REPORT ON THE VERTEBRATE FAUNA FROM CA-STA-207, CENTRAL DIABLO RANGE, STANISLAUS COUNTY, CALIFORNIA: EVIDENCE FOR AN UPLAND ADAPTATION WITH LONG-TERM STABILITY IN THE CENTRAL DIABLO RANGE

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The Diablo Mountain Range has been written off in the past as peripheral to core sites in Santa Clara Valley and the Central Valley. Yet research in this area, including the Cabrillo College 2010 field school excavation of site CA-STA-207 along Orestimba Creek, has revealed a long-term seasonal occupation with a distinct upland adaptation that did not undergo the same massive cultural shift as is seen in neighboring areas of California. By analyzing the $^{1}/_{8}$ in. faunal material from two units representing the Early and Late periods at this site, I will help paint a picture of this upland adaptation and explore the phenomena that led to this long-term stability.

CA-STA-207 lies in the Orestimba Creek basin of the central Diablo Range. This region is composed of blue oak and grey pine forest peppering expanses of grassy hills where deer, rabbits, rodents, snakes, and other animals furtively roam. The region has been deemed a "very productive" region for root and nut exploitation in the Central Valley (Wohlgemuth 2010). Little research has been done in the area, but three archaeological surveys sponsored by the California Department of Forestry and Fire Protection (CDF) revealed extensive cultural deposits (Hylkema 1993). Eric Zaborsky's thesis research in the Diablo Range at site FRE-1331 further supports extensive and long-term use of the area (Zaborsky 2006). The Cabrillo College field school surveyed and excavated the site in 2010 in collaboration with California State Parks and the Amah-Mutsun tribe. Excavations revealed a seasonal habitation site that is associated with an extensive network of bedrock mortars and plant processing locales.

BACKGROUND

Botanical Analysis

The paleobotanical analysis at STA-207 suggests a fall seasonal occupation, with an overwhelming focus on pine nut, and a slight increase in other nuts, especially bay, during the later occupation. These findings are distinctive from other sites in California, in that acorn does not appear to be a staple, and only shows a marginal increase in usage in the later occupation (Wohlgemuth 2010). Acorn intensification in the Late period in California is often associated with high population density, sedentism, and sociopolitical complexity (Jones 1996). What makes the Diablo Range an interesting area of study is the surprising cultural continuity through time exhibited by a relatively stable subsistence economy.

Lithic and Artifact Analysis

Lithic analysis at STA-207, performed by Dustin McKenzie in early 2011, reveals a low lithic waste index of 0.55, with a moderate ground stone formality index of 0.42. This suggests a relatively low investment in hunting technology, and a higher investment in food-processing technology.

Excavation of the site revealed a rich artifact assemblage containing temporally diagnostic artifacts that reflect trends in material culture through time that are similar to those of surrounding sites. Figures 1 and 2 show some of the temporally diagnostic artifacts from the Early and Late periods, respectively.

Figure 1. Early-period artifacts found at CA-STA-207.

Figure 2. Late-period artifacts found at CA-STA-207.

Faunal Analysis

In 2012, I analyzed a 50-percent sample by weight of the faunal sample recovered from the $^{1}/_{8}$ in. screens of Control Units 1 and 3 was analyzed in 2012; I had previously participated in the Cabrillo College Field School excavation of STA-207 in 2010. This analysis was compared and combined with that of the $^{1}/_{4}$ in. sample analyzed by Dustin McKenzie in 2011, all in consultation with Diane Gifford-Gonzalez. Unit 1 at 30-60 cm depth and Unit 3 at 130-160 cm depth were selected for analysis in an effort to compare Early- and Late-period subsistence patterns at this site.

METHODS

In late 2011, the $^{1}/_{8}$ in. sample was sorted into specimen bags as identifiable to species, family, or size class. I completed all sorting and taxonomic identification in early 2012 with the use of comparative specimens at the University of California, Santa Cruz (UCSC) Faunal Analysis Lab. In order to eliminate some sampling bias and create a better-rounded sample, the $^{1}/_{8}$ in. sample data was combined with the $^{1}/_{4}$ in. data compiled by McKenzie in 2011. A simple NISP (Lyman 1985) is used to represent species and size class ratios. Given the very fragmentary nature of the sample, size class is important in representing a more accurate distribution of species. Size classes here include very small (i.e., most rodents), small (i.e., squirrels, rabbits), medium (i.e., bobcats, coyotes), and large mammal (i.e., deer).

