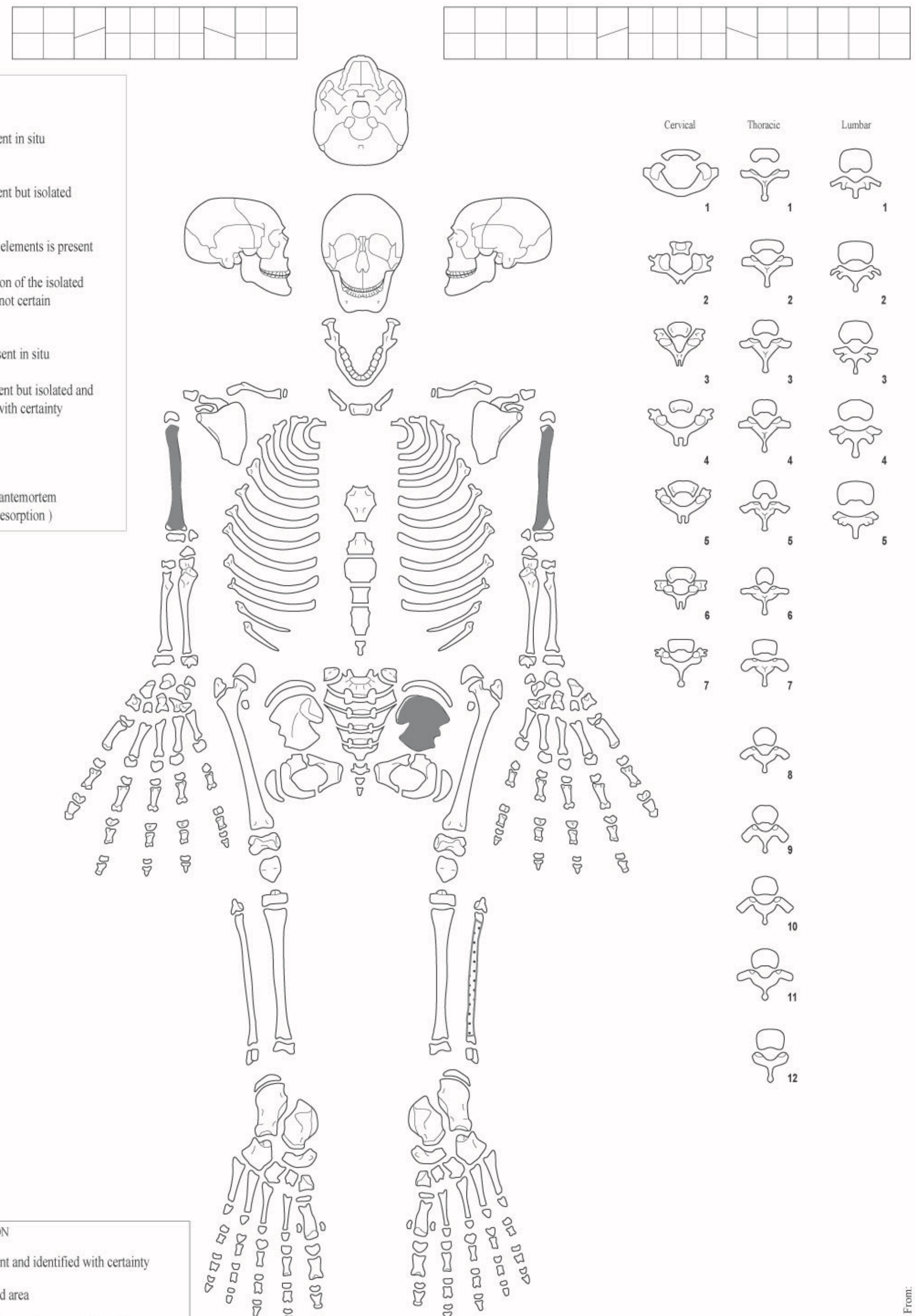
1 Rib Fragment (Right or Left)

BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From:
URA 376 CNRS d'après T. S Constandse-Westermann et C Meikeljohn, modifié par P. Courtaud, H. Duday et M. Guillon. Informatisation M. Coutureau (AFAN)


Conservation Form: Juvenile
Year: 2012
SITE: CA-LAN-361
Skeleton #: Juvenile #4
Provenience: Unknown
DENTAL LEGEND
Germ present in situ
Germ present but isolated
One of the elements is present
Identification of the isolated element is not certain
Tooth present in situ
Tooth present but isolated and identified with certainty
Agenesy
Tooth lost antemortem (Alveolar resorption)
Cervical
Thoracic
Lumbar
BONE CONSERVATION
Area present and identified with certainty
Fragmented area
Exact location not known with certainty
Right or Left ?
Adapted From:
U R A 376 CNRS d'après T. S Constandse-Westermann et C Meikeljohn, modifié par P. Courtaud, H. Duday et M. Guillon. Informatisation M. Coutureau (AFAN)



Conservation Form: Juvenile

Year: 2012

SITE: CA-LAN-361

Skeleton #: Juvenile #5

Provenience: Unknown

DENTAL LEGEND

- Germ present in situ
- Germ present but isolated
- One of the elements is present
- Identification of the isolated element is not certain
- Tooth present in situ
- Tooth present but isolated and identified with certainty
- Agenesy
- Tooth lost antemortem (Alveolar resorption)

BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From:
U R A 376 CNRS d'après T. S Constandse- Westermann et C Meikeljohn, modifié par P. Courtaud, H. Duday et M. Guillon. Informatisation M. Coutureau (AFAN)

Conservation Form: Juvenile

Year: 2012

SITE: CA-LAN-361

Skeleton #: Juvenile #6

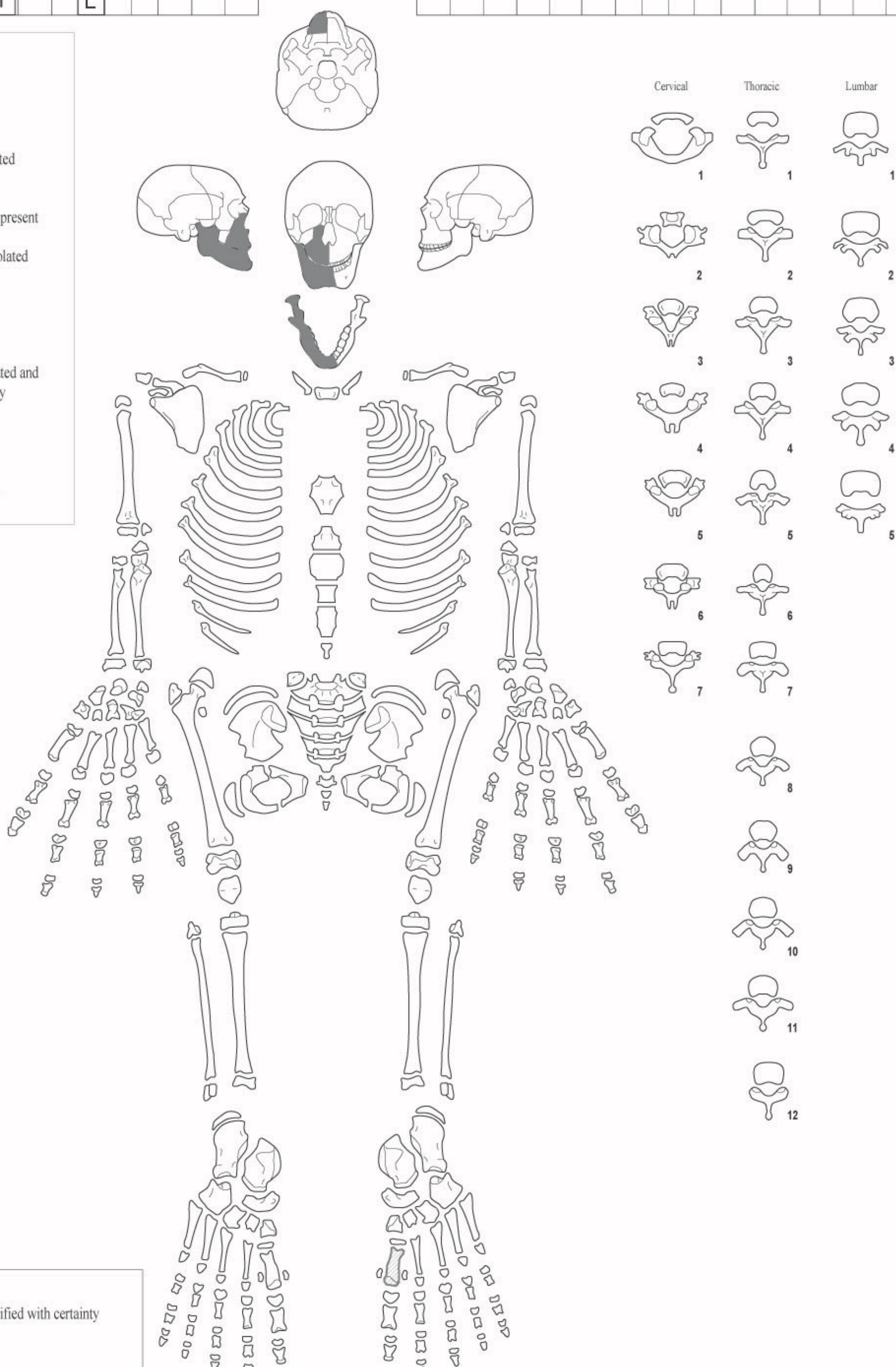
Provenience: Unknown

I	I		L					
I	I		L					

		L												

DENTAL LEGEND

- Germ present in situ
- Germ present but isolated
- One of the elements is present
- Identification of the isolated element is not certain
- Tooth present in situ
- Tooth present but isolated and identified with certainty
- Agenesy
- Tooth lost antemortem (Alveolar resorption)



BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From:
URA 376 CNRS d'après T. S Constandse- Westermann et C. Meikeljohn, modifié par P. Courtaud, H. Duday et M. Guillon. Informatisation M. Coutureau (AFAN)

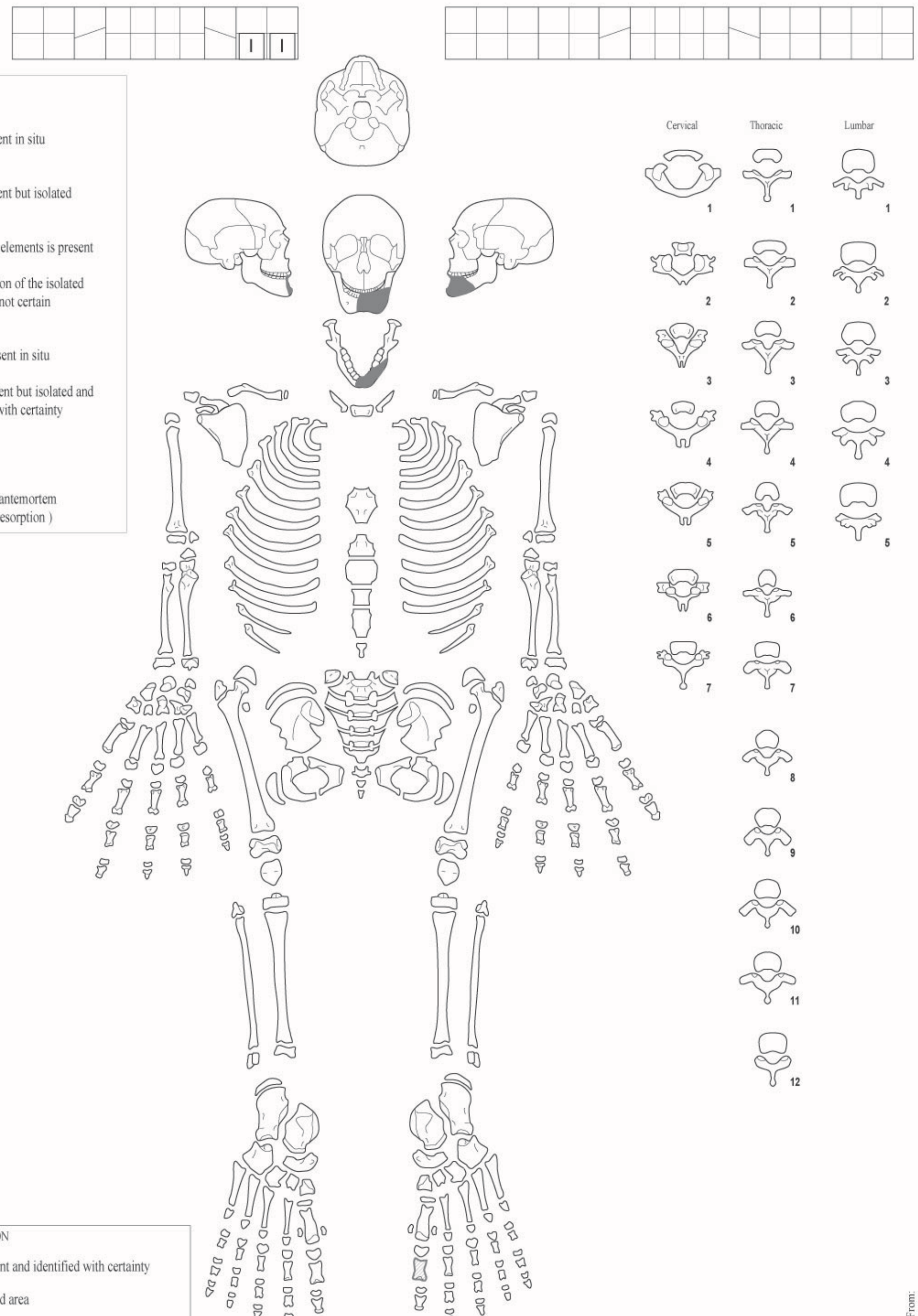
Conservation Form: Juvenile

Year: 2012

SITE: CA-LAN-361

Skeleton #: Juvenile #7

Provenience: Unknown



DENTAL LEGEND

- Germ present in situ
- Germ present but isolated
- One of the elements is present
- Identification of the isolated element is not certain
- Tooth present in situ
- Tooth present but isolated and identified with certainty
- Agenesy
- Tooth lost antemortem (Alveolar resorption)

BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From: URA 376 CNRS d'après T.S Constandse-Westermann et C Meikeljohn, modifié par P. Courtaud, H Duday et M. Guillon. Informatisation M. Coutureau (AFAN)

