WHAT THE LITHICS FOUND AT THE SODA SPRINGS ROCKSHELTER CAN REVEAL ABOUT THE FORMER INHABITANTS THERE

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Soda Springs Rockshelter is a looted site located about 60 mi. northeast of Barstow, California on the southern shoreline of Pleistocene Lake Mojave. Despite heavy disturbance, the materials recovered from archaeological excavations still allow the determination of key aspects of the site. The types of artifacts and ecofacts found, along with the nature of the stone tools and debitage, indicate that the rockshelter was a hunting camp where processing of game animals took place. The latest excavations also provide evidence for only a rather recent use of the site, from the Late Archaic through the Late Prehistoric.

Soda Springs Rockshelter, or Zzyzx Rockshelter (CA-SBR-363b), is located on the southern shoreline of a Pleistocene lake known as Lake Mojave. It is on a protected shore above the high beach line and is near Soda Springs (Roth and Warren, in press). It is on the east side of the Soda Mountains and the west side of Soda Lake (or Soda Playa) in the Mojave Desert (in the southwestern Great Basin). Soda Lake happens to be one of the remnants of Pleistocene Lake Mojave. It is the sink of the Mojave River, which enters from the south, and, on occasion, it actually receives water from the river. There are also several springs that flow in the area north of the rockshelter. The site is located approximately 60 mi. northeast of Barstow, California and 8.5 mi. southwest of Baker, California (Cameron 1984).

According to Cameron (1984), the overall site consists of Limestone Hill (CA-SBR-363a), the rockshelter of interest in the east side of the hill that faces the lake (CA-SBR-363b), and West Pond