CHAPTER 4

METHODOLOGY

THE EXCAVATIONS

The Lost Valley excavations were performed by undergraduate and graduate students of the Anthropology Department of San Diego State University beginning in 1997 and terminating in 2003. Each field season took place during the month of June when the weather was likely to be dry and warm, and there was an absence of other campers (Boy Scouts) in the valley. The Boy Scout campers arrived en masse the first week of July when the second phase of excavations took place. This second phase consisted of a graduate student leading a small group of Boy Scouts in an archaeological field school so the boys could earn an archaeology merit badge, a rarely offered and therefore valued addition to their uniform sash. These “amateur” excavations were positioned and laid out in slightly less sensitive areas by participating graduate students in late June, and were only excavated down to minimal depths, as the time allowed for the scouts’ excavation activities were more limited. Other scouting activities included an archaeology lecture, a lesson on archaeological ethics, and a tour of sites in the valley exhibiting lithic and ceramic sherd scatters and granite bedrock outcrops featuring multiple mortars and grinding slicks.

Surface surveys were undertaken over the seven-year field school project at various times throughout the field season and yielded no additional sites. In 2003, a series of 12 shovel test pits approximately 12” (30.5 cm) square and no more than 18” (46 cm) deep, were placed in a line running due north up a gentle slope from VS-766-C. The matrix was passed through a 1/8th inch (3 mm) screen and yielded very little, often no more than a single quartz flake per shovel test unit. Every student kept a field notes log, recording the day’s events. These are kept as part of the official project collection as documentation. Photographic records are in the collection as well. Color and black and white 35 mm film, and digital photographs, were taken at nearly every level, and recorded every feature.

The 2002 and 2003 field seasons were both promptly followed by laboratory analysis by Victoria Kline and myself and included the unpacking of the field collection and the subsequent cleaning, sorting, weighing, measuring, repacking, and labeling of all the materials. Each individual artifact was assigned a catalog number that was immediately entered into a computer SPSS database and also recorded on a columnar ledger in paper form. Lithic detritus and ceramic potsherds were separated into material categories and given a single catalog number for each individual unit and level and combined into individual bags. Faunal remains were likewise assigned catalogue numbers, combined into unit/level groups and so bagged. Each catalog entry received all applicable entry information such as, site numbers, unit and level data, weights, measurements, and composite material identification. Any questionable data were immediately cross referenced with level sheets and/or field notebooks and corrected when found to be in error, or recorded promptly when discovered to be missing any information. Very little was found to be in any form of discrepancy, as the field system was very reliable and all bags were labeled clearly and completely.

PROTEIN RESIDUE ANALYSIS

Two samples were subjected to a protein residue analysis, a Paleoindian fluted point and a soil sample that was submitted as a control. A soil sample was collected at the time of the fluted point's discovery at the same depth along with additional soil samples from every 10 cm. level, along the western wall of the 2m2 unit. This soil sample collection site was selected for collection because the fluted point was found within about 20 cm of the central portion of the west unit wall. Soil samples were troweled directly into Ziplock© plastic, sandwich sized bags.

Archaeological artifacts presumed to have been used to kill and/or butcher animals can be tested for the presence of blood proteins to determine the specific family of the animal whose blood or tissues came into contact with the artifact. Protein residue analysis is a method that uses an immunologically based technique referred to as cross over immunoelectrophoresis (CIEP or COE). This method originated from forensic work devised by Culliford (1964; 1971), and later revised by Newman (1989) and the Royal Canadian Mounted Police (RCMP) Serology Laboratory in Toronto, Canada. Additional improvements were made at the Paleo Research Laboratory in the Denver VA Medical Center, and the University of Colorado Health Sciences Center. For further details and history on this method, see Appendix A.

To test an artifact for protein residue, it is bathed in a medium to separate the proteins from the artifact. Since soils are likely to contain bacteria and animal feces that may provoke a false positive reaction, a soil sample from the proximity of the artifact's in situ position is tested as a control, thus eliminating the argument that the residue(s) may have resulted via soil contamination. The extract residues are tested against prepared animal antisera that are obtained from pharmaceutical suppliers and specialists that produce antisera specifically for testing of various animals including humans and extinct Pleistocene megafauna such as the Colombian Mammoth or the predacious Saber-tooth Cat.