Burn Color as an Indicator for Human Influence

Evidence of burning on faunal remains is prevalent in archaeological sites and may be the result of culinary or disposal practices. Whether the animal was roasted on a fire or perhaps the bones were disposed of by being tossed into the fire after consumption, it is generally interpreted that this burnt bone is part of a consumption pattern. As bone burns, it goes through the process of losing its organic

component and turns black as it becomes carbonized. Once the bone loses its calcium component, it turns white and becomes calcined. This is a function of temperature and duration of exposure. A bone may become calcined by a long-term, low-temperature exposure or a short-term, high-temperature exposure. For example, if a bone sits in the hearth for days after disposal, it may eventually become calcined.

Some identifiable specimens within the sample were analyzed for burn color, as this can be considered a mild indicator of whether a species was brought to the site through human activity or by natural occurrence. Burn colors include "no burning," "partial brown," "total brown," "total dark brown," "light brownish gray," "dark grayish brown," "partial black," "black," "gray-black," "gray-white," and "white." Each burn color corresponds to a 10YR Munsell color and indicates the stage of burning.

Bone Grease Extraction

Bone grease extraction is a moderately labor-intensive process that produces a high yield of fat-rich nutrients, perfect for supplementing a low-fat diet. It involves breaking up bones containing marrow, and boiling them in either a pot or basket until the marrow floats to the top, where it can be collected (Outram 2002). The process of breaking up bones for this purpose is called "pot-sizing." Studies of pot-sizing have raised questions about the efficiency of small fragmentation when rendering grease (Church and Lyman 2003); however, follow-up studies reveal that breaking large mammal diaphyses into small, specific sizes, while seemingly labor-intensive, actually minimizes the use of water, and in turn fuel and labor, therefore extracting grease with greater efficiency (Brown and Vasquez 2011).

Large mammal diaphyses and rib fragments from the $^{1}/_{4}$ in. sample of Unit 1, 30-60 cm, and Unit 3, 130-160 cm, were analyzed for evidence of human modification and pot-sizing. I took measurements of the primary and secondary maximum dimensions, analyzed the nature of the fracture lines for fresh versus weathered fracture (Outram 2002, 2004), and looked for other indicators of intentional bone modification, such as impact notches.

RESULTS

Taxonomic representation

Out of the total 7,092 specimens analyzed from STA-207, 5 percent were identifiable to taxon (species, family), and 71 percent were identifiable to size class. Results of the analysis are outlined in Table 1 and visually represented in Figure 3.

Early Period Subsistence

Unit 3 at 130-160 cm depth brought back a radiocarbon date at the basal level of 5000 B.P., making it our Early-period representation. A total of 5,441 specimens were analyzed. Out of 257 specimens identifiable to taxon, 26 percent were identified as *Odocoileus hemionus* (mule deer), 30 percent as Leporidae (rabbit), 15 percent Sciuridae (squirrel), 18 percent *Thomomys* sp. (pocket gopher), 8 percent *Neotoma fuscipes* (dusky-footed woodrat), 3 percent reptile, with less than 1 percent each *Microtus* sp. (vole), canid, and *Lynx rufus* (bobcat). Of the 3,862 specimens identifiable to size class, 64 percent were identified as large mammal, 22 percent as small mammal, and 14 percent as very small mammal. Figure 2 highlights the size class ratio for the Early period.

Late Period Subsistence

Unit 1 at 30-60 cm depth was radiocarbon-dated from 1600-500 B.P., making it our representation of Late-period occupation at this site. A total of 1,651 specimens were analyzed. Of the 108 identifiable to taxon, 34 percent were identified as *Odocoileus hemionus* (mule deer), 28 percent as Leporidae (rabbit), 11 percent Sciuridae (squirrel), 11 percent *Thomomys* sp. (pocket gopher), 9 percent reptile, and 1 percent *Neotoma fuscipes* (dusky-footed woodrat). Out of the 1,190 identifiable to size class, 60 percent were

Table 1. CA-STA-207 fauna from Unit 1, 30-60 cm, and Unit 3, 130-160 cm, in 2010 excavation.