Conservation Form: Juvenile

Year: 2012

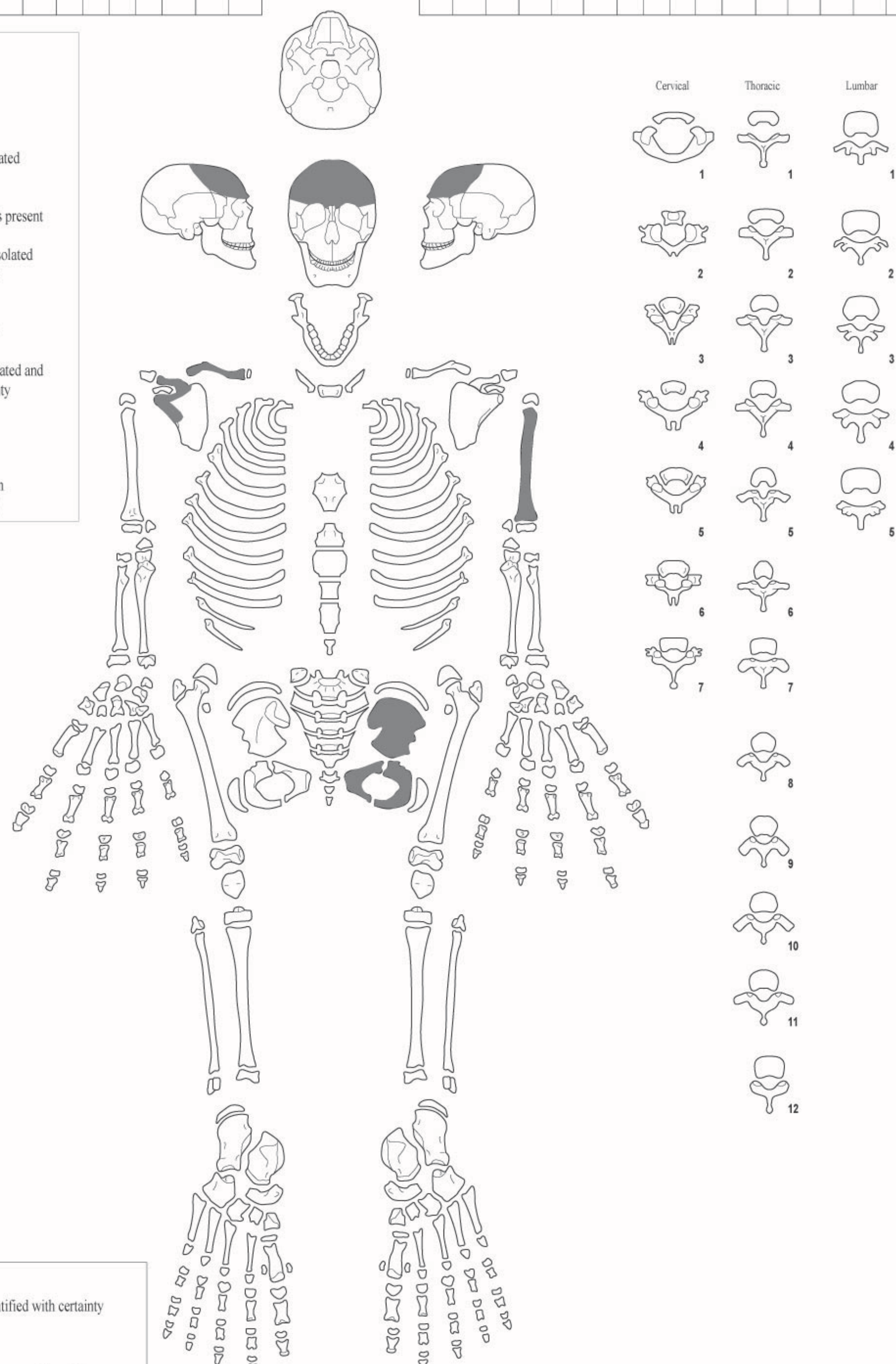
SITE: CA-LAN-361

Skeleton #: Juvenile #8

Provenience: 105J

DENTAL LEGEND

- Germ present in situ
- Germ present but isolated
- One of the elements is present
- Identification of the isolated element is not certain
- Tooth present in situ
- Tooth present but isolated and identified with certainty
- Agenesy
- Tooth lost antemortem (Alveolar resorption)



BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From:
URA 376 CNRS d'après T. S Constandse-Westermann et C Meikeljohn, modifié par P. Courtaud, H Duday et M. Guillon. Informatisation M. Coutureau (AFAN)

Conservation Form: Juvenile

Year: 2012

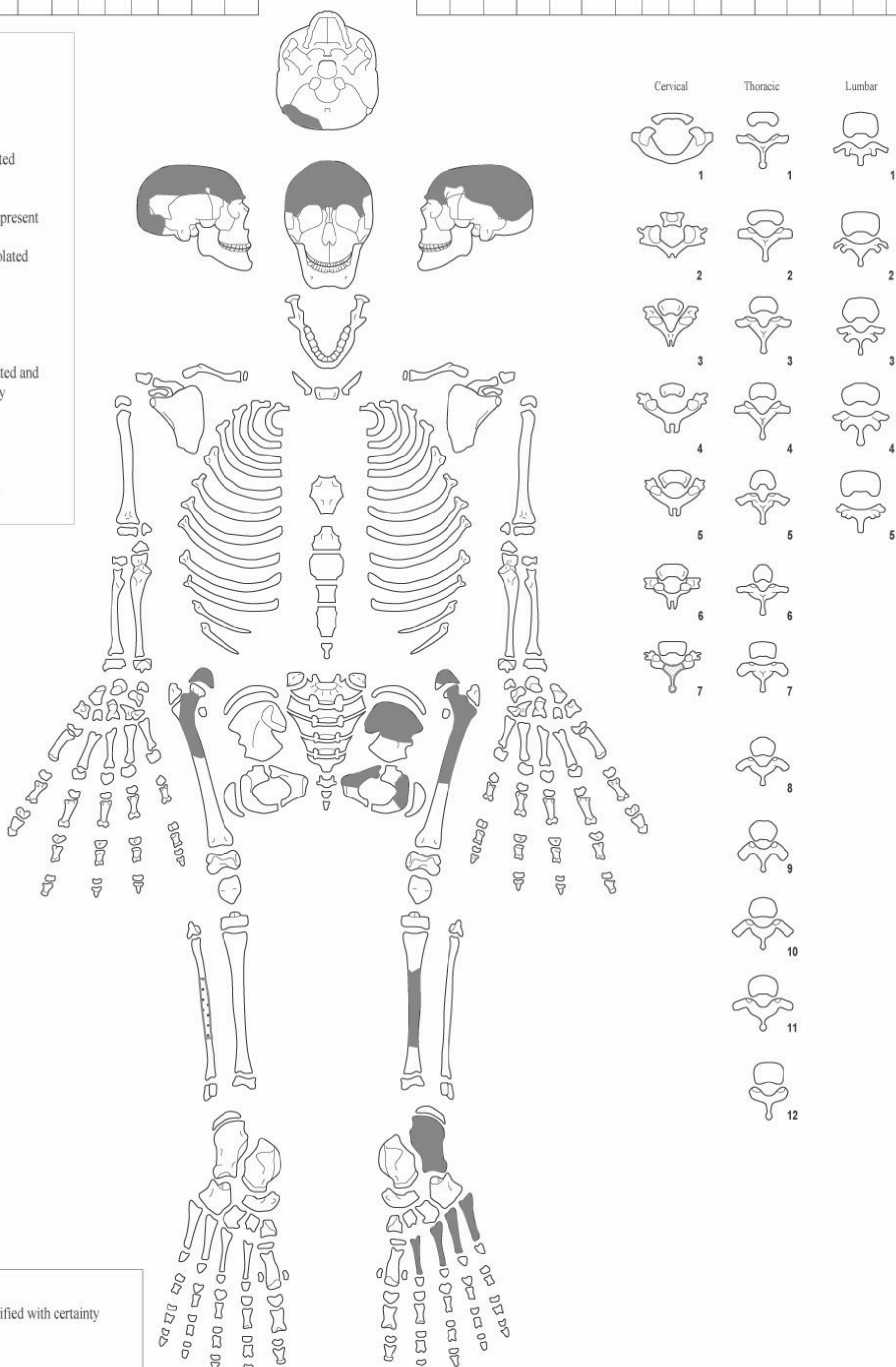
SITE: CA-LAN-361

Skeleton #: Juvenile #9

Provenience: 106J

DENTAL LEGEND

- Ⓘ Germ present in situ
- Ⓛ Germ present but isolated
- ? One of the elements is present
- ? Identification of the isolated element is not certain
- I Tooth present in situ
- L Tooth present but isolated and identified with certainty
- ☒ Agenesy
- ☒ Tooth lost antemortem (Alveolar resorption)



BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From:
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Conservation Form: Juvenile

Year: 2012

SITE: CA-LAN-361

Skeleton #:Juvenile #10

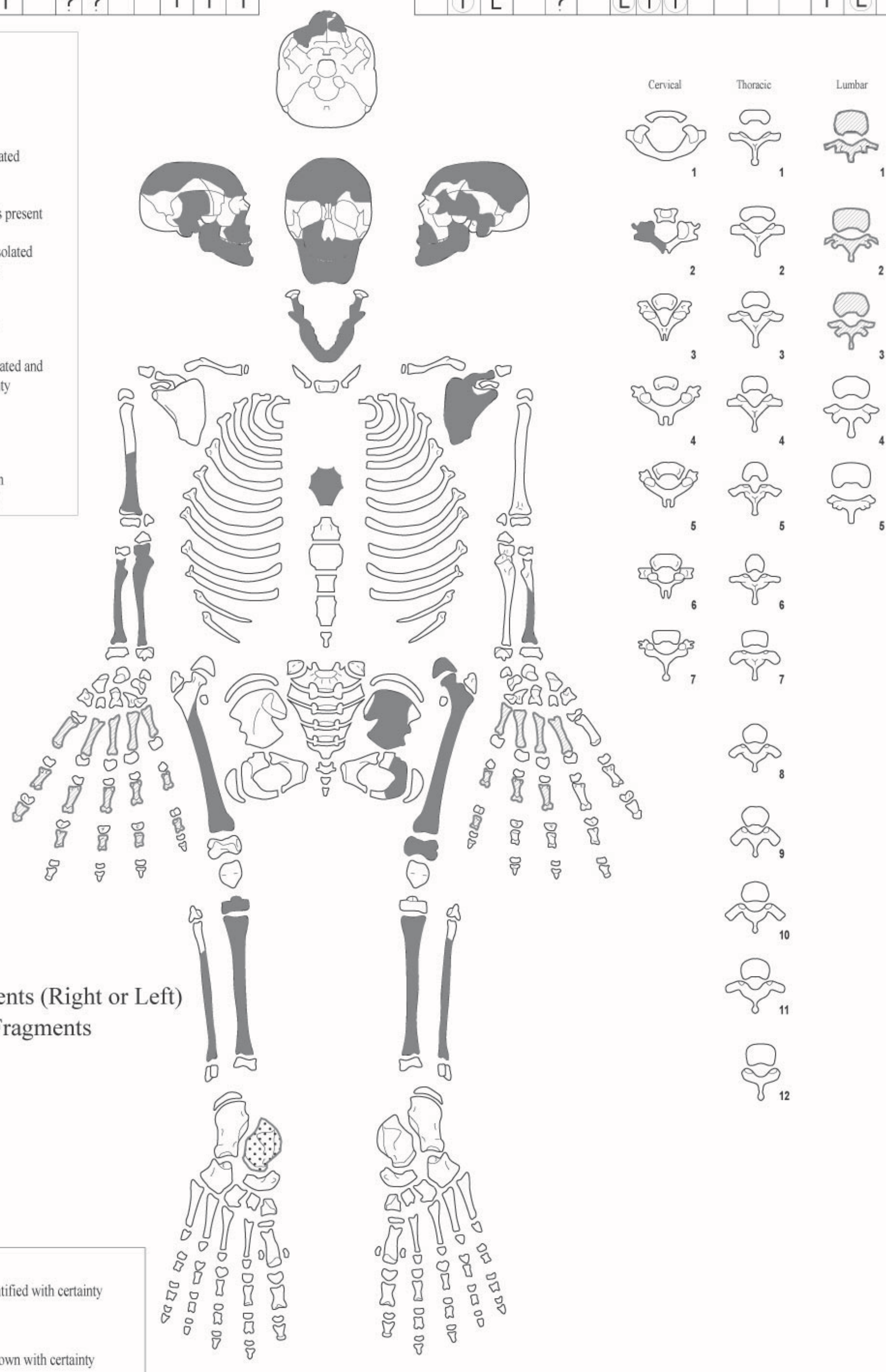
Provenience: Unknown

I	I	I					I	I	
I	I		?	?		I	I	I	

	L	L					L	I					L	
	I	L		?		L	I	I				I	L	

DENTAL LEGEND

- I Germ present in situ
- L Germ present but isolated
- ? One of the elements is present
- ? Identification of the isolated element is not certain
- I Tooth present in situ
- L Tooth present but isolated and identified with certainty
- X Agenesy
- X Tooth lost antemortem (Alveolar resorption)

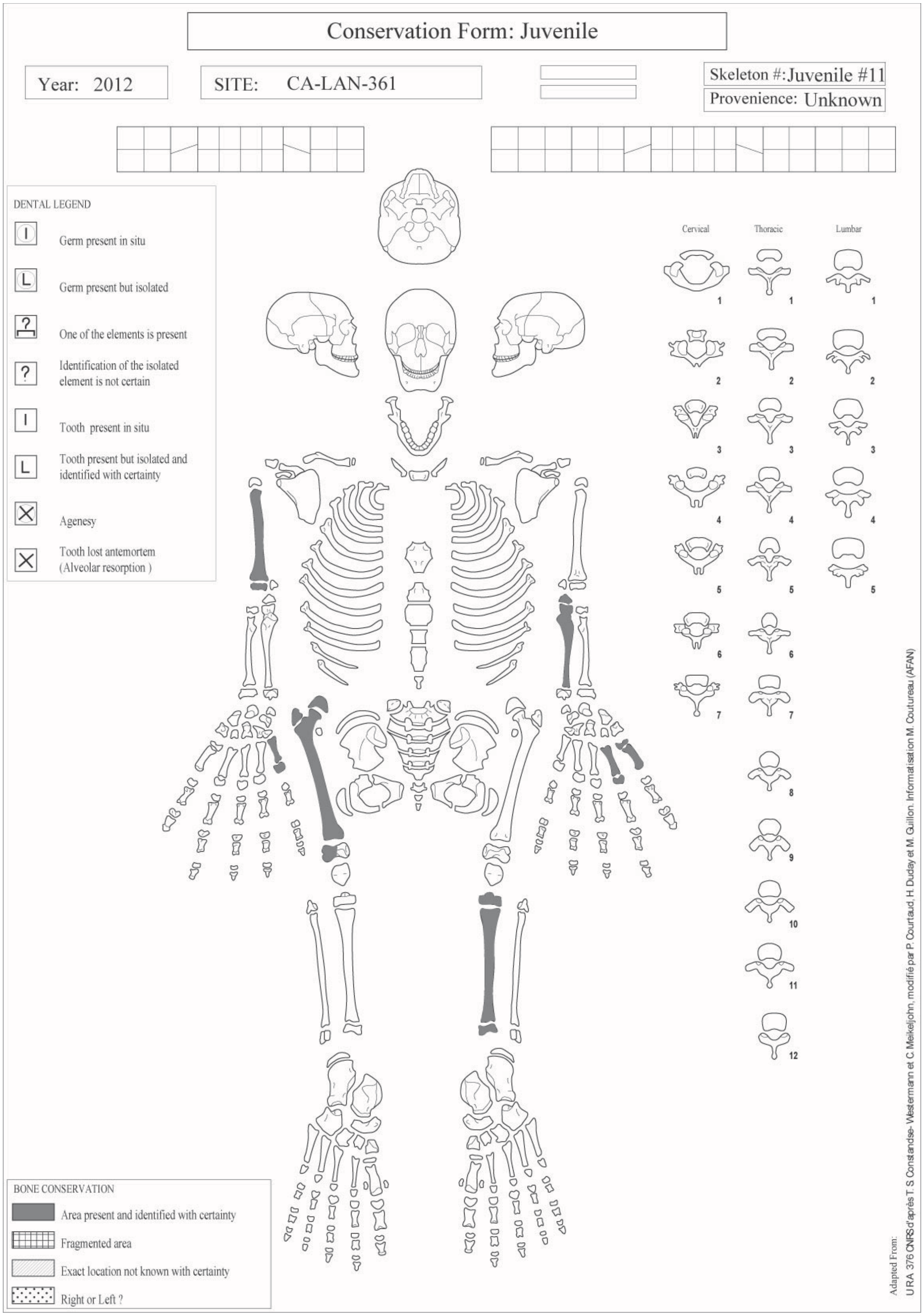


30 Rib Fragments (Right or Left)
13 Vertebrae Fragments

BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From:
URA 376 CNRS d'après T. S Constandse- Westermann et C Meikeljohn, modifié par P. Courtaud, H. Duday et M. Guillon. Informatisation M. Coutureau (AFAN)



Conservation Form: Juvenile

Year: 2012

SITE: CA-LAN-361

Skeleton #: Juvenile #11

Provenience: Unknown

DENTAL LEGEND

- Germ present in situ
- Germ present but isolated
- One of the elements is present
- Identification of the isolated element is not certain
- Tooth present in situ
- Tooth present but isolated and identified with certainty
- Agenesy
- Tooth lost antemortem (Alveolar resorption)

BONE CONSERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left ?