Results identified in CIEP are limited to the animal's family level. Species that are related relatively close will have common serum proteins. Some cross-reactions will occur between closely related species and sometimes between distantly related animals. Elephant serum, for example will test positive with Mammoth blood, and deer antiserum will react with other members of the Cervidae family, such as other species of deer, elk, and moose.

GEOCHEMICAL ANALYSES

Geochemical research is an invaluable tool that researchers can use to identify trace elements in lithic materials such as obsidian, to establish its geologic/geographic origins. By measuring quantities of trace elements contained within stone from known sources, researchers can identify where the raw materials of finished artifacts and debitage originated, after being transported to various outlying areas by human means. When used in conjunction with obsidian hydration analyses, a closer relative date can be calculated as different obsidians hydrate at differing rates.

When the raw material sources are known, and compared to the sites where they are excavated, a clearer picture can be presented, exhibiting the trade and/or migration routes and the distances that prehistoric peoples carried these materials and implements. In this thesis, the Paleoindian component is represented by one artifact, specifically, a fluted point shown in Figure 7 (p. 69). The specimen was geochemically sourced (Appendix B) through energy dispersive x-ray fluorescence (edxrf) analysis (Hughes 2006).

In addition, another obsidian waste flake was tested utilizing this technique (Appendix C). This flake was chosen for this analysis because it had a discernable patina that was not present on the other debitage. This sample was also subjected to obsidian hydration analysis and the results from the hydration measurement determined that a geochemical analysis was requisite as well. Kaylene Flemming (1999) previously subjected five obsidian flakes for analysis and all five tested positive to the Obsidian Butte source. I used this information to support my thesis in the obsidian hydration results as well.

TECHNOLOGICAL ANALYSES

Flaked stone artifacts are manufactured in a process that has evolved over millions of years, from the earliest simple Oldowan tools, which were simple sharp edged broken pebbles and flakes (Lewin 1993), through a long, evolving, and diverse spectrum of methods, varieties, styles, and usages, to the finely crafted array of stone tools exemplified in the late prehistoric archaeological record.

By examining the attributes of flaked stone tools and waste flakes, under magnification, a technological specialist can determine the order of actions that were administered to the particular specimen and by comparison, with multiple examples, patterns and associations can be identified with an analogy similar to reverse engineering. The intentions behind a debitage analysis are to introduce inferences concerning lithic tool manufacture, use, maintenance behavior, and related activities. Projectile point analyses may produce additional inferences with regards to the maintenance, reuse, discard, and chronological indicators. By analyzing these among other flaked stone artifact types, behavioral interpretations can be surmised leading to theories of technological change across time and space (M. Rondeau, personal communication 2007). The Paleoindian fluted point was sent to Mike Rondeau for analysis and is reported in the results section and detailed in Appendix D.

OBSIDIAN HYDRATION ANALYSIS

The discovery and science behind this dating technique was discovered by geologists Irving Friedman and Robert L. Smith and is reported in their (1960) American Antiquity article. Together with Archaeologists Clifford Evans and Betty J. Meggers (1960), this team of four, developed the method in its early stages and are directly responsible for the valuable chronological dating tool it has become today. There are many who argue that this method is, or is not, a relative, or an absolute dating technique. This disagreement derives from the problem of accuracy in the association of mathematic equations, and the direct relationship to an age/date derived from the hydration rind measurement. It has been demonstrated that differing sources of obsidians hydrate at different rates. This problem is compounded by numerous variables that play into the equation. Some of the problems lie in the differences of obsidian flows within the same volcanic source, the average temperature of environment where the glass hydrated, and that the process of hydration front penetration slows gradually over time. Some past studies have used relative dating by comparing ^{14}C dates within the same strata to obsidian hydration measurements. This method is useful but it is rare that organic materials are in direct association with obsidian samples in a stable stratified matrix – at least within the vast majority of the environments in southern California. The soil matrices of Lost Valley would not yield such advantageous comparisons due to the obvious bioturbation from burrowing animals, and the intrusion of roots from trees and shrubs.

Obsidian hydration rates of the glasses from Obsidian Butte at the southern end of Salton Sea are a controversial issue among San Diego archaeologists. There are at least six published rate equations as discussed by Don Laylander (1992:88). Those six calibration constants varied from the minimum of 47 years per micron to a maximum of 314. If we take these diverse factors and average them we get an average constant for our equation of 150.6.

To establish a hydration rate specific to the samples from Lost Valley, a known or hypothesized reference point for a given sample must be designated and then compared to the remaining samples – all of which are assumed to have hydrated in the same environment and originate for the same geologic source. When this rate constant is identified or designated, a reasonable time frame can be derived for each sample building an occupational time span of a given site.