Taxon		Number of Specimens (NSP)	
Mammal - size Indeterminate		1675	23.62% of NSP
Taxon		Number of Specimens (NSP)	% of LID
Large Mammal		3173	62.81
Medium Mammal		26	0.51
Small Mammal		1195	23.65
Very Small Mammal		658	13.02
Less Identifiable (LID) Subtotal		5052	71.24% of NSP
Taxon	Common name	Number of Specimens (NSP)	% of ID
Odocoileus hemionus (large)	Mule deer	103	28.22
Sylvilagus sp. (small)	Brush rabbit	32	8.77
Lepus californicus (small)	California jackrabbit	3	0.82
Leporidae - indeterminate (small)	Rabbit or hare	70	19.18
Spermophilus beecheyi (small)	Beechey's ground squirrel	10	2.74
Sciurus griseus (small)	Western gray squirrel	2	0.55
Sciuridae - indeterminate (small)	Squirrel	37	10.14
Thomomys talpoides (very small)	Pocket gopher	59	16.16
Neotoma fuscipes (very small)	Dusky-footed woodrat	22	6.03
Microtus californicus (very small)	California vole	2	0.55
Peromyscus sp. (very small)	Field mouse	5	1.37
Reptile (small-very small)	Snake or lizard	17	4.66
Lynx rufus (medium)	Bobcat	2	0.55
Canis sp. (medium)	Canine - indeterminate	1	0.27
Identifiable Subtotal		365	5.15% of NSP
Total Number of Specimens		7092	

classified as large mammal, 30 percent as small mammal, and 10 percent as very small mammal or rodent. Figure 4 shows the similarities in size class ratios between the Early and Late periods.

Bone Grease Extraction

One hundred and twenty-one large-mammal specimens from the $^{1}/_{4}$ in. sample were measured for primary and secondary maximum dimensions; a majority of the specimens measured were diaphysis and rib fragments. The primary maximum dimension most commonly occurred along the long axis of the bone and averaged 17 mm, with a standard deviation of ±6.0. The secondary maximum dimension more commonly occurred along the curved axis of the bone, averaging 8.4 mm, with a standard deviation of ±2.7. No thorough quantification of fracture pattern was made, as the fragmentary nature of the sample made this impractical; however clear evidence of fresh fracture and impact notches were observed on multiple specimens. The absence of pot polish suggests that a basket method is more likely, and rules out ceramic pot wear (Diane Gifford-Gonzalez, personal communication 2012).

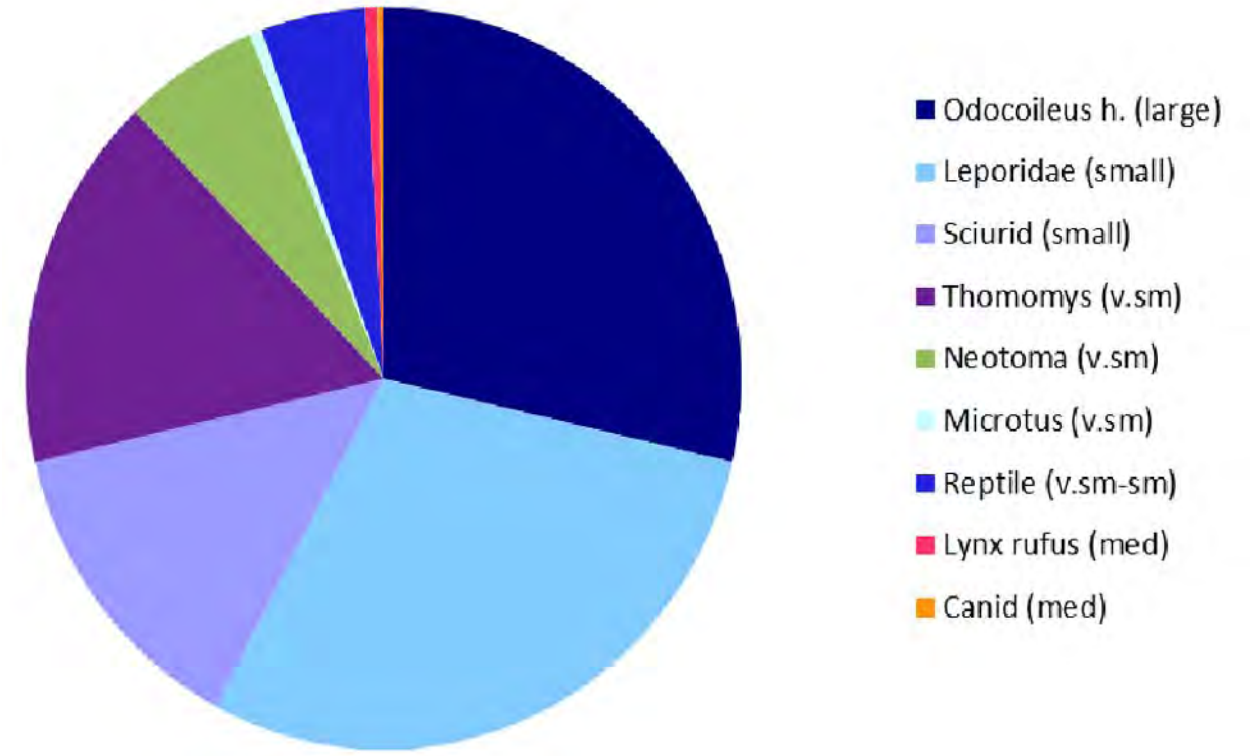

Figure 3. CA-STA-207 faunal taxonomic distribution.