Adapted From:
URA 376 CNRS d'après T. S Constandse-Westermann et C Meikeljohn, modifié par P. Courtaud, H. Duday et M. Guillon. Informatisation M. Coutureau (AFAN)

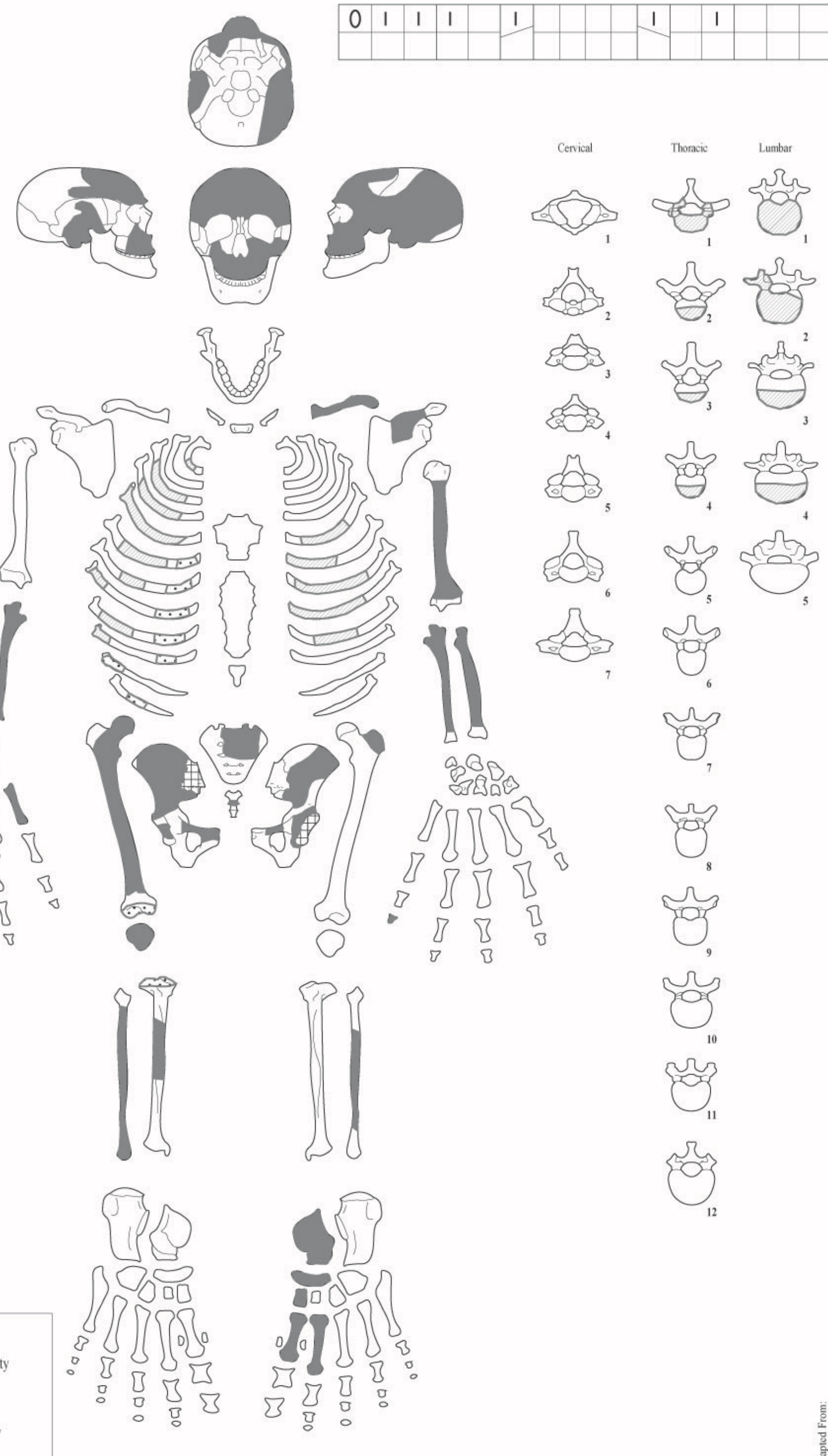
CONSERVATION FORM: ADULT

Year: 2012

SITE: CA-LAN-361

Skeleton #: Adult #1

Provenience: 108J



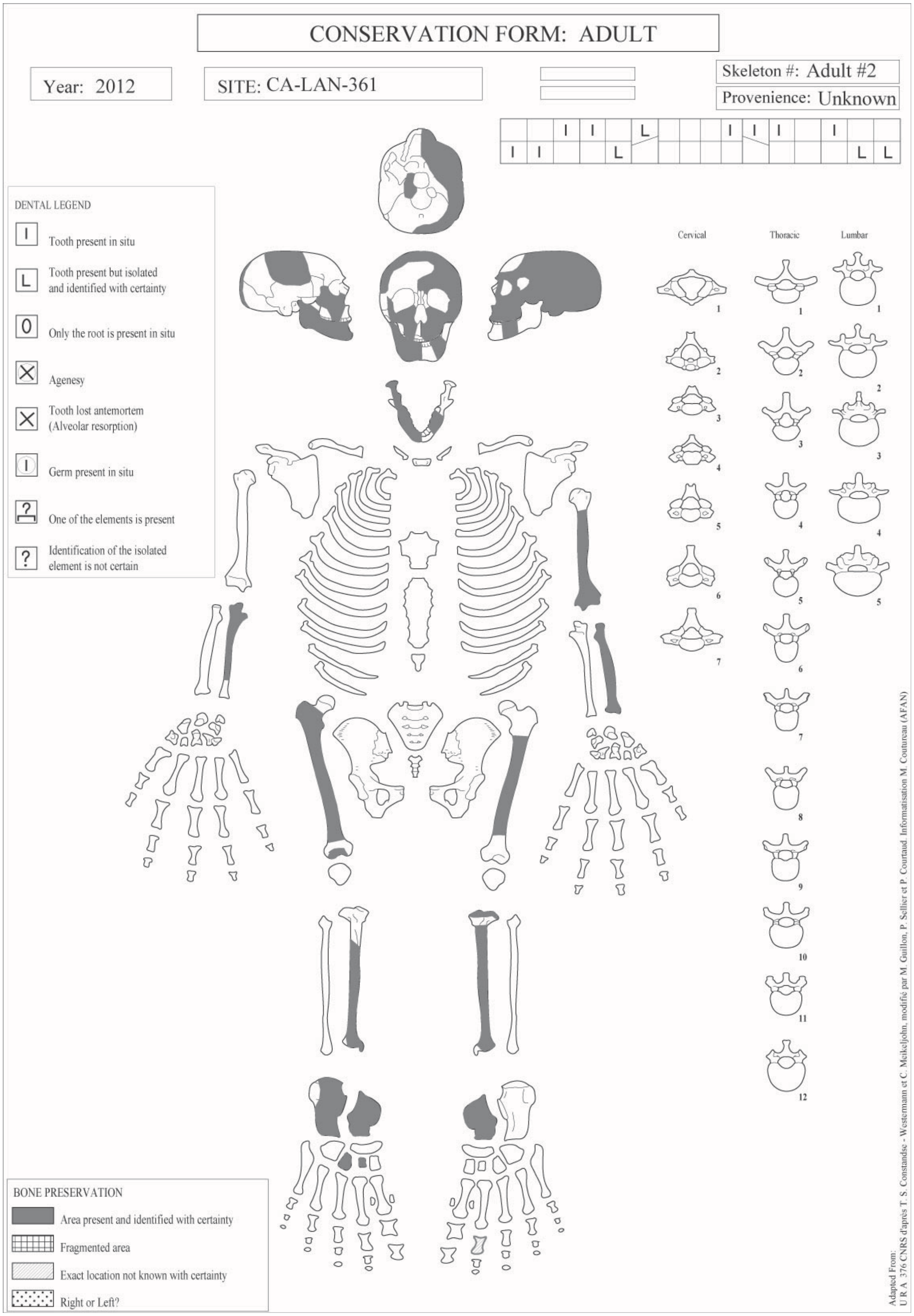
DENTAL LEGEND

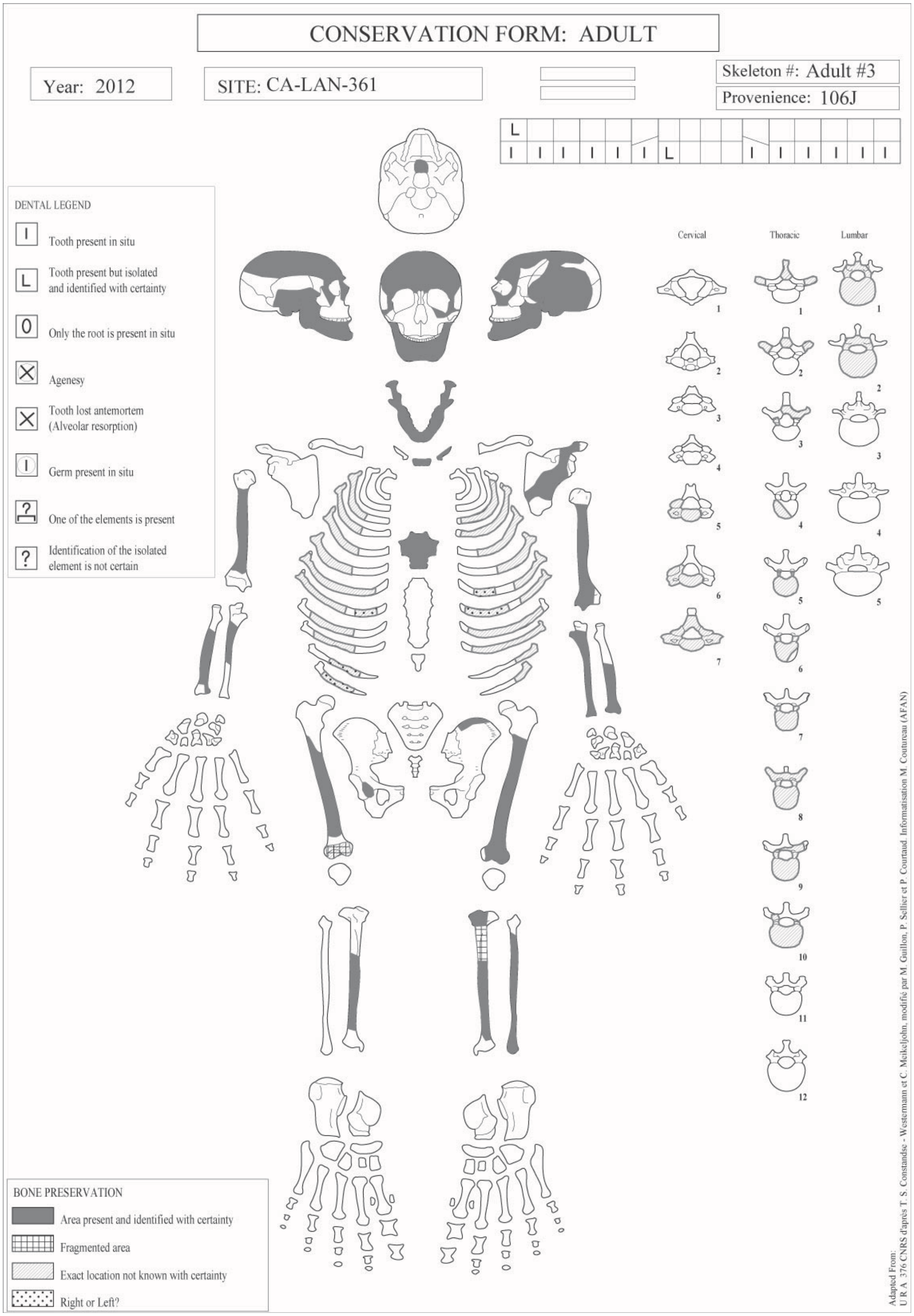
- I — Tooth present in situ
- L — Tooth present but isolated and identified with certainty
- 0 — Only the root is present in situ
- X — Agenesy
- X — Tooth lost antemortem (Alveolar resorption)
- I — Germ present in situ
- ? — One of the elements is present
- ? — Identification of the isolated element is not certain

BONE PRESERVATION

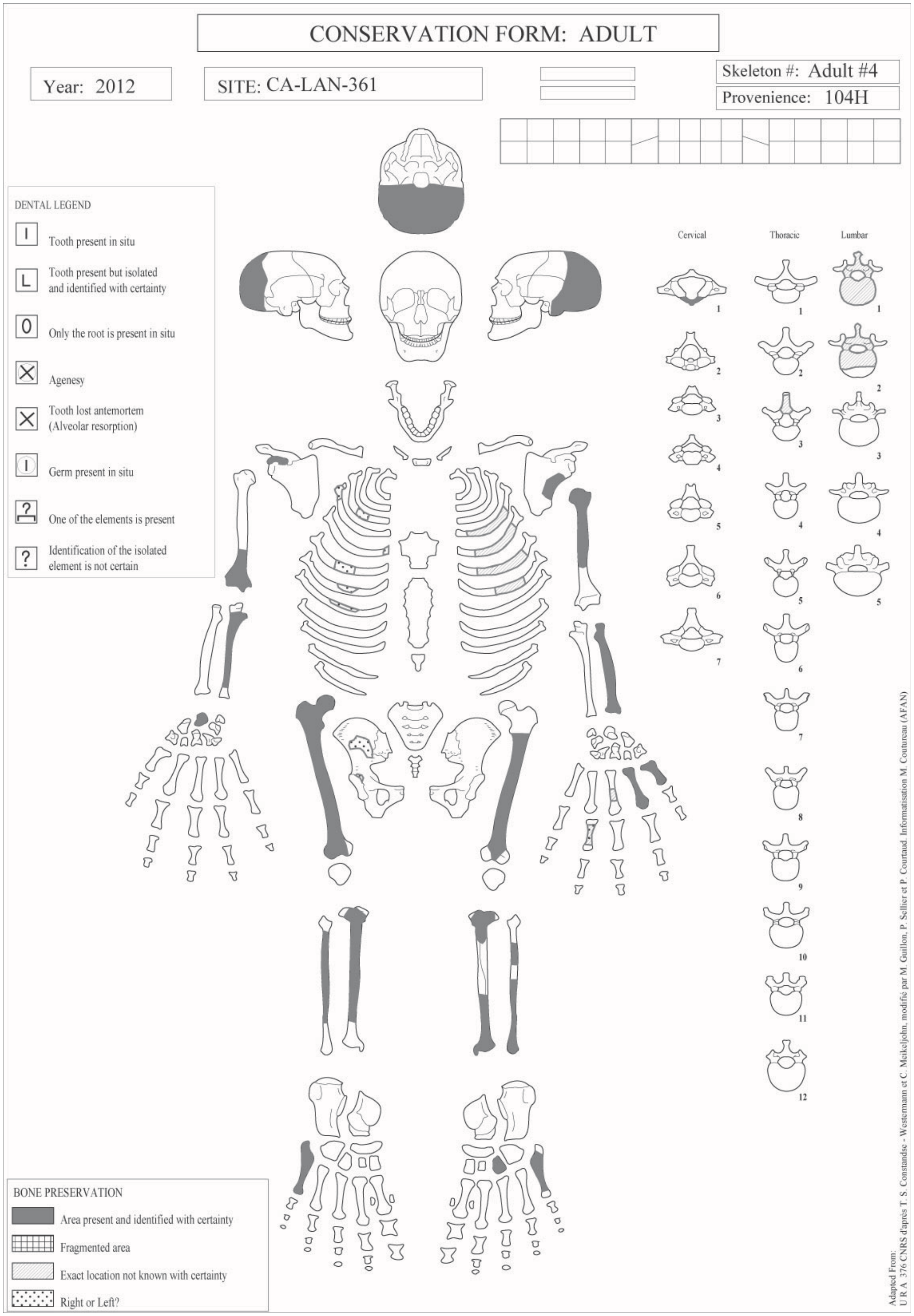
- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left?