Under the direct supervision and instruction of Dr. Glenn Russell, Myself and another graduate student, Stephen Rochester, set up an obsidian hydration laboratory as a part of the archaeology lab in Hardy Tower at San Diego State University. During the set-up we tested several un-provenienced obsidian objects as practice slides to acquire the skill and "the feel" of producing a quality slide. When we were confident of our skills and Dr. Russell had declared our capability sufficient for scientific applications, we began to produce slides from the Lost Valley collection.

I cut the samples on the lapidary saw and ground them down to approximately 2 to $3mm^2$ thin transparent cross-sections. Next, I mounted the samples on a microscope slide with Lakeside cement that was pre-heated on a slide warmer at approximately 80° to 85° C. Removing the slide from the warmer, it quickly cooled, and within seconds I was able to begin grinding one side down to a smooth flat surface with 400 grit abrasive on an 18" (45 cm) square, ¼" (6 mm) glass plate. I then proceeded to grind them down, producing a flat cross section, at which time I placed a small pencil mark on one edge to delineate "side one" on the sample. Next I removed the sample from the slide and reattached the previously flattened, ground down side to the microscope slide, and continued to grind the remaining saw cut surface down to leave an approximately 2 µm cross sectional slice (see Friedman, Trembour, and Hughes 1997:300-301) (see also Michels 1973:201-218). When the slide was cleaned and dried, a small dab of Canada balsam was placed on the sample surface and a microscope cover slip was placed on top. The entire slide was then briefly placed on a slide warmer to set the Canada Balsam as a thin, clear, bonding agent. Measurements were visualized on a Meiji model ML9430 polarizing microscope and rendered optically with an Infinity Model INFINITY2-3C microscope mounted digital camera fed into the Dell PC through a USB connection. Digital optics were previewed and captured using IMT iSolution Lite Version 7.0 software, where specimens were measured on the monitor screen with the computer curser by click-and-drag mouse action. The software application was calibrated with a 40X magnification objective lens and a 10X viewing lens on the microscope where 10 pixels is equal to 1µm of hydration. A calibration slide was included in the optical software package which I calibrated the imaging to 100 (micron) measured units is actually equal to 96.477 µm. With this calibration equation, I refined the measurements by multiplying the measured units by 1.03652 to correct for the errors that were incurred from the conversion from optical to digital imaging.

$$100 \div 96.477 = 1.03652$$

After the direct computer measurement of the hydration rind was determined, the measurement was then multiplied by 1.03652 to calculate the actual, calibrated rind measurement variable. When this calibrated measurement was known, I needed to determine a constant to complete the equation. Knowing that the historical documents state that the Cupeño were forcibly removed from their ancestral lands in 1903 (Phillips 1975; Castillo

1978a, 1978b, 1978c) and the last recorded presence of a Cupeño group in Lost Valley was approximately 1901, I used the date of 1902 as a reference point to assign to the most recent hydration measurement. 1902 was 106 years before this writing, so I hypothesized that 1.22 µm, calibrated to 1.26µm, represents the smallest measurement at 106 years BP. The measurements must be squared because the hydration process proceeds at the square root of time (Taylor 1997). Therefore 1.0µm = 66.77 years, since:

$$1.26^2 = 1.5876$$

$$106 \div 1.5876 = 66.77\ldots \textit{(Years per micron)}$$

or

$$1.5876 \times 66.77 \textit{ (constant)} = 106 \textit{ (Years before present)}$$

Wherever possible an average measurement was taken from as many sides and locations as visually available from an individual specimen unless the measurements were more than 0.4 µm, at which time it was assumed to be two separate cultural data points. Measurements were rounded to the nearest hundredth of a micron. Digital photos were saved in a .tiff file format for further scrutiny, in addition to the slides themselves, which were labeled and filed. The software allows for the option to save the photomicrographs as .tiff files, set as a default, but also readily allows for the saving and conversion of photomicrographs in a jpeg or several other common digital photographic formats. The measurements and the recording of data were checked by Dr. Glenn Russell throughout the entire process during the months of October through December of 2007. The hydration rind measurements and all relative data are detailed in Appendix E.