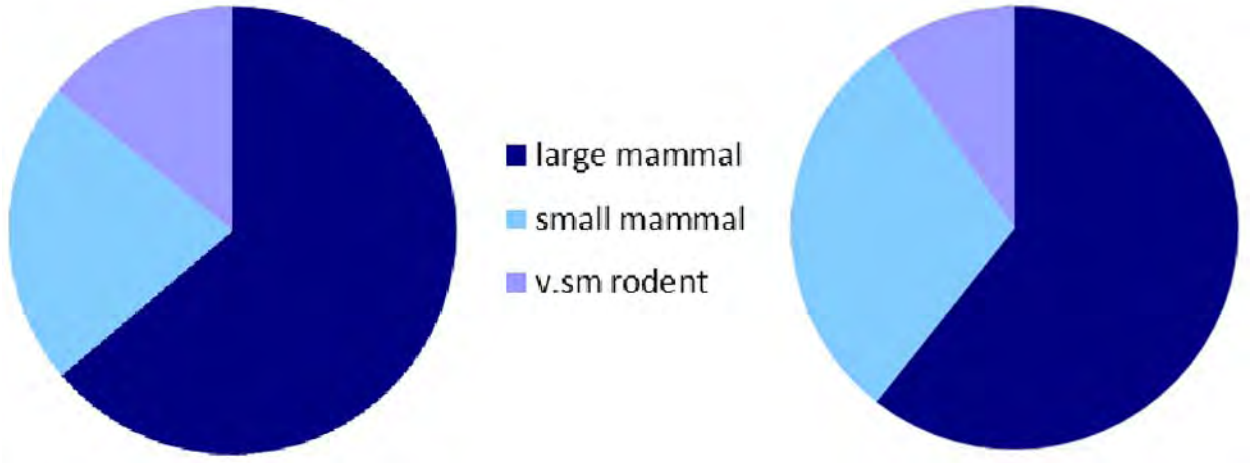

Figure 4. Size class ratio comparison between Early (left) and Late (right) periods.

Table 2. CA-STA-207, percentages of vertebrate elements with thermal alteration, with Celsius temperatures interpolated for experimentally calibrated temperature ranges.

Burn Color	Total	Large	Small	Rodent	Leporidae	Sciuridae	*Neotoma*	*Thomomys*	Reptile
None	21.6	16.5	13.9	57.7	22.5	19.5	18.2	18.9	46.2
Partial brown	4.1	6.1	2.5	15.4	4.1	4.9	--	5.7	--
Total brown	17.9	13.0	30.4	3.9	20.4	36.6	18.2	37.7	15.4
Total dark brown (440º C)	16.5	6.1	20.3	--	14.3	22	36.4	30.2	30.8
Light brownish gray	2.6	7.0	--	--	--	--	--	--	--
Dark grayish brown	1.8	0.9	3.2	--	4.1	--	--	--	--
Partial black	6.4	8.7	5.7	--	2.0	--	9.1	7.6	--
Black (645º C)	11.0	9.6	10.8	3.9	18.4	14.6	9.1	--	--
Gray-black (675º C)	2.6	5.2	--	3.9	--	--	4.5	--	--
Gray-white (745º C)	6.9	13.9	6.3	3.9	8.2	--	--	--	--
White (745º C)	8.5	13.0	7.0	11.5	6.1	2.4	4.5	--	7.7
Total burnt	78.3	83.5	86.2	42.5	77.6	80.5	81.8	81.2	53.9

Burn Color

Three hundred and ninety specimens were assigned a burn color (Table 2). A total of 78 percent of the specimens analyzed for burning exhibited thermal alteration. Leporidae, Sciuridae, *Thomomys talpoides*, and *Neotoma fuscipes* exhibited alteration in the 77-82 percent range, whereas undifferentiated rodents and reptiles only showed burning on 43-54 percent of the specimens analyzed.