Adapted From:
U R A 376 CNRS d'après T. S. Constandse - Westermann et C. Meikeljohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)


CONSERVATION FORM: ADULT
Year: 2012
SITE: CA-LAN-361
Skeleton #: Adult #2
Provenience: Unknown
DENTAL LEGEND
Tooth present in situ
Tooth present but isolated and identified with certainty
Only the root is present in situ
Agenesy
Tooth lost antemortem (Alveolar resorption)
Germ present in situ
One of the elements is present
Identification of the isolated element is not certain
Cervical
Thoracic
Lumbar
BONE PRESERVATION
Area present and identified with certainty
Fragmented area
Exact location not known with certainty
Right or Left?
Adapted From:
U R A 376 CNRS d'après T. S. Constandse - Westermann et C. Meikeljohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)



CONSERVATION FORM: ADULT
Year: 2012
SITE: CA-LAN-361
Skeleton #: Adult #3
Provenience: 106J
DENTAL LEGEND
Tooth present in situ
Tooth present but isolated and identified with certainty
Only the root is present in situ
Agenesy
Tooth lost antemortem (Alveolar resorption)
Germ present in situ
One of the elements is present
Identification of the isolated element is not certain
Cervical
Thoracic
Lumbar
BONE PRESERVATION
Area present and identified with certainty
Fragmented area
Exact location not known with certainty
Right or Left?
Adapted From: U R A 376 CNRS d'après T. S. Constandse - Westermann et C. Meikeljohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)


CONSERVATION FORM: ADULT
Year: 2012
SITE: CA-LAN-361
Skeleton #: Adult #4
Provenience: 104H
DENTAL LEGEND
Tooth present in situ
Tooth present but isolated and identified with certainty
Only the root is present in situ
Agenesy
Tooth lost antemortem (Alveolar resorption)
Germ present in situ
One of the elements is present
Identification of the isolated element is not certain
Cervical
Thoracic
Lumbar
BONE PRESERVATION
Area present and identified with certainty
Fragmented area
Exact location not known with certainty
Right or Left?
Adapted From:
U R A 376 CNRS d'après T. S. Constandse - Westermann et C. Meikeljohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)

CONSERVATION FORM: ADULT

Year: 2012

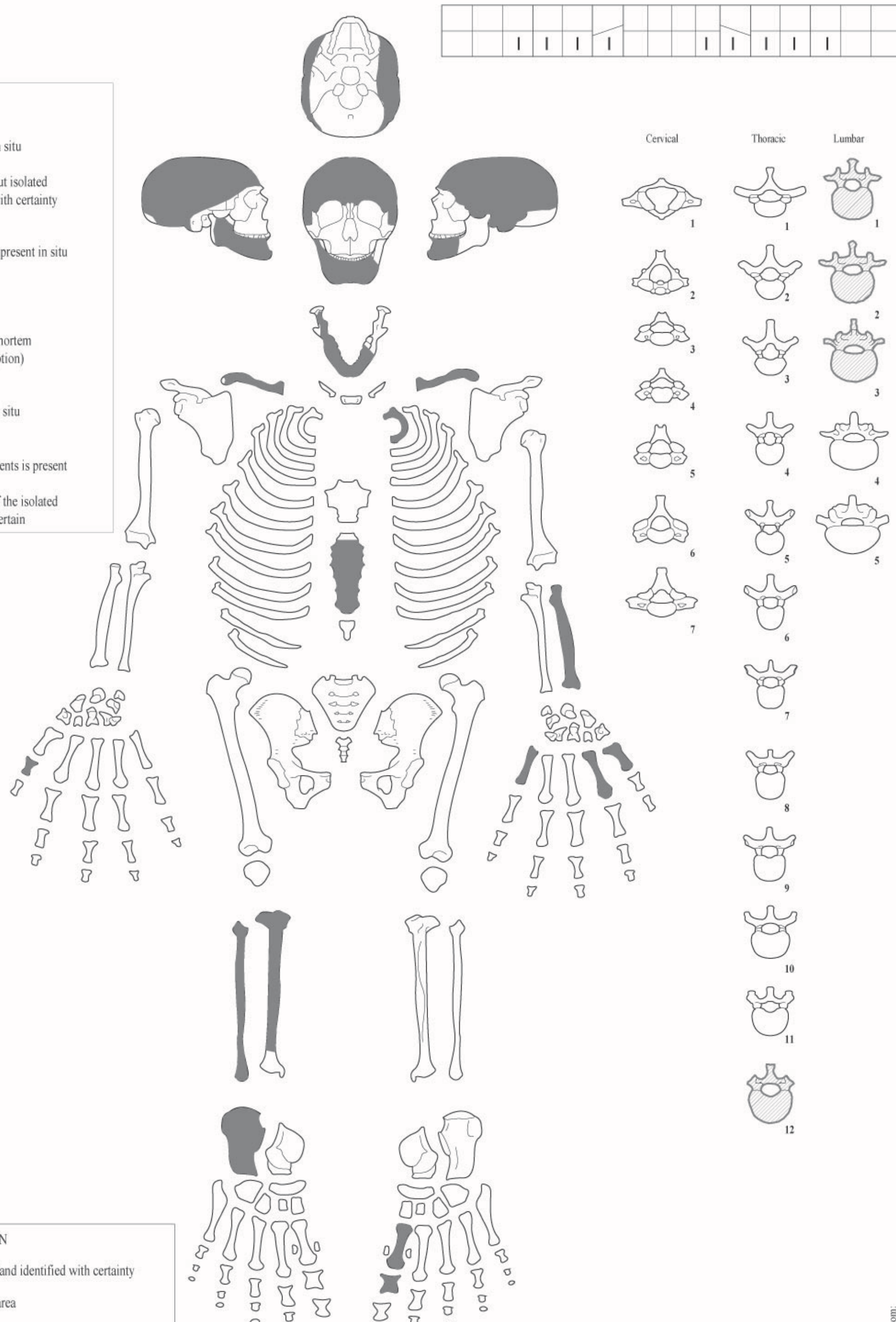
SITE: CA-LAN-361

Skeleton #: Adult #5

Provenience: Unknown

DENTAL LEGEND

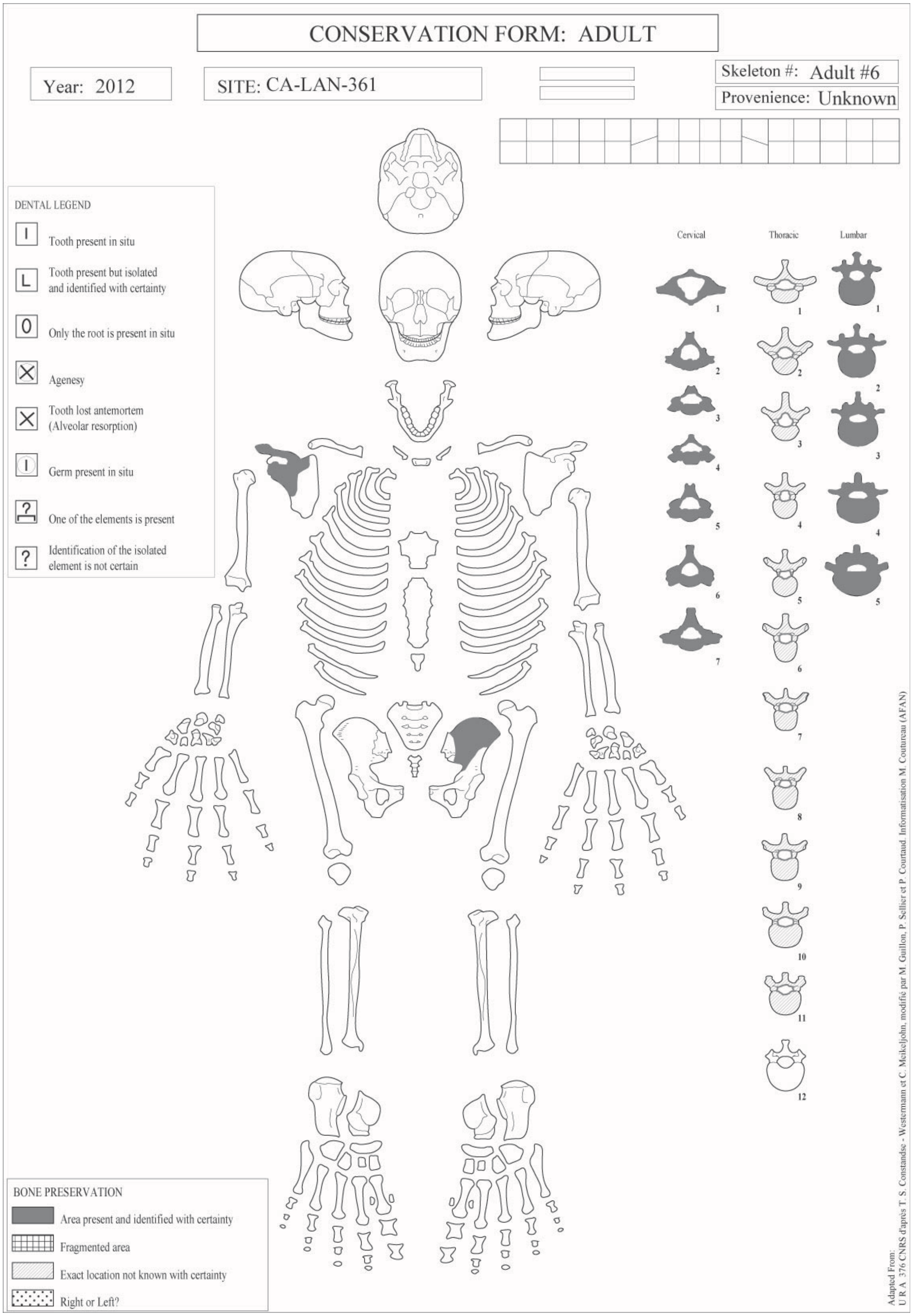
- I — Tooth present in situ
- L — Tooth present but isolated and identified with certainty
- 0 — Only the root is present in situ
- X — Agenesy
- X — Tooth lost antemortem (Alveolar resorption)
- (I) — Germ present in situ
- ? — One of the elements is present
- ? — Identification of the isolated element is not certain



BONE PRESERVATION

- Area present and identified with certainty
- Fragmented area
- Exact location not known with certainty
- Right or Left?

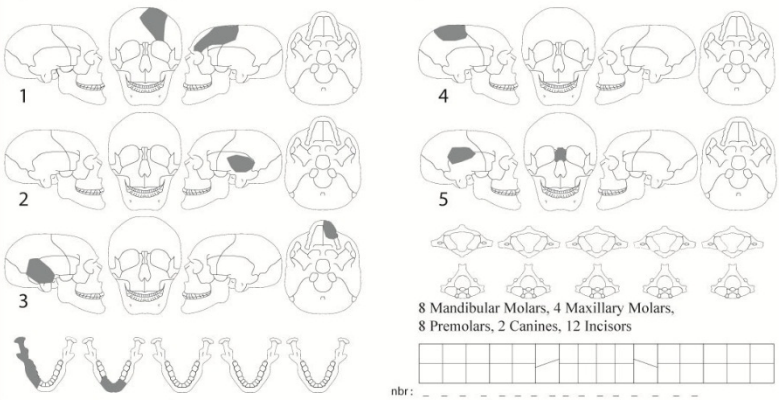
Adapted From:
U R A 376 CNRS d'après T. S. Constandse - Westermann et C. Meiklejohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)


CONSERVATION FORM: ADULT
Year: 2012
SITE: CA-LAN-361
Skeleton #: Adult #6
Provenience: Unknown
DENTAL LEGEND
Tooth present in situ
Tooth present but isolated and identified with certainty
Only the root is present in situ
Agenesy
Tooth lost antemortem (Alveolar resorption)
Germ present in situ
One of the elements is present
Identification of the isolated element is not certain
Cervical
Thoracic
Lumbar
BONE PRESERVATION
Area present and identified with certainty
Fragmented area
Exact location not known with certainty
Right or Left?
Adapted From:
U R A 376 CNRS d'après T. S. Constandse - Westermann et C. Meikeljohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)

Skeletal Elements Not Associated With An Individual

Year: 2012

Site : CA-LAN-361



8 Mandibular Molars, 4 Maxillary Molars,
8 Premolars, 2 Canines, 12 Incisors

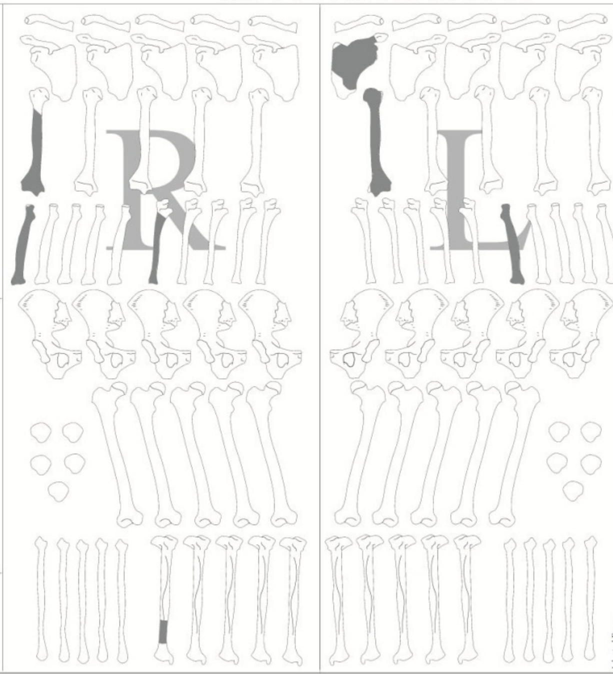
nbr :

NMI :

réalisé sur :

architecture funéraire :

mobilier :



	Count
Cervical Vertebrae	8
Thoracic Vertebrae	1
Lumbar Vertebrae	
Ribs	
Manubrium	
Sternum	
Sacrum	
Coccyx	

Area present and identified with certainty

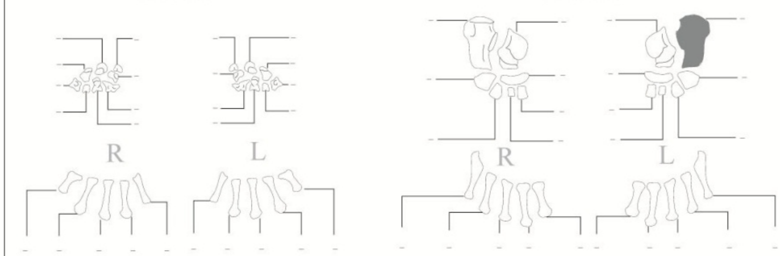
Fragmented Area

Right or Left?