One of the difficulties encountered was in sawing a slice from a piece of obsidian that was too small to hold with the fingers and remain a comfortable distance from the rapidly rotating diamond saw blade. The pieces that were too small (measuring significantly less than $1 cm^2$) to hold with bare hands or with any mechanical device were subjected to nearly total destruction having only saved the slide sample with the remaining edges ground away. When a fragment of obsidian was too small to cut out a cross section, I used the outermost edge of the diamond saw to grind two edges of the obsidian flake, leaving only a remaining cross section, having ground away the rest of the flake. The remaining cross section was applied to the slide and ground down to a 2 µm thin sample as stated in detail above.

Although a geochemical sourcing analysis was not performed on all of the samples, I am assuming at this point that the majority of the debitage and utilized flake fragments that have undergone hydration analysis are from Obsidian Butte. Richard E. Hughes and Delbert L. True (1985) published an article on the distribution of obsidians in San Diego County and demonstrated that Obsidian Butte obsidians are “the dominant glass in archaeological collections in the area.” However The Coso Hot Springs glasses “occur more frequently at sites near the Pacific Coast than at sites in the interior.” Based on this knowledge, together with the random samples of geochemical analyses that have been completed, I am basing all of the obsidian hydration samples on the assumption that all samples are from the Obsidian Butte source.

It is logical to assume that using the Obsidian Butte hydration rates it would make little difference in the overall scheme. As I have no radiometric dates in direct association with the obsidian, I can relate all measurements against each other to suggest that the thinnest hydration rind represents a historic (ca 1901) component. Through the construction of a histogram, we can observe the relationship of the least hydrated sample as being representative of the most recent (historic) occupation, to the deepest rind penetration being representative of the oldest. Any gaps or missing measurements would represent non-occupation of the site, or that no obsidian was deposited where excavations occurred during those relative dates, or that the availability of obsidian was interrupted. When entertaining the thought of intermittent lake stands of Lake Cahuilla, a gap in measurements could represent non-availability due to a submerged Obsidian Butte source quarry.

FLAKED STONE TOOL ANALYSIS

The use of flaked stone artifacts is ubiquitous in archaeological collections. By analyzing the various attributes of the stone raw materials, the tools derived from them, and the presence or absence of other attributes, we are able to develop theories pertaining to the people and cultures that developed and used them. The analyses used here focus on projectile points, the materials from which they are made, and the styles and technologies as they changed over time.

A significant population of artifacts is required in order to perform a statistical analysis of the projectile points. The late prehistoric component of the Lost Valley collection presented an adequate number of comparable artifacts. Since two basic styles were represented and many diverse materials, it was apparent that only certain options were available. During the excavations, I observed that the white quartz points were rarely notched as opposed to higher quality cryptocrystalline materials. Knowing this, I viewed the materials in two categories as well. The white quartz as one category, and other higher quality cryptocrystalline materials as the “other.” I constructed a two by two table chi square analysis to the data to visualize the variables in table and chart form through the SPSS® computer program that is made available through the SDSU server. SPSS is a Data Analysis computer program, which includes comprehensive statistics software. The data is easily transferable to Microsoft Word or Excel files. The chi square numerical results that I obtained through the SPSS software was duplicated into an Excel file to produce the graphs and charts used in this thesis.

I performed the chi square analysis in the data analysis lab at SDSU from the original Lost Valley database stored on the local PC in the archaeological lab. I also saved the entire database into a Microsoft Excel file, which I saved on a CD and also on my personal PC hard drive. Certain recoding was requisite to make the transformation, which I performed at home.

The main reason for transferring the data into Microsoft software applications was to have it available at home and for use on my personal laptop PC, but also for saving as a back-up source of the entire Lost Valley Collection data. This back-up maneuver ended up being a huge benefit since now it is the only surviving data. At some point between the final entry of the data and the start of my thesis writing, the lab computer was changed out and up-graded. All of the data – the entire Lost Valley Collection that was stored in the old machine in SPSS format – is now gone except for the saved SPSS CD, and the Excel data on CD and the Laptop PC hard drive.

DEBITAGE ANALYSIS

Flaked stone tools are made from naturally occurring lithic raw materials by a process of controlled fracturing. This action creates waste materials in a distinct place in time and space that can theoretically be recreated. Debitage is produced throughout the reduction process of manufacturing a flaked stone artifact.