DISCUSSION AND CONCLUSION

The faunal data from STA-207 reveal a subsistence pattern that remained relatively stable over time. This lean meat diet of deer and rabbit, with a distinct absence of elk, fish, or birds, appears to have been supplemented for fat content by bone grease extraction, and may have also included gophers, squirrels, and dusky-footed woodrats. The absence of quail is curious, because at field school the quail were often tempting as an easy meal and they would have provided a source of fat. Perhaps birds served another function, such as bone whistle production, possibly negating them from consumption, or perhaps a lack of investment in trapping technology such as nets could explain for their absence.

Foraging Demographics and Opportunistic Hunting

Some research has sought to highlight the subsistence activity of children and juveniles within foraging communities. Gifford-Gonzalez (personal communication 2012) suggests that the dusky-footed wood rat may have been a targeted resource for young foragers, as woodrats can be easily ambushed in their nests and tend to live in dense chaparral, where children would have easier access. The presence of *Neotoma fuscipes* at STA-207 supports this hypothesis. The presence of rodents in the diet suggests both a broader scope of foraging demographics beyond adult males and an opportunistic hunting strategy rather than a front-loaded investment in hunting.

Bone Grease Extraction

The presence of bone grease extraction further suggests a high investment in maximizing nutritional returns paired with a low investment in acquisition of deer. While deer and rabbit were

apparently plentiful and easy to acquire, fatty animals such as fish were absent, making bone grease extraction an appealing option as a reliable investment in fat acquirement.

The fragment size data collected supports the graduate research conducted at UCSC suggesting that fuel efficiency was the primary motivator for breaking the bone into such small fragments. The small standard deviation surrounding the secondary maximum dimensions along the curved axis of the bone would suggest that creating small, flat pieces of bone was key to maintaining a low water level and using less fuel.

Burn Color: Issues and Implications

There are some issues with using burn color as an indicator of human influence: natural fire can be a factor, there is some difficulty distinguishing between soil staining and burning, and burning can occur on bones deposited within 10 cm of a hearth feature (Shipman et al. 1984). However, differential burning between species has been observed at several sites in the UCSC Faunal Analysis Lab. While more research is needed in this area, it has been my observation that generally, gophers, small rodents, and reptiles exhibit little to no burning within a context of predominantly burnt bone, while rabbits and other known subsistence species consistently show burning. Therefore, when burning is significantly present on gophers and other species often assumed to be naturally present, it should be considered with some caution that they may in fact contribute to subsistence. In this case, the dusky-footed woodrat was apparently consumed, and it is likely that gophers and squirrels, while also inhabiting the site naturally, were consumed as well.

Investment of Labor

When faced with a site that shows relative stability in a social and geographical context of rapid change and expanding populations, one must explore what it is about their way of life that led to this stability. This group of people intelligently made trade-offs in labor intensity, focusing their labor on specific priorities. On one hand, we find a low tool formality index, with the absence of a major increase in acorn exploitation, and on the other hand, we have an elaborate plant processing site and bone grease extraction. When considering labor intensity, one must also consider the specific payoff. While acorn exploitation might support a growing population, grease offers a minimal processing with a high nutritional return, and can be stored (Wohlgemuth 2010), making it a sustainable option. Bone grease extraction can be done on the small scale of individual meals, enriching the fat content, and making lean meat subsistence a sustainable option (Diane Gifford-Gonzalez, personal communication 2012). In other words, why intensify if you do not need to?

Considering Gender

It seems necessary here to consider the female influence on this labor economy. Big-game hunting and acorn intensification are both often associated with status and growth. In this case, the focus is on sustainability rather than growth, with labor minimized but strategically applied. With a labor focus on intensive plant and culinary processing, it is easy to see the female contribution to both the planning and execution of these tasks. Females are in the unique biological position of allocating resources to their offspring from conception onward, and are therefore acutely aware of energetic inputs and outputs. The intelligently applied labor allocation seen at STA-207 exemplifies this.

Enriching Central California Prehistory

The Diablo Range is a poorly studied geographic area in terms of archaeological research, due to the presumption that this area was a peripheral region to other Central Valley sites. The excavation of STA-207 reveals an intensive seasonal habitation exhibiting a distinctive upland adaptation, whose subsistence economy does not follow the Late-period trend of intensification that is typical of surrounding sites. This highlights the danger of making assumptions or blanket categorizations, particularly in central

California prehistory, where there is so much diversity. Exploring regions like this that have previously been dismissed will help paint an increasingly complex picture of the mosaic of cultural practices in central California.

Much archaeological research is focused on increasing complexity, resource intensification, and the causal relationship between the two. When long-term continuity is observed within similar environmental contexts, understanding the underlying causes of this stability is equally important to understanding where we find ourselves today. In our modern struggle for sustainability, it would be wise to take lessons from the past.

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