Adapted From:
Fiche élaborée pour la nécropole de Bordeneuve, d'après U.R.A. 376 CNRS d'après T. S. Constandse - Westermann et C. Meiklejohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)

Palmar View

Dorsal View



Hands

Proximal Phalanges #: 1 MNI:___

Intermediate Phalanges #: 1 MNI:___

Distal Phalanges #: 1 MNI:___

Feet

Proximal Phalanges #:___ MNI:___

Intermediate Phalanges #:___ MNI:___

Distal Phalanges #: 1 MNI:___

	Disposition	Localisation
Répartition des crânes	☐ rangement ☐ aléatoire ☐ aire anatomique	☐ chevet 1/3 ☐ milieu 2/3 ☐ pieds 3/3
Répartition des os du thorax	☐ rangement ☐ aléatoire ☐ aire anatomique	☐ chevet 1/3 ☐ milieu 2/3 ☐ pieds 3/3
Répartition des os du bassin	☐ rangement ☐ aléatoire ☐ aire anatomique	☐ chevet 1/3 ☐ milieu 2/3 ☐ pieds 3/3
Répartition des os longs membre sup.	☐ fagots ☐ aléatoire ☐ aire anatomique	☐ chevet 1/3 ☐ milieu 2/3 ☐ pieds 3/3
Répartition des os longs membre inf.	☐ fagots ☐ aléatoire ☐ aire anatomique	☐ chevet 1/3 ☐ milieu 2/3 ☐ pieds 3/3

Portions anatomiques en connexion

Crâne / atlas / axis :

Ceinture scapulaire :

Thorax :

Ceinture pelvienne :

membre inférieur :

membre supérieur :

OBSERVATIONS :

Adapted From:
Fiche élaborée pour la nécropole de Bordeneuve, d'après U.R.A. 376 CNRS d'après T. S. Constandse - Westermann et C. Meiklejohn, modifié par M. Guillon, P. Sellier et P. Courtaud. Informatisation M. Coutureau (AFAN)

Appendix D: Skeletal Measurements and Descriptions

Below is the complete list of measurements from Bräuer (1988) and White et al. (2011) that have been considered in the present study. In the tables that follow, only those that could be taken on at least one individual are presented.

Cranial Measurements

Maximum cranial length: Glabella to Opisthocranion
Maximum cranial breadth: Euryon to Euryon
Biasterionic breadth: Asterion to Asterion
Bi-parietal boss breadth: Parietal boss to Parietal Boss
Byzygomatic breadth (or diameter): Zygion to Zygion
Biauricular breadth: Auriculare to Auriculare
Maximum cranial height (or basion-bregma height): Basion to Bregma
Cranial base length: Basion to Nasion
Basion-prosthion length: Basion to Prosthion
Frontal chord: Nasion to Bregma
Frontal arc: Nasion to Bregma
Parietal chord: Bregma to Lambda
Parietal arc: Bregma to Lambda
Occipital chord: Lambda to Opisthion
Occipital arc: Lambda to Opisthion
Occipital plane chord: Lambda to Inion
Occipital plane arc: Lambda to Inion
Total facial height: Gnathion to Nasion
Upper facial height: Prosthion to Nasion
Upper facial breadth: Frontomalare temporale to Frontomalare temporale
Minimum frontal breadth: Frontotemporale to Frontotemporale
Nasal aperture height (or nasal height): Nasospinale to Nasion
Nasal aperture breadth (or nasal breadth): Alare to Alare
Orbital height: greatest, perpendicular to breadth
Orbital breadth: Dacryon to Ectoconchion
Biorbital breadth: Ectoconchion to Ectoconchion
Interorbital breadth: Dacryon to Dacryon
Palate length: Orale to Staphylion
Palate breadth: Endomolare to Endomolare
Maxillo-alveolar breadth: Ectomolare to Ectomolare
Maxillo-alveolar length: Prosthion to Alveolare (or infradentale superior)
Foramen magnum length: Basion to Opisthion
Foramen magnum breadth: greatest, perpendicular to length
Mastoid length: vertical component of Auriculare to Mastoidale
Thickness at parietal boss

Thickness at frontal boss

Cranial Indices

Cranial index: (cranial breadth ÷ cranial length) ×100
Cranial module: (cranial length + cranial breadth + cranial height) ÷3
Cranial length-height index: (cranial height ÷ cranial length) ×100
Cranial breadth-height index: (cranial height ÷ cranial breadth) ×100
Total facial index: (total facial height ÷ bizygomatic breadth) ×100
Upper facial index: (upper facial height ÷ bizygomatic breadth) ×100
Nasal aperture index: (nasal aperture breadth ÷ nasal aperture height) ×100
Orbital index: (orbital height ÷ orbital width) ×100
Palatal index: (palate breadth ÷ palate length) ×100

Mandible

Bicondylar breadth: Condylion laterale to Condylion laterale
Bigonial breadth: Gonion to Gonion
Mandibular length: horizontal component of Pogonion to Gonion
Mandibular angle (°): angle between inferiormost two points of corpus and the posteriormost two points of ramus + condyle
Maximum ramal breadth: anteriormost of ramus to line connecting the posteriormost two points of ramus + condyle
Minimum ramal breadth: smallest, perpendicular to height
Maximum ramal height: Condylion superior to Gonion
Mandibular body height: base to alveolar margin, at mental foramen
Mandibular body breadth: maximum breadth at mental foramen
Symphyseal height (or chin height): Gnathion to Infradentale

Clavicle and Scapula

Maximum clavicular length
Clavicular "anteroposterior" midshaft diameter
Clavicular superoinferior midshaft diameter
Clavicular midshaft circumference

Maximum length (or anatomical height or total height)
Morphological (or anatomical) breadth
Length of spine
Length of supraspinous line
Length of infraspinous line
Scapular index: (anatomical breadth ÷ anatomical height) × 100

Arm: Humerus, Radius, and Ulna

Maximum humeral length

Humeral biomechanical length
Humeral bicondylar (or bi-epicondylar) breadth
Humeral midshaft circumference
Vertical head diameter
Humeral torsion
Maximum midshaft diameter
Minimum midshaft diameter

Maximum radial length
Radial biomechanical length
Radial head anteroposterior diameter
Radial midshaft circumference
Radial anteroposterior midshaft diameter
Radial mediolateral (or transverse) midshaft diameter

Maximum ulnar length
Ulnar biomechanical length
Ulnar physiological length
Maximum anteroposterior diameter
Maximum mediolateral (or transverse) diameter
Ulnar minimum circumference

Hand: Metacarpals and Phalanges

Maximum metacarpal length
Metacarpal biomechanical (or articular) length
Midshaft dorsopalmar height
Midshaft mediolateral breadth

Maximum phalangeal length
Phalangeal biomechanical (or articular) length
Midshaft anteroposterior (or dorsopalmar) height
Midshaft mediolateral breadth

Pelvis: Sacrum and Os Coxae

Maximum anterior height (or ventral height)
Maximum anterior breadth
Ventral height arc
Dorsal height
Anterosuperior breadth
Middle breadth
Auricular surface height
Auricular surface breadth
Sacral index: (maximum anterior breadth ÷ maximum anterior height) × 100

Os coxae height
Superior iliac breadth (also os coxae breadth)
Immature iliac breadth
Immature iliac height
Iliac length (or height)
Pubic length
Acetabulosymphyseal length
Ischial length
Acetabular height
Acetabular depth
Obturator foramen length
Obturator foramen breadth

Transverse diameter
Oblique diameter
Anatomical conjugate
True conjugate
Diagonal conjugate
Straight conjugate
Inferior sacropubic diameter
Median conjugate
Bi-iliac breadth (or intercristal distance or diameter)
Interspinous distance (or diameter)
Subpubic angle (°)

Leg: Femur, Patella, Tibia, and Fibula

Maximum femoral length
Femoral biomechanical length
Femoral bicondylar (or physiological) length
Femoral midshaft circumference
Femoral epicondylar breadth
Femoral torsion
Femoral anteroposterior (or sagittal) midshaft diameter
Femoral mediolateral (or transverse) midshaft diameter
Platymeric index: (anteroposterior midshaft diameter ÷ mediolateral midshaft diameter) × 100

Maximum patellar height
Maximum patellar breadth

Maximum tibial length
Tibial biomechanical length
Tibial maximum proximal epiphyseal breadth
Tibial maximum distal epiphyseal breadth
Tibial midshaft circumference

Tibial circumference at nutrient foramen
Tibial anteroposterior midshaft diameter
Tibial mediolateral (or transverse) midshaft diameter
Tibial maximum shaft diameter at nutrient foramen
Tibial mediolateral (or transverse) shaft diameter at nutrient foramen
Platycnemic index: (mediolateral shaft diameter at nutrient foramen ÷ maximum shaft diameter at nutrient foramen) × 100

Maximum fibular length
Maximum fibular midshaft diameter
Fibular midshaft circumference

Foot: Tarsals, Metatarsals, and Phalanges

Maximum calcaneal length
Posterior calcaneal length
Talar length
Maximum talar length

Maximum metatarsal 1 length
Metatarsal biomechanical (or articular) length
Midshaft height
Midshaft breadth

Maximum metatarsal 2-5 length
Metatarsal biomechanical (or articular) length
Midshaft height
Midshaft breadth

Phalangeal length
Phalangeal biomechanical (or articular) length
Midshaft anteroposterior (or dorsoplantar) height
Midshaft mediolateral breadth

<table>
<tr><th colspan="13">Table D1: Adult Skeletal Measurements</th></tr>
<tr><th></th><th colspan="2">Adult #1</th><th colspan="2">Adult #2</th><th colspan="2">Adult #3</th><th colspan="2">Adult #4</th><th colspan="2">Adult #5</th><th colspan="2">Adult #6</th></tr>
<tr><th></th><th>Right</th><th>Left</th><th>Right</th><th>Left</th><th>Right</th><th>Left</th><th>Right</th><th>Left</th><th>Right</th><th>Left</th><th>Right</th><th>Left</th></tr>
<tr><td colspan="13">Cranial Measurements</td></tr>
<tr><td>Maximum cranial length</td><td></td><td></td><td colspan="2">166.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Maximum cranial breadth</td><td></td><td></td><td colspan="2">145.5</td><td></td><td></td><td></td><td></td><td colspan="2">161.0</td><td></td><td></td></tr>
<tr><td>Biasterionic breadth</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">110.1</td><td colspan="2">114.5</td><td></td><td></td></tr>
<tr><td>Bi-parietal boss breadth</td><td></td><td></td><td colspan="2">142.0</td><td></td><td></td><td></td><td></td><td colspan="2">132.0</td><td></td><td></td></tr>
<tr><td>Frontal chord</td><td></td><td></td><td colspan="2">106.0</td><td colspan="2">116.7</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Frontal arc</td><td></td><td></td><td></td><td></td><td colspan="2">132.0</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Parietal chord</td><td></td><td></td><td colspan="2">105.9</td><td></td><td></td><td colspan="2">107.6</td><td colspan="2">98.2</td><td></td><td></td></tr>
<tr><td>Parietal arc</td><td></td><td></td><td colspan="2">119.0</td><td></td><td></td><td colspan="2">126.0</td><td colspan="2">108.0</td><td></td><td></td></tr>
<tr><td>Occipital chord</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">95.1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Occipital arc</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">117.0</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Occipital plane chord</td><td></td><td></td><td colspan="2">64.0</td><td></td><td></td><td colspan="2">65.2</td><td colspan="2">7.6</td><td></td><td></td></tr>
<tr><td>Occipital plane arc</td><td></td><td></td><td colspan="2">70.0</td><td></td><td></td><td colspan="2">72.0</td><td colspan="2">79.0</td><td></td><td></td></tr>
<tr><td>Minimum frontal breadth</td><td colspan="2">94.0</td><td></td><td></td><td colspan="2">92.0</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Orbital height</td><td></td><td></td><td></td><td>32.6</td><td></td><td>36.6</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Orbital breadth</td><td></td><td></td><td></td><td>35.9</td><td></td><td>34.4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Interorbital breadth</td><td colspan="2">24.1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Foramen magnum length</td><td></td><td></td><td colspan="2">30.8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Mastoid Length	39.4				35.4	33.4				38.2		
Thickness at parietal boss		5.0	4.5	5.0		7.0			4.5	5.0		
Thickness at frontal boss	5.0	5.5	4.5	4.5	6.0	6.0			6.0	6.0		
Cranial Indices												
Cranial index			87.7									
Orbital index				90.9		106.5						
Mandible												
Bicondylar breadth					120.9							
Bigonial breadth					105.9							
Mandibular length			76.5		80.5				82.0*			
Mandibular angle			125.5°		114.0°							
Maximum ramal breadth					52.3	53.0						
Minimum ramal breadth					42.4	41.4						
Maximum ramal height			63.0		59.0							
Mandibular body height			25.6		30.3	28.0			35.7	35.0		

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Mandibular body breadth					14.0	13.5			10.5	11.0		
Symphyseal height (or chin height)			28.6		37.2				33.8			
Clavicle and Scapula												
Maximum clavicular length		>137.0							>149.5	>151.5		
Clavicular "anteroposterior" midshaft diameter		11.1							9.0	7.8		
Clavicular superoinferior midshaft diameter		8.9							10.8	11.3		
Clavicular midshaft circumference		33.0							32.5	32.5		
Morphological (or anatomical) breadth											>90.5	
Length of Spine											>119.1	
Arm: Humerus, Radius, and Ulna												
Maximum humeral length		>272.0		>254.0	>232.5	>270.0		>228.0				

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Humeral bicondylar (or bi-epicondylar) breadth				60.1			53.5					
Humeral midshaft circumference		61.5		62.0	64.0	59.0		50.5				
Vertical head diameter								38.4				
Maximum midshaft diameter		21.3		21.8	23.6	20.84		18.2				
Minimum midshaft diameter		16.2		16.6	15.7	13.8		12.8				
Maximum radial length	248.0	>218.0		230.0*	>192.0	>141.0		219.5		255.5		
Radial biomechanical length	234.0							208.5		240.0		
Radial head anteroposterior diameter	23.1	22.8		19.6						>17.9		
Radial midshaft circumference	43.5	41.3		39.0	40.0*			39.0		45.5		
Radial anteroposterior midshaft diameter	11.3	11.5		9.9	10.5*			10.9		12.8		
Radial mediolateral (or transverse) midshaft diameter	16.2	15.6		14.9	14.9			14.6		17.0		

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum ulnar length	266.0	>253.0	>230.0		>105.0	>235.0	>191.0					
Ulnar biomechanical length	242.0					232.0*						
Ulnar physiological length	236.0					219.0						
Maximum anteroposterior diameter	13.2	13.7	12.7			11.8	10.5					
Maximum mediolateral (or transverse) diameter	16.2	15.0	14.6			14.1	12.8					
Ulnar minimum circumference	34.0	33.5	29.0			33.0	29.0					
Hand: Metacarpals and Phalanges												
Maximum metacarpal 1 length								39.9		43.3		
Metacarpal biomechanical (or articular) length								38.5		41.5		
Midshaft dorsopalmar height								7.6		11.1		
Midshaft mediolateral breadth								9.7		14.2		