The goal of a lithic debitage analysis as defined by George H. Odell "is to understand the processes of tool production in a prehistoric society by studying the debris that results from lithic reduction" (2000). There have been various tests and analysis methods designed to determine how the waste flakes came to be when removed them from the core. These analyses have always proven to be tedious tasks because of the variety of forms the debitage take. There are an infinite number of sizes, shapes, and physical attributes present in these collections, making divisions among the variants seem mostly arbitrary. If the debitage collection presents a homogenous and continuous spectrum from the smallest piece that the sifting screen held back, to the largest unused stone flake, what do the divisions tell us? If we cannot positively identify distinct attributes to their relative causal actions, the analysis is meaningless drivel.

Most lithic debitage analyses thus far have dealt with the higher quality, and predictable cryptocrystalline materials. This study, however, is forced to focus mainly on the white quartz commonly found in pegmatite and quartz dikes throughout the peninsular ranges of granitic batholithic and plutonic igneous rocks. White milky quartz is by far the most utilized flaked stone material in northeastern San Diego County, specifically the Cupeño areas as a whole, where it represent the highest percentage of its artifacts, represented at 94% (Dietler 2004).

As this collection has been amassed mainly by undergraduates in a learning capacity, the experts in identifying the various lithic materials were hard pressed to oversee every opportunity to identify the variations in flaked stone raw materials. Even among professional archaeologists, agreement to differentiations between cherts, jaspers, flints, and chalcedonies remain tenuous, leaving region wide consensus lacking (Ford 1971). There were minute quantities of various chalcedonous materials that may have been misidentified, so the identification of these may be challenged in the future. When these questionable materials became a focus of a particular problem they were reclassified into the more general identification, or were not used in the analysis. The quantity of materials that were omitted due to this conundrum were minimal, measuring less than 0.1 percent of the component classification.

William Andrefsky Jr. (1998) refers to quartz lithic materials as either microcrystalline or macrocrystalline silica dioxide (SiO_2). The microcrystalline or cryptocrystalline quartz fractures concoidally and thus was used by humans to a greater extent than any other lithic material. It is known by many different names based either on its appearance or manner of formation. Chert, chalcedony, flint, jasper, and agate, among other terms, are all forms of cryptocrystalline silica dioxide. Macrocrystalline quartz is the form familiar to many as the large, showy, six sided transparent crystals that are sometimes tinted colors from the presence of trace elements. This form fractures concoidally but is rare when compared to the many other forms of SiO_2 (Andrefsky 1998).

Attribute analysis utilizes classic identifiable flake attributes, such as bulbs of percussion, striking platforms, elrailure scars, and striations, to identify what stage of production produced the particular debitage (Sullivan and Rozen 1985; Rozen and Sullivan 1989).

Aggregate analysis typically sorts waste flakes by size using a series of continuously smaller sized mesh screens. Large flakes are assumed to be from primary (core) reduction, and successively smaller sizes are identified as soft hammer percussion, and even smaller, pressure flakes (Andrefsky 1998). This type of analysis has been questioned as to its effectiveness of interpretation when differences in flintknapping styles and techniques are involved (Andrefsky 2006). The quartz waste material was represented in the form of angular debris and small nodules that are likely spent cores.

This poor quality white quartz appears as a translucent milky white color and seems to possess an aggregation of unorganized minute crystalline structures. Milky white quartz is mostly composed of many small crystals that formed together in an random array with numerous inclusions of fluid water. The better quality quartz crystals are represented by a hexagonal structure, a clear or lightly variable colored hue with a high transparency factor. The superior crystalline quartz material exhibits concoidal fracture properties facilitating predictable knapping. The low quality milky quartz, however, shatters, crumbles, or otherwise breaks unpredictably, resulting in increased waste.

When I questioned several California archaeologists about this material, the most common reply was an initial wordless facial expression denoting dread or revulsion followed by a supportive “good luck.” I have found a dearth of published information on this subject, thus prompting me to pursue this subject as one focus herein. My research into previously published articles on this material yielded an article by Michael S. Bisson (1990), writing about a site in Chingola, Zambia, a site with similar geological origins.

> There are few things more discouraging for an archaeologist interested in the study of lithic reduction sequences than to be faced with the analysis of an assemblage that is made on poor quality quartz (Bisson 1990).

Attribute analysis was difficult to impossible since the removed white milky quartz flakes are seldom found intact due to the numerous inclusions and flaws inherent in the material. Typological analysis did not yield results since the classic identifiable attributes, such as bulbs of percussion, striking platforms, elrailure scars, and striations, are either absent altogether or nearly impossible to detect. Since very few quartz artifacts were notched, negligible amounts of notching flakes would be expected, and none were indeed identified.