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum metacarpal 2 length								62.7		69.5		
Metacarpal biomechanical (or articular) length								60.0		67.0		
Midshaft dorsopalmar height								7.9		8.7		
Midshaft mediolateral breadth								7.1		8.6		
Maximum metacarpal 5 length	52.6									57.7		
Metacarpal biomechanical (or articular) length	51.5									57.0		
Midshaft dorsopalmar height	6.8									7.2		
Midshaft mediolateral breadth	8.6									9.4		
Maximum proximal phalangeal 1 length										30.3		
Phalangeal biomechanical (or articular) length										27.5		
Midshaft anteroposterior (or dorsopalmar) height										6.5		

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Midshaft mediolateral breadth										9.3		
Maximum intermediate phalangeal 2 length	24.3											
Phalangeal biomechanical (or articular) length	23.0											
Midshaft anteroposterior (or dorsopalmar) height	4.8											
Midshaft mediolateral breadth	7.8											
Maximum intermediate phalangeal 3 length	29.1											
Phalangeal biomechanical (or articular) length	27.0											
Midshaft anteroposterior (or dorsopalmar) height	5.7											
Midshaft mediolateral breadth	8.8											

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum distal phalangeal 5 length		16.5										
Phalangeal biomechanical (or articular) length		14.5										
Midshaft anteroposterior (or dorsopalmar) height		3.2										
Midshaft mediolateral breadth		3.9										
Pelvis: Sacrum and Os Coxae												
Superior iliac breadth (also os coxae breadth)												>123.8
Acetabular height		50.6										
Leg: Femur, Patella, Tibia, and Fibula												
Maximum femoral length	>401.0		>414.0	>318.0	>263.0	>362.0	417.0	>343.5				
Femoral biomechanical length							394.0					

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Femoral bicondylar (or physiological) length							413.5					
Femoral midshaft circumference	84.5		82.5	81.0	84.5	87.0	72.5	73.5				
Femoral epicondylar breadth						73.37	>62.0					
Femoral torsion							32.0°					
Femoral anteroposterior (or sagittal) midshaft diameter	28.5		28.1	26.6	29.8	31.8	24.4	25.4				
Femoral mediolateral (or transverse) midshaft diameter	25.5		24.1	25.0	22.9	23.6	22.0	22.7				
Platymeric index	111.5		116.7	106.4	130.2	134.5	110.7	112.0				
Maximum patellar height	41.7											
Maximum patellar breadth	44.1											
Maximum tibial length	>112.0			>352.0	>217.5	>326			>312.0			

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Tibial maximum proximal epiphyseal breadth				>72.4					73.1			
Tibial maximum distal epiphyseal breadth				>37.8								
Tibial midshaft circumference				83.0	76.5	78.5	72.0		88.0			
Tibial circumference at nutrient foramen				89.5	83.5				101.0*			
Tibial anteroposterior midshaft diameter				31.5	29.4	29.9	27.3		35.6			
Tibial mediolateral (or transverse) midshaft diameter				21.0	18.7	19.2	17.3		22.3			
Tibial maximum shaft diameter at nutrient foramen				33.3	33.0				38.6			
Tibial mediolateral (or transverse) shaft diameter at nutrient foramen				21.8	19.9	21.0	19.7		26.2			
Platycnemic index				65.4	60.3				67.9			

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum fibular length	>352.0	>204.0				>311.0	>262.0	>180.5	330.0			
Maximum fibular midshaft diameter	15.9					13.6	15.4		15.7			
Fibular midshaft circumference	40.5					39.0	39.0		43.0			
Foot: Tarsals, Metatarsals, and Phalanges												
Maximum calcaneal length									78.0			
Posterior calcaneal length									57.7			
Talar length		50.9										
Maximum talar length		58.1										
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum metatarsal 1 length		64.2								63.4		
Metatarsal biomechanical (or articular) length		59.0								61.5		
Midshaft height		11.8								14.8		
Midshaft breadth		12.2								14.1		

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum metatarsal 2 length		72.9										
Metatarsal biomechanical (or articular) length		69.5										
Midshaft height		9.2										
Midshaft breadth		8.5										
Maximum metatarsal 5 length							65.4	>51.7				
Metatarsal biomechanical (or articular) length							56.5					
Midshaft height							6.6	6.8				
Midshaft breadth							9.3	9.4				
Proximal phalangeal 1 length										32.2		
Phalangeal biomechanical (or articular) length										27.0		
Midshaft anteroposterior (or dorsoplantar) height										9.5		

	Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Midshaft mediolateral breadth										11.7		
Proximal phalangeal 2-5 length				24.2								
Phalangeal biomechanical (or articular) length				22.0								
Midshaft anteroposterior (or dorsoplantar) height				5.5								
Midshaft mediolateral breadth				4.9								

Notes
* indicates estimated measurement
> indicates minimum measurement on an incomplete bone
All measurements in mm except where indicated

Table D2: Juvenile Skeletal Measurements																						
	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Cranial Measurements																						
Maximum cranial length																	176.0					
Maximum cranial breadth																	120.5*		133.0			
Biasterionic breadth																	96.0					
Bi-parietal boss breadth																	120.0		127.5			
Frontal chord															106.5		100.2		99.8			
Frontal arc															118.0		113.0		117.0			
Parietal chord			111.2														111.5		102.7			
Parietal arc			124.0														124.0		116.5			
Occipital plane chord																	72.2					
Occipital plane arc																	78.0*					
Minimum frontal breadth																	88.0					
Interorbital breadth																	22.0					
Thickness at parietal boss			1.5	1.0													3.0	3.0	3.0	3.5		
Thickness at frontal boss															2.0	2.0	2.0		2.0	2.5		
Cranial Indices																						
Cranial index																	68.5					
Mandible																						
Bicondylar breadth			>76 .0																			

	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Bigonial breadth			66.5																77.0			
Mandibular length			52.0								69.5								62.0			
Mandibular angle (°)			133.0								119.0								120.5			
Maximum ramal breadth											40.9											
Minimum ramal breadth				21.0							31.9									34.2		
Maximum ramal height			>29.0								46.0								>34.5			
Mandibular body height			17.4	17.3							23.2			19.9					22.4	22.3		
Mandibular body breadth			9.0	9.0							9.0			9.0					10.0	10.0		
Symphyseal height (or chin height)			20.4								22.5		22.2						21.9			
Clavicle and Scapula																						
Maximum clavicular length															78.0							
Clavicular "anteroposterior" midshaft diameter															4.9							
Clavicular superoinferior midshaft diameter															5.8							
Clavicular midshaft circumference															19.0							
Maximum length (or anatomical height or total height)																				72.1		

	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Morphological (or anatomical) breadth		>43.1													>43.3					52.3		
Length of Spine		>51.6													>50.6					58.1		
Length of supraspinous line																				24.3		
Length of infraspinous line																				64.4		
Scapular index																				72.6		
Arm: Humerus, Radius, and Ulna																						
Maximum humeral length									110.0	>105.0						>141.0			>70.5		256.5	
Humeral bicondylar (or bi-epicondylar) breadth																>29.0						
Humeral midshaft circumference									31.0	30.0						36.0					50.5	
Maximum midshaft diameter									11.0	10.8						12.2					17.7	
Minimum midshaft diameter									7.8	8.4						9.3					13.9	
Maximum radial length		>139.0				157.0	>86.0												117.0	>74.0		
Radial head anteroposterior diameter		12.9				14.1																
Radial midshaft circumference		23.0				28.0	20.0												24.0			

	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Radial anteroposterior midshaft diameter		6.8				7.9	5.9												6.6			
Radial mediolateral (or transverse) midshaft diameter		8.8				9.7	6.9												8.1			
Maximum ulnar length		>86.0					148.0												131.5			233.5
Maximum anteroposterior diameter							7.9												7.1			13.3
Maximum mediolateral (or transverse) diameter							6.8												6.5			12.6
Ulnar minimum circumference							19.0												18.0			34.0
Hand: Metacarpals and Phalanges																						
Maximum metacarpal 1 length																						47.7
Metacarpal biomechanical (or articular) length																						45.5
Midshaft dorsopalmar height																						9.1
Midshaft mediolateral breadth																						11.4
Maximum metacarpal 2 length																						62.9

	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Metacarpal biomechanical (or articular) length																						60.0
Midshaft dorsopalmar height																						8.4
Midshaft mediolateral breadth																						7.7
Maximum metacarpal 5 length																					49.2	
Metacarpal biomechanical (or articular) length																					48.5	
Midshaft dorsopalmar height																					5.5	
Midshaft mediolateral breadth																					6.9	
Pelvis: Sacrum and Os Coxae																						
Immature iliac breadth		>76.7			77.4		>54.2			51.2						73.5				>72.7		
Immature iliac height		>66.6			70.3		49.9			45.4						70.2				71.1		
Leg: Femur, Patella, Tibia, and Fibula																						
Maximum femoral length	>134.0	274.0		>121.0													>124.0	>161.0	>176.0	204.0	402.0	
Femoral midshaft circumference	45.0	44.0																53.0	45.5	44.5	78.0	
Femoral epicondylar breadth		>48.5																				

	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Femoral anteroposterior (or sagittal) midshaft diameter	14.5	14.7																17.8	14.6	14.1	25.4	
Femoral mediolateral (or transverse) midshaft diameter	15.0	13.7																16.3	14.2	14.0	25.0	
Platymeric index	96.6	107.0																109.8	102.5	100.6	101.4	
Maximum tibial length	>173.0	>160.0		>82.0		>184.0												>129.0	170.0	170.0		334.0
Tibial biomechanical length																						315.0
Tibial maximum proximal epiphyseal breadth						38.7																65.5
Tibial maximum distal epiphyseal breadth																						43.7
Tibial midshaft circumference						41.0												47.0	45.5	46.5		71.0
Tibial circumference at nutrient foramen						44.0												51.5	52.0	54.0		77.0
Tibial anteroposterior midshaft diameter						15.2												17.3	15.3	15.0		27.8

	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Tibial mediolateral (or transverse) midshaft diameter						11.2												12.6	13.6	13.6		17.7
Tibial maximum shaft diameter at nutrient foramen						15.9												18.1	17.2	17.5		29.4
Tibial mediolateral (or transverse) shaft diameter at nutrient foramen						11.6												14.4	16.3	16.7		18.8
Platycnemic index						72.6												79.8	94.8	95.1		64.1
Maximum fibular length	>196.0								>108.0								81.0		>154.0	>143.5		
Maximum fibular midshaft diameter																			8.3	7.9		
Fibular midshaft circumference																			25.0	23.0		
Foot: Tarsals, Metatarsals, and Phalanges																						
Maximum calcaneal length																		49.8				
Maximum metatarsal 1 length												38.1										
Midshaft height												11.4										
Midshaft breadth												10.9										

	Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum metatarsal 2 length																		38.2				
Midshaft height																		6.0				
Midshaft breadth																		5.1				
Maximum metatarsal 3 length																		39.0				
Midshaft height																		6.5				
Midshaft breadth																		5.5				
Maximum metatarsal 4 length																		36.9				
Midshaft height																		6.6				
Midshaft breadth																		5.0				
Maximum metatarsal 5 length																		36.4				
Midshaft height																		5.6				
Midshaft breadth																		7.0				
Maximum metatarsal 2-5 length			20.3																			
Midshaft height			3.2																			
Midshaft breadth			3.7																			

Notes
* indicates estimated measurement
> indicates minimum measurement on an incomplete bone
All measurements in mm except where indicated

Table D3: Neonate Skeletal Measurements						
	Neonate #1		Neonate #2		Neonate #3	
	Right	Left	Right	Left	Right	Left
Cranial Measurements						
Mandibular body height			13.6			
Mandibular body breadth			7.0			
Arm: Humerus, Radius, and Ulna						
Maximum humeral length					85.0*	
Maximum ulnar length		64.0				
Maximum anteroposterior diameter		4.2				
Maximum mediolateral (or transverse) diameter		4.3				

Notes
* indicates estimated measurement
> indicates minimum measurement on an incomplete bone
All measurements in mm except where indicated

Appendix E: Age and Sex Table

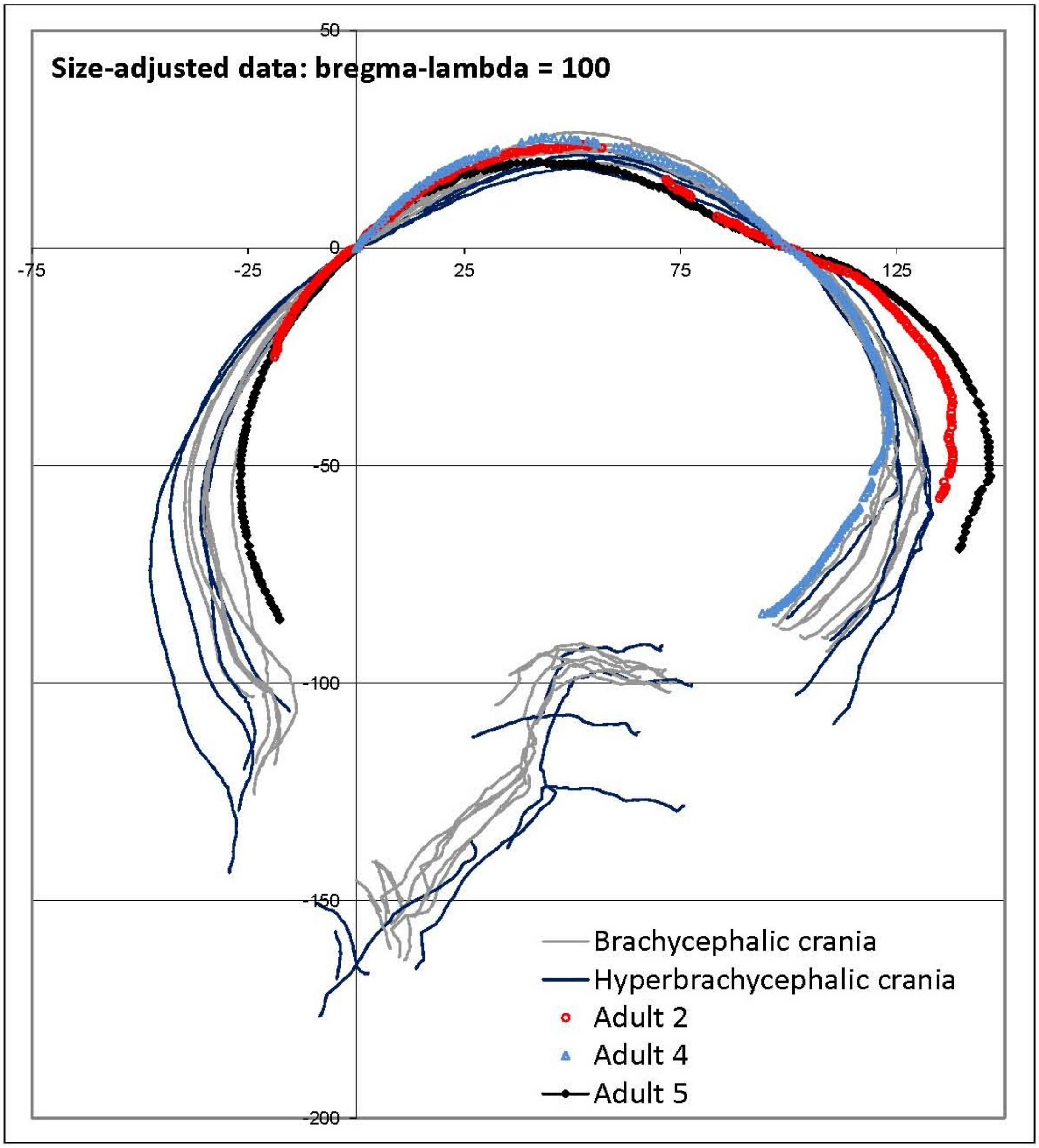
Table E1

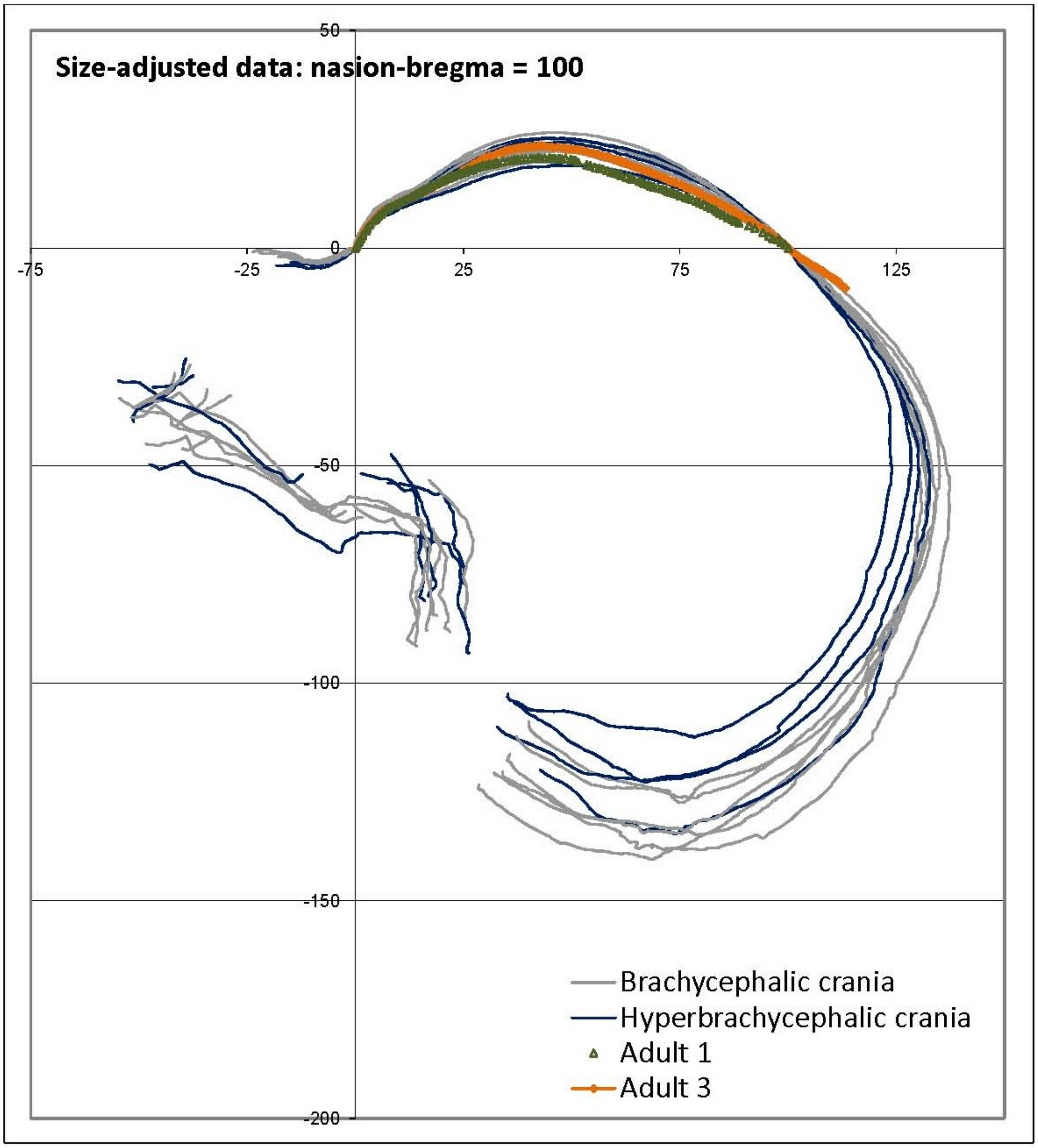
Age and Sex for Individuals from CA-LAN-361

	Age Range (Years)				
Individual	Male	Female	Method	Class	Sex
Neonate #1	0.125	0.25	Ulnar Length	1	Indeterminate
Neonate #2	0.875 (~10.5 Months)		Crown dm_2 3/4 complete	1	Indeterminate
Neonate #3	0.25-0.50	0.25-0.50	Humeral Length	1	Indeterminate
Juvenile #1	5.0-7.5	5.0-8.0	Femoral Length	3	Indeterminate
Juvenile #2	1.7-2.75	1.5-2.7	Root dm_2 complete	2	Indeterminate
Juvenile #3	5.5-9.0	5.5-10.5	Radial Length	3	Indeterminate
Juvenile #4	4.0-6.5	4.0-7.0	Ulnar Length	2/3	Indeterminate
Juvenile #5	1.0-1.5	1.0-1.5	Humeral Length	2	Indeterminate
Juvenile #6	6.0-9.25	5.5-8.5	Root M^1 1/2 complete	3	Indeterminate
Juvenile #7	6.0-9.25	5.5-8.5	dm_1 and dm_2	3	Indeterminate
Juvenile #8	5.0-7.0	5.0-7.0	Clavicular Length	3	Indeterminate
Juvenile #9	7.0-12.0	7.0-12.0	Secondary centre of lesser trochanter	3/4	Indeterminate
Juvenile #10	5.0-8.0	5.0-7.5	Crown M_2 3/4 complete	3	Indeterminate
Juvenile #11	11.0-13.5	10.5-14.0	Femoral Length	4	Indeterminate
Adult #1	20+	20+		6	Indeterminate
Adult #2	20+	20+		6	Indeterminate
Adult #3	20+	20+		6	Indeterminate
Adult #4	20+	20+		6	Indeterminate
Adult #5	20+	20+		6	Indeterminate
Adult #6	20+	20+		6	Indeterminate

Class 1: Neonate 0-1; Class 2: Juvenile 1-4; Class 3: Juvenile 5-9; Class 4: Juvenile 10-14; Class 5: Juvenile 15-19; Class 6: Adult 20+

Appendix F: Cranial Profiles





Size-adjusted data: nasion-bregma = 100
50
0
-50
-100
-150
-200
-75
-25
25
75
125
Brachycephalic crania
Hyperbrachycephalic crania
Adult 1
Adult 3

Appendix G: Discrete Traits

The dental discrete traits given in Tables G1 to G8 were recorded following Turner II et al. (1991). When the tooth was too worn or broken the (-) symbol was used to indicate an indeterminate score. The cranial and infracranial discrete traits given in Tables G9 and G10 were defined by Finnegan (1978), Saunders (1978), and Lahr (1996). In these tables, (+) indicates present, (-) indicates absent, and (0) indicates indeterminate.

Table G1

Dental Discrete Traits for Adult #1

Upper Jaw		I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear						4	4			4	4	3		1			
Caries																	
Winging																	
Labial Curve																	
Shovel						-	-										
Double Shovel						-	-										
Interruption Groove																	
I & C Tuberculum Dentale						-	-										
C Mesial Ridge						-	-										
C Distal Accessory Ridge						-	-										
P Mesial and Distal Accessory Cusps										-	-						
Metacone												-		4/5			
Hypocone												-		4			
Cusp 5												-		-			
Carabelli												-		0			
C2 Parastyle												-		0			
Enamel Extensions										0	-	0		0			
Root Number						-	-			-	-	3		3		-	
Radical Number						-	-			-	-	-		-			
Peg-Shaped I & M																	
Odontome										-	-						
Congenital Absence										0	0						
Hypoplasia Age																	
Uto-Aztecan																	
MxPAR	M									-	-						
	D									-	-						
Lower Jaw		I1R	I1R	I2L	I2R	CL	CR	P1L	P1R	P2L	P2R	M1L	M1R	M2L	M2R	M3L	M3R
Status/Wear																	
Caries																	
Shovel																	
C Distal Accessory Ridge																	
P Lingual Cusps																	
Groove Pattern																	
M Cusp Number																	
Deflecting Wrinkle																	
C1-C2 Distal Trigonid Crest																	
Protostylid																	
Cusp 5																	
Cusp 6																	
Cusp 7																	
Enamel Extensions																	
Root Number																	
Radical Number																	
Odontome																	
Congenital Absence																	
Hypoplasia Age																	
Anterior Fovea																	
Tomes Root																	
Torsomolar																	

Table G2

Dental Discrete Traits for Adult #2

Upper Jaw		I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear					3	3	3		3	3		3	3				
Caries																	
Winging																	
Labial Curve																	
Shovel					4	-	-										
Double Shovel					0	-	-										
Interruption Groove					0												
I & C Tuberculum Dentale					0	-	-										
C Mesial Ridge						-	-										
C Distal Accessory Ridge						-	-										
P Mesial and Distal Accessory Cusps									-	-							
Metacone												4	4				
Hypocone												-	-				
Cusp 5												-	-				
Carabelli												-	-				
C2 Parastyle												0	-				
Enamel Extensions									-	-		-	-				
Root Number			1		-	1	-				1	3			1		1
Radical Number																	
Peg-Shaped I & M					0												
Odontome																	
Congenital Absence				-	0					0	0					-	0
Hypoplasia Age																	
Uto-Aztecan										-							
MxPAR	M								-	-							
	D								-	-							
Lower Jaw		I1R	I1R	I2L	I2R	CL	CR	P1L	P1R	P2L	P2R	M1L	M1R	M2L	M2R	M3L	M3R
Status/Wear									1					2	2	-	0-1
Caries																	
Shovel																	
C Distal Accessory Ridge																	
P Lingual Cusps									1								
Groove Pattern																	
M Cusp Number														-	-	-	5
Deflecting Wrinkle																	
C1-C2 Distal Trigonid Crest																	
Protostylid														-	-	-	0
Cusp 5														-	-	-	4
Cusp 6														-	-	-	0
Cusp 7														-	-	-	0
Enamel Extensions									0					0	0	0	0
Root Number									1					2	-	2	-
Radical Number																	
Odontome									0								
Congenital Absence																0	0
Hypoplasia Age																	
Anterior Fovea																	
Tomes Root																	
Torsomolar																	

Table G3

Dental Discrete Traits for Adult #3

Upper Jaw		I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear																	
Caries																	
Winging																	
Labial Curve																	
Shovel																	
Double Shovel																	
Interruption Groove																	
I & C Tuberculum Dentale																	
C Mesial Ridge																	
C Distal Accessory Ridge																	
P Mesial and Distal Accessory Cusps																	
Metacone																	
Hypocone																	
Cusp 5																	
Carabelli																	
C2 Parastyle																	
Enamel Extensions																	
Root Number																	
Radical Number																	
Peg-Shaped I & M																	
Odontome																	
Congenital Absence																	
Hypoplasia Age																	
Uto-Aztecan																	
MxPAR	M																
	D																
Lower Jaw		I1R	I1R	I2L	I2R	CL	CR	P1L	P1R	P2L	P2R	M1L	M1R	M2L	M2R	M3L	M3R
Status/Wear						3	3	3	3	3	3	4	4	3	3	0-1	0-1
Caries																	
Shovel																	
C Distal Accessory Ridge																	
P Lingual Cusps								-	-	-	-						
Groove Pattern												-	-	-	-	-	-
M Cusp Number												-	-	-	-	5	5
Deflecting Wrinkle												-	-	-	-	-	-
C1-C2 Distal Trigonid Crest												-	-	-	-	1	1
Protostylid												-	-	-	-	0	-
Cusp 5												-	-	-	-	4	4
Cusp 6												-	-	-	-	0	0
Cusp 7												-	-	-	-	0	0
Enamel Extensions								-	-	-	-	-	-	0	0	0	0
Root Number												3	3	2	2	-	2
Radical Number																	
Odontome								-	-	-	-						
Congenital Absence		0	0							0	0					0	0
Hypoplasia Age																	
Anterior Fovea												-	-				
Tomes Root																	
Torsomolar																~35°	~35°

Table G4

Dental Discrete Traits for Adult #5

Upper Jaw	I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear																
Caries																
Winging																
Labial Curve																
Shovel																
Double Shovel																
Interruption Groove																
I & C Tuberculum Dentale																
C Mesial Ridge																
C Distal Accessory Ridge																
P Mesial and Distal Accessory Cusps																
Metacone																
Hypocone																
Cusp 5																
Carabelli																
C2 Parastyle																
Enamel Extensions																
Root Number																
Radical Number																
Peg-Shaped I & M																
Odontome																
Congenital Absence																
Hypoplasia Age																
Uto-Aztecan																
MxPAR M																
MxPAR D																
Lower Jaw	**I1R**	**I1R**	**I2L**	**I2R**	**CL**	**CR**	**P1L**	**P1R**	**P2L**	**P2R**	**M1L**	**M1R**	**M2L**	**M2R**	**M3L**	**M3R**
Status/Wear	4		4		3	4	3	3	3	3	3	3				
Caries																
Shovel																
C Distal Accessory Ridge					-	-										
P Lingual Cusps							-	-	-	-						
Groove Pattern											-	-				
M Cusp Number											-	-				
Deflecting Wrinkle											-	-				
C1-C2 Distal Trigonid Crest											-	-				
Protostylid											-	-				
Cusp 5											-	-				
Cusp 6											-	-				
Cusp 7											-	-				
Enamel Extensions							0	0	0	0	0	0				
Root Number	1		-		-	1	-	-	-	-	2/3	2/3				
Radical Number	1		-		-	1	-	-	-	-	-	-				
Odontome							-	-	-	-						
Congenital Absence	0	0							0	0					-	-
Hypoplasia Age																
Anterior Fovea											-	-				
Tomes Root							-	-								
Torsomolar																

Table G5

Dental Discrete Traits for Juvenile #2

Upper Jaw		I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	dm2R	dm2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear																			
Caries																			
Winging																			
Labial Curve																			
Shovel																			
Double Shovel																			
Interruption Groove																			
I & C Tuberculum Dentale																			
C Mesial Ridge																			
C Distal Accessory Ridge																			
P Mesial and Distal Accessory Cusps																			
Metacone																			
Hypocone																			
Cusp 5																			
Carabelli																			
C2 Parastyle																			
Enamel Extensions																			
Root Number																			
Radical Number																			
Peg-Shaped I & M																			
Odontome																			
Congenital Absence																			
Hypoplasia Age																			
Uto-Aztecan																			
MxPAR	M																		
	D																		
Lower Jaw		I1R	I1R	I2L	I2R	CL	CR	P1L	P1R	P2L	P2R	dm2L	dm2R	M1L	M1R	M2L	M2R	M3L	M3R
Status/Wear												0	0	0					
Caries																			
Shovel																			
C Distal Accessory Ridge																			
P Lingual Cusps																			
Groove Pattern																			
M Cusp Number												5	5						
Deflecting Wrinkle																			
C1-C2 Distal Trigonid Crest												0	0						
Protostylid																			
Cusp 5																			
Cusp 6																			
Cusp 7																			
Enamel Extensions												-	-						
Root Number												-	-						
Radical Number																			
Odontome																			
Congenital Absence		0																	
Hypoplasia Age																			
Anterior Fovea																			
Tomes Root																			
Torsomolar																			