Analyses of these cryptocrystalline materials are often performed by identifying flake attributes, flake shapes or types, or by separating size categories (aggregate analysis) thus determining the method of their individual production. With the type of quartz found commonly in sites of Lost Valley these methods pose considerable difficulties.

Aggregate analysis would not reveal much information either, since there is no large difference in size, and commonly a large percussion flake of this material often separates in fragments upon impact. Pressure flakes tended to come off in fragments, or in flakes small enough to pass through the 1/8” screen.

Experimental core reduction yielded very similar detritus forms that were angular, flat-sided “chips” rather than curved flakes with the common attributes. Fractures in this material often followed the many interlocking natural facets, inclusions, or cleavage planes. What can be analyzed successfully are the various sources of raw materials present.

This debitage analysis consists of a quantitative comparison of materials and the depths from which they were excavated. A statistical attribute analysis on all materials other than the milky quartz would not reveal adequate information since the population quantities were insufficient. The milky quartz material component of the debitage is inherently fractured to the point where an intact flake is rarely encountered. The milky quartz debitage appeared as a spectral continuum of debris, ranging from slightly more than sand grains to the spent core. An aggregation analysis would be meaningless unless a reliable size division can somehow be ascertained.

This situation left me with the opportunity to compare debitage materials numerically and to present the debitage materials, quantities, and contexts graphically. I used Microsoft Excel to construct the database directly from the SPSS data saved on a CD. From this I produced a pie chart to exhibit the comparative overall quantities and a 3-D bar graph to show the distribution and differentiation of materials quantitatively.

An Experiment in Debitage

I performed an experiment on milky quartz and its debitage to hopefully discover more about the attributes of milky quartz debitage. My questions were many, but included:

1. Why was this relatively sub-adequate material used to the extent that it was?
2. Why does this material differ from other cryptocrystalline and chalcedonous materials?
3. What are the differences in the flintknapping tools and techniques necessary to produce a usable product?
4. Would experimental debitage resemble that which was excavated, using the tools and techniques believed to have been used for other materials?
5. What other information can experiments disclose about the differences between the finer materials and the milky quartz?
6. Just how much more difficult is it to produce a product from milky quartz?

Although in this section I claim to have an insider's knowledge of flint-knapping, I do not and of course could not claim to know what ancient peoples thought, knew, or believed about the use and manufacture of stone materials, or what they knew of the stone's physical properties. What I mean by the phrase "insider's knowledge," I am referring to a flint-knapper's knowledge of how certain lithic materials behave, both in the hand and under the tool. I do however ponder the act of surviving on, and the making of stone tools while in the process of making flaked lithic artifact reproductions as experiments. My whole intent is not to produce pretty things, but to reproduce what I see in the archaeological record using the same methods and raw materials that that were used in the past. Having the basic scientific education of geology and mineralogy on which to build, added to well over a decade of experimentation in lithic technology, I possess only one alternative view of the art. I realize, as do all professionals in the anthropological fields, that we cannot place ourselves in the lives, experiences and states of knowledge of long past cultures, or for that matter, even others in the present. What I am presenting here is my own personal observations and a plausible explanation based on my own experiences with the materials I see present in this local environment, and the technology of flint-knapping as I have learned it.

If a modern flintknapper produces a similar tool to what ancient peoples manufactured using similar methods and tools, and produces debitage that resembles the debitage that we typically find in the sites we record and analyze "then the tools and debitage produced during the experiment should be true replicas of the ancient artifacts produced with the same reduction sequence" (Yerkes and Kardulias 1993).

In his book "Survival Skills of Native California," Paul Campbell (1999:320-31) describes the diversity of techniques applied in this venture, through writings of the earliest of anthropologists in the mid to late 1800s and testimony and demonstrations by native informants from several different areas in California. One example, Ishi, who gained fame as the last Yahi, demonstrated to Alfred Kroeber, (Justice 2002:19; Campbell 1999:320) various techniques in the manufacture of flaked stone tools.

Jeffrey Boudreau (1981) published an article describing his experiments of working with quartz. His descriptions parallel what I have experienced on analyzing the Lost Valley debitage along with my own backyard creations. His experimental point typology replicated the "Squibnocket" series points, which the triangular versions closely resemble the cottonwood series of the western U.S. (Boudreau 1981).