Table G6

Dental Discrete Traits for Juvenile #6

Upper Jaw		I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	dm2R	dm2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear												1		0					
Caries																			
Winging																			
Labial Curve																			
Shovel																			
Double Shovel																			
Interruption Groove																			
I & C Tuberculum Dentale																			
C Mesial Ridge																			
C Distal Accessory Ridge																			
P Mesial and Distal Accessory Cusps																			
Metacone														4					
Hypocone														4					
Cusp 5														-					
Carabelli												-		-					
C2 Parastyle														0					
Enamel Extensions												0		0					
Root Number												3		3					
Radical Number																			
Peg-Shaped I & M																			
Odontome																			
Congenital Absence				0						0	0								
Hypoplasia Age																			
Uto-Aztecan																			
MxPAR	M																		
	D																		
Lower Jaw		I1R	I1R	I2L	I2R	CL	CR	P1L	P1R	P2L	P2R	dm2L	dm2R	M1L	M1R	M2L	M2R	M3L	M3R
Status/Wear													2						
Caries																			
Shovel																			
C Distal Accessory Ridge																			
P Lingual Cusps																			
Groove Pattern																			
M Cusp Number													5						
Deflecting Wrinkle																			
C1-C2 Distal Trigonid Crest													-						
Protostylid																			
Cusp 5																			
Cusp 6																			
Cusp 7																			
Enamel Extensions													0						
Root Number													2	2					
Radical Number																			
Odontome																			
Congenital Absence																			0
Hypoplasia Age																			
Anterior Fovea																			
Tomes Root																			
Torsomolar																			

Table G7

Dental Discrete Traits for Juvenile #7

Upper Jaw		I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	dm2R	dm2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear																			
Caries																			
Winging																			
Labial Curve																			
Shovel																			
Double Shovel																			
Interruption Groove																			
I & C Tuberculum Dentale																			
C Mesial Ridge																			
C Distal Accessory Ridge																			
P Mesial and Distal Accessory Cusps																			
Metacone																			
Hypocone																			
Cusp 5																			
Carabelli																			
C2 Parastyle																			
Enamel Extensions																			
Root Number																			
Radical Number																			
Peg-Shaped I & M																			
Odontome																			
Congenital Absence																			
Hypoplasia Age																			
Uto-Aztecan																			
MxPAR	M																		
	D																		
Lower Jaw		I1R	I1R	I2L	I2R	CL	CR	P1L	P1R	P2L	P2R	dm2L	dm2R	M1L	M1R	M2L	M2R	M3L	M3R
Status/Wear												2							
Caries																			
Shovel																			
C Distal Accessory Ridge																			
P Lingual Cusps																			
Groove Pattern																			
M Cusp Number												-							
Deflecting Wrinkle																			
C1-C2 Distal Trigonid Crest												-							
Protostylid																			
Cusp 5																			
Cusp 6																			
Cusp 7																			
Enamel Extensions												0							
Root Number												2							
Radical Number																			
Odontome																			
Congenital Absence		-	-							-	-							-	-
Hypoplasia Age																			
Anterior Fovea												-							
Tomes Root																			
Torsomolar																			

Table G8

Dental Discrete Traits for Juvenile #10

Upper Jaw		I1R	I1L	I2R	I2L	CR	CL	P1R	P1L	P2R	P2L	dm2R	dm2L	M1R	M1L	M2R	M2L	M3R	M3L
Status/Wear			0		0							0-1	1		0	0	0		
Caries																			
Winging			-																
Labial Curve			0																
Shovel			3		2														
Double Shovel			5		3														
Interruption Groove			0		-														
I & C Tuberculum Dentale			1		-														
C Mesial Ridge																			
C Distal Accessory Ridge																			
P Mesial and Distal Accessory Cusps																			
Metacone															4	4	4		
Hypocone															4	3	3		
Cusp 5															0	0	0		
Carabelli												2	2		4	0	0		
C2 Parastyle															0	0	0		
Enamel Extensions												0	0		0	0	0		
Root Number			-		-							-	3		3	-	-		
Radical Number																			
Peg-Shaped I & M																			
Odontome																			
Congenital Absence				0	0														
Hypoplasia Age																			
Uto-Aztecan																			
MxPAR	M																		
	D																		
Lower Jaw		I1R	I1R	I2L	I2R	CL	CR	P1L	P1R	P2L	P2R	dm2L	dm2R	M1L	M1R	M2L	M2R	M3L	M3R
Status/Wear			0									1	1	0	0	0	0		
Caries																			
Shovel			3																
C Distal Accessory Ridge																			
P Lingual Cusps																			
Groove Pattern																			
M Cusp Number												5	5	6	5	5	-		
Deflecting Wrinkle														2	1	-	-		
C1-C2 Distal Trigonid Crest												0	0	0	0	0	-		
Protostylid														6	6	1	-		
Cusp 5														3	3	3	-		
Cusp 6														2	0	0	-		
Cusp 7														0	0	0	-		
Enamel Extensions												0	0	-	-	-	-		
Root Number												2	2	-	-	-	-		
Radical Number																			
Odontome																			
Congenital Absence			0															-	-
Hypoplasia Age																			
Anterior Fovea												2	2	3	3				
Tomes Root																			
Torsomolar																			

Table G9

Adult Cranial and Infracranial Discrete Traits

		Adult #1		Adult #2		Adult #3		Adult #4		Adult #5		Adult #6	
		Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Cranium	Supraorbital foramen	-	+	0	+	-	-	0	0	0	+	0	0
	Supraorbital notch	+	0	0	-	+	+	0	0	0	-	0	0
	Lambdoid ossicle	0		+		0		-		+		0	
	Parietal Notch Bone	0	-	0	-	0	-	0	-	0	-	0	0
	Asterionic Bone	0	-	0	-	0	+	0	-	0	-	0	0
	Occipitomastoid Bone	0	-	0	0	0	-	0	-	0	0	0	0
Mandible	Accessory Mental Foramen	0	0	0	0	-	-	0	0	-	-	0	0
Humerus	Supracondyloid process	0	0	0	-	0	-	0	0	0	0	0	0
	Septal aperture	0	0	0	-	0	-	+	0	0	0	0	0
Femur	Allen's fossa	-	0	0	0	0	0	-	0	0	0	0	0
	Poirier's facet	-	0	0	0	0	0	-	0	0	0	0	0
	Plaque	-	0	0	0	0	0	-	0	0	0	0	0
	Hypotrochanteric fossa	-	0	0	0	0	0	-	0	0	0	0	0
	Exotosis in trochanteric fossa	0	0	0	0	0	0	-	0	0	0	0	0
	Third trochanter	+	+	-	0	0	0	+	0	0	0	0	0
Tibia	Medial tibial squatting facet	0	0	-	-	0	0	0	-	0	0	0	0
	Lateral tibial squatting facet	0	0	-	-	0	0	0	-	0	0	0	0
Calcaneus	Anterior calcaneal facet double	0	0	-	0	0	0	0	0	-	0	0	0
	Anterior calcaneal facet absent	0	0	-	0	0	0	0	0	-	0	0	0
	Peroneal tubercle	0	0	0	0	0	0	0	0	-	0	0	0
Talus	Os trigonum	0	-	-	-	0	0	0	0	0	0	0	0
	Medial talar facet	0	-	-	-	0	0	0	0	0	0	0	0
	Lateral talar extension	0	-	-	-	0	0	0	0	0	0	0	0
	Inferior talar articular surface	0	-	-	-	0	0	0	0	0	0	0	0

Table G10

		Juvenile Cranial and Infracranial Discrete Traits																					
		Juvenile #1		Juvenile #2		Juvenile #3		Juvenile #4		Juvenile #5		Juvenile #6		Juvenile #7		Juvenile #8		Juvenile #9		Juvenile #10		Juvenile #11	
		Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Cranium	Supraorbital foramen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	+	-	+	-	0	0	0
	Supraorbital notch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	+	+	-	-	0	0	0
	Lambdoid ossicle	0		+		0		0		0		0		0		0		-		0		0	
Mandible	Accessory Mental Foramen	0	0	-	+	0	0	0	0	0	0	-	0	0	-	0	0	0	0	+	-	0	0

Appendix H: Skeletal Data Summary

Neonate #1
Age: 0.125-0.25 yrs. (~1.5-3.0 months)
Age Class: 1
Sex: Indeterminate
Provenience: 106J 24-30”
Pathologies: None Observed
Discrete Traits: None Observed
Taphonomy: None Observed
Violence: None Observed

Neonate #2
Age: 0.875 yrs. (~10.5 months)
Age Class: 1
Sex: Indeterminate
Provenience: 107K 24-30”
Pathologies: None Observed
Discrete Traits: None Observed
Taphonomy: None Observed
Violence: None Observed

Neonate #3
Age: 0.25-0.50 yrs.
Age Class: 1
Sex: Indeterminate
Provenience: Unknown
Pathologies: None Observed
Discrete Traits: None Observed
Taphonomy: Weathering
Violence: None Observed

Juvenile #1
Age: 5.0-8.0 yrs.
Age Class: 3
Sex: Unknown
Provenience: 107I/108I
Pathologies: Indeterminate
Discrete Traits: See Appendix G: Table G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #2
Age: 1.5-2.75 yrs.
Age Class: 2
Sex: Unknown

Provenience: 107J
Pathologies: Enamel dysplasia on the occlusal surface of the Rdm_2. Slight enamel dysplasia on the Rdm_1.
Discrete Traits: See Appendix G: Tables G5 and G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #3
Age: 5.5-10.5 yrs.
Age Class: 3/4
Sex: Indeterminate
Provenience: Unknown
Pathologies: Indeterminate
Discrete Traits: See Appendix G: Table G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #4
Age: 4.0-7.0 yrs.
Age Class: 3
Sex: Indeterminate
Provenience: Unknown
Pathologies: Indeterminate
Discrete Traits: See Appendix G: Table G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #5
Age: 1.0-1.5 yrs.
Age Class: 2
Sex: Indeterminate
Provenience: Unknown
Pathologies: Indeterminate
Discrete Traits: See Appendix G: Table G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #6
Age: 5.5-9.25 yrs.
Age Class: 3
Sex: Indeterminate
Provenience: Unknown
Pathologies: Hypoplasia pitting on occlusal surface of Rdm_1. Dental carie at the enamel/dentine junction of the distal side of the Rdm^1. Dental carie on the crown of the mesial side of the Rdm^2. Hypoplasia pitting and enamel dysplasia on the Rdm^2 and RM^1.
Discrete Traits: See Appendix G: Tables G6 and G10

Taphonomy: None Observed
Violence: None Observed

Juvenile #7
Age: 5.5-9.25 yrs.
Age Class: 3
Sex: Indeterminate
Provenience: Unknown
Pathologies: Enamel dysplasia on the Ldm_1 and enamel dysplasia on the Ldm_2.
Discrete Traits: See Appendix G: Tables G7 and G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #8
Age: 5.0-7.0 yrs.
Age Class: 3
Sex: Indeterminate
Provenience: 105J 24-30”
Pathologies: Indeterminate
Discrete Traits: See Appendix G: Table G10
Taphonomy: Burned
Violence: None Observed

Juvenile #9
Age: 7.0-12.0 yrs.
Age Class: 3/4
Sex: Indeterminate
Provenience: 106J 24-30”
Pathologies: Indeterminate
Discrete Traits: See Appendix G: Table G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #10
Age: 5.0-8.0 yrs.
Age Class: 3
Sex: Indeterminate
Provenience: Unknown
Pathologies: Enamel dysplasia on the distal crowns of both dm_1’s and the LM_1.
Discrete Traits: See Appendix G: Tables G8 and G10
Taphonomy: None Observed
Violence: None Observed

Juvenile #11
Age: 10.5-14.0 yrs
Age Class: 4

Sex: Indeterminate
Provenience: Unknown
Pathologies: Indeterminate
Discrete Traits: See Appendix G: Table G10
Taphonomy: None Observed
Violence: None Observed

Adult #1
Age: Indeterminate
Age Class: 6
Sex: Indeterminate. Notes: Presence of Third Trochanter and the absence of Poirier's Facet and Allen's Fossa. Morphology of the remains are not particularly gracile or robust.
Provenience: 108J
Pathologies: Slight vertebral osteophytosis. Severe arthritis (eburnation) on left first metatarsal. No evidence of dental caries or hypoplasia.
Discrete Traits: See Appendix G: Tables G1 and G9
Taphonomy: None Observed
Violence: None Observed

Adult #2
Age: Indeterminate
Age Class: 6
Sex: Indeterminate. Notes: Robust and rugose infracranial remains. Absence of the Septal Aperture and Third Trochanter.
Provenience: Unknown
Pathologies: Slight osteoarthritis on the right, proximal ulna. Moderate to severe osteoarthritis, pitting, and eburnation on the left radial head. One large dental carie on the LM^1. No evidence of dental hypoplasia.
Discrete Traits: See Appendix G: Tables G2 and G9
Taphonomy: Possibly burned
Violence: Minor blunt force trauma to the left parietal (either interpersonal violence or personal injury).

Adult #3
Age: Indeterminate
Age Class: 6
Sex: Indeterminate. Notes: Robust and rugose cranial and infracranial remains.
Provenience: 106J 24-30"
Pathologies: Slight vertebral osteophytosis on lumbar vertebrae. Possible dislocated femoral head; severely arthritic/exostosis? No evidence of dental caries or hypoplasia.
Discrete Traits: See Appendix G: Tables G3 and G9
Taphonomy: Rodent gnaw marks on: right radius, left humerus, left ulna, left radius.
Violence: None Observed

Adult #4

Age: Indeterminate
Age Class: 6
Sex: Indeterminate. Notes: More gracile cranial and infracranial remains and the presence of the Septal Aperture and the Third Trochanter and the absence of Poirier's Facet and Allen's Fossa.
Provenience: 104H 30-36"
Pathologies: Slight vertebral osteophytosis on lumbar vertebrae. Severe pitting and eburnation of articular surfaces of the right lunatum. High frequency of very small pitting, one of the symptoms of osteoarthritis, on the left humeral head. The general state of the joints appears to have presence of deterioration.
Discrete Traits: See Appendix G: Table G9
Taphonomy: Rodent gnaw marks on: right humerus, right tibia, left tibia.
Violence: None Observed

Adult #5
Age: Indeterminate
Age Class: 6
Sex: Indeterminate. Notes: Robust and rugose cranial and infracranial remains.
Provenience: Unknown
Pathologies: Moderate vertebral osteophytosis. Pacchioni on endocranial frontal and parietals and along the entrance of the middle meningeal arteries (arachnoid foveae or granular foveae)? Osteophytes extending superiorly from the tibial tuberosity on right tibia. Very rugose soleal line on right tibia. Osteophytes extending anteriorly on the medial process of the right calcaneus. Abscess on anterior mandible below RI_1. Hypoplasia pit on buccal face of the RP_2.
Discrete Traits: See Appendix G: Tables G4 and G9
Taphonomy: Weathered and cracked. Fractures and splinters in the tibia, metatarsal, and mandible.
Violence: None Observed

Adult #6
Age: Indeterminate
Age Class: 6
Sex: Indeterminate
Provenience: Unknown
Pathologies: Slight vertebral osteophytosis on thoracic vertebrae; moderate to severe vertebral osteophytosis on lumbar vertebrae.
Discrete Traits: See Appendix G: Table G9
Taphonomy: None Observed
Violence: None Observed