Having perused these among other works, I gained a few "pointers" which allowed me to perfect the craft to a finer level of craftsmanship. In a manner of something akin to reverse engineering, I have attempted to gain some insight as to what it was like to make a living in California before the arrival of Europeans. In addition to flintknapping and the ceramic experiment, covered in a subsequent section, I have also experimented with cordage and basketry from local and backyard vegetal sources, and produced ground stone metates, manos, mortars, pestles, and other specialty items from a variety of igneous sources. The knowledge gained by actually investing the time and effort into the production these utilitarian objects, as well as the blisters, calluses, and lacerations suffered, added a new dimension of understanding to the phenomena. I may even now have some insight on late prehistoric first aid. It is one thing to know the details involved in the technology, but it is another altogether different outlook that one gains while experiencing the feel of the stone, the sweat dripping from your brow, the smell and taste of the rock dust, and the time investment involved in producing these various artifact replicas. The results of these experiments are reported in Chapter 5.

A Flintknapping Experiment

As the excavations and the subsequent lab processing and handling of the collection progressed in the years 2002 and 2003, I noticed that the diversity of projectile points occurred mainly in two categories, notched and unnotched. I also paid particular attention to the various materials that were used. Having practiced flintknapping, I took special notice that the unnotched specimens were more likely to be made from a lesser quality material. “Lesser quality” is defined here as a material that is less predictable in it’s behavior when flaked by percussion or pressure. This is opposed to higher quality materials, such as a homogenous obsidian or chert, where a predictable reaction can be relied upon from a precise pressure or percussive action.

It became apparent that a large majority of the projectile point artifacts that were manufactured of the “better” lithic materials were notched type styles of projectile points. Desert Side Notched Cluster styles were predominant among them (Justice 2002:379-402). Conversely, the most abundant material in the collection was the only material commonly available locally – milky white quartz. I located a sample of this raw material alongside the road leading into the valley on the way out one afternoon and transported it home for additional research into the behavior of this material under various methods of lithic reduction. In the process of fashioning several usable preforms, I became somewhat adept at flaking this mineral. The sample of quartz that I used was nearly identical to that of the majority of the artifacts excavated from the above-mentioned sites and generated reproductions that could be mistaken for the actual artifacts. To test my hypothesis that this material was not conducive to notching, I attempted to produce several Desert Side Notched points and found it extremely likely that the notch would be just barely a notch, more akin to a recess, or would break the perform and render it useless. The only notching that was successful was in reality not a notch per se, but a mere indentation, which upon applying a slight grinding to dull the edge of the indentation, would adequately serve as a hafting location, but I would have difficulty maintaining that this should be considered a “true notch” in the literal and stylistic sense of the word.

I proceeded to test the alternatives to notching and soon efficiently produced several un-notched points identical to the many samples collected from the excavation in the various forms of Western Triangular Series (Justice 2002:367-78). With well over ten years of experimenting with a host of lithic materials, I found that this milky quartz example was miserable at best, compared to high-grade obsidian, but with adequate practice one could become increasingly familiar with the diverse properties of, and the myriad of variability in the quality of quartz and produce adequate lithic tools.

CERAMICS

The presence of ceramic sherds immediately gives us a reliable time frame of occupation in the more recent time frame of the late prehistoric. The clays that make up the different visually distinctive ceramic components of a site may tell us of exchange patterns and relationships with neighboring peoples as well.

Tizon Brown Ware, a red-brown ceramic with a quartz sand temper and no slip, commonly occurs in late prehistoric sites throughout San Diego County. It would be expected that this form would make up a large percentage, if not all, of the ceramic sherds in local sites.

A detailed and in depth analysis of the ceramic component of this collection is not within the scope of this work. I did not delve deep into a ceramic typology or material analysis but only report what was observed by a non-specialist, as the ceramic materials were excavated, sorted, cataloged, and curated. Kayleen Fleming reported that Tizon Brown Ware was the predominant ceramic material in CA-SDI-2508, and other ceramic types present were sherds of Tumco Buff, Salton Brown, and Lower Colorado Buff, as identified by Jerry Schaefer PhD of ASM Affiliates (Flemming1999).

In this project I only report on two observations from the Bog Site, that will provide additional knowledge concerning this collection that will show additional ceramic information to the Lost valley collection from that previously reported in Flemming's 1999 Thesis of excavations on the Leaning Pines Site (CA-SDI-2508), located just across the road from the Bog Site (CA-SDI-2506). These observations will be discussed in the results section, with the intent to spur another graduate student, whose interest lies specifically in the realm of ceramic studies, to perform this much needed addition to the archaeological record of Lost Valley. I have noted most of the obvious and some subtle attributes observed while handling the collection, and itemize them in detail in the results chapter (Chapter 5).

GROUNDSTONE

Milling Stones

The groundstone artifacts that are identified as being used for milling or food processing tools, by far were the weightiest component of the collection. Numerous cobble-sized, shaped and unshaped manos were present and many fragments of metates were discovered, scattered throughout the sites. Several pestles were noted, making sense of the numerous bedrock mortar features located throughout the valley and specifically within the Bog Site at its northern edge. These artifacts are not the focus of the work, but I felt compelled to report specific details on a few distinct noteworthy artifacts that I thought were important, and that provide new knowledge pertinent to Cupeño archaeology. A more detailed report of groundstone was previously compiled by Kaylene Flemming (1999) in her master's thesis, and with only specific, and noteworthy instances I will show additional data.

Shaped Groundstone Implements

Other tools identified in this work were digging-stick weights or "doughnut stones", and arrowshaft straighteners. These will be discussed in detail in the results chapter concerning their specific attributes. A detailed qualitative or quantitative analysis is not the focus of this project. I am only reporting observations gleaned from excavation and laboratory processing activities.

Doughnut stones have been conclusively identified as digging stick weights and are ubiquitous throughout southern coastal California and the Channel Islands.

The successful test-use of heated grooved stones, identified ethnographically as arrowshaft straighteners, has been aptly demonstrated through experimentation by Cosner (1951). Costner describes the use of the arrowshaft straightener by heating the stone to the point where the arrow shaft lightly smokes upon contact with the stone. The application of heat both softens the cellular structure of the plant fibers as well as any residual pitch, which allows for ease of bending without breakage. Direct heating of the shaft was applied to some materials also in the form of baking over mesquite coals and also by submersing in boiling water (Cosner 1951). The slot or groove on the stone both applies heat to a portion of the circumference of the shaft's surface and allows for leverage in bending the shaft at a given point to straighten out inherent bends, and/or flatten surface bumps. A smooth straight arrow-shaft eases the smooth release of the arrow across the bow. When cooled in the desired position the cellular structure of the arrowshaft retains much of the re-formed and desired shape.

Ethnological reports from nearby groups have identified these artifacts for the same purposes using identical and similar arrowshaft materials. John P. Harrington reports the preference of steatite for the manufacture of arrowshaft straighteners by the Juaneño at the San Juan Capistrano Mission in Boscana's Chinigchinich (Boscana et al. 1978:172), and Kroeber (1925:531) describes and exhibits several variations used by the Cahuilla and the Diegueño among others. Most of these examples are decorated with variations of incised parallel and crossed lines. Several examples have also been exhibited and described in archaeological collections and in archaeological reports of neighboring groups such as the Luiseño (True et al. 1991) and within the Cuyamaca Complex (True 1970).

The arrowshaft straighteners in this report were researched using published reports, were measured, weighed, and photographed. They were not compared with existing local collections or subjected to any in-depth analyses.

Body Adornment Artifacts

Items of physical body adornment were present in only a few examples. One as a zoomorph, and two as pendants, and all featured a biconical drilled hole for possible attachment with cordage. These artifacts are extremely interesting and hold as yet unknown scientific information. A brief comparative analysis was performed by way of a literature search for similar specimens in published reports. I did not compare these with other artifacts in local collections, but at some future point in time this should be performed. These specimens are thoroughly described, photographed, measured, and displayed in the results chapter.

OTHER STONE

Several other types of mineral and stone artifacts that lie within this broad category are reported in the results section pertaining to their unique qualities, and how these particular items draw a picture of Cupeño life, with relations to prior studies of neighboring cultures, historic ethnographic accounts, or any other relationships leading to relative hypotheses and/or theories. An in-depth statistical analysis of this category of artifacts was not the goal of this thesis, but I felt the need to briefly report on them for their scientific and cultural value, and also in the hopes that it will spawn further research on this collection by other graduate students in the pursuit of an advanced degree.

In this report, I show one example of a tourmaline crystal that seemed to have a purposely-shaped end. This specimen has been measured, weighed, and photographed and appears in the results Chapter 5.

Other materials in this category are merely reported as present and the details as far as context and quantities are contained in the Raw Data in Appendix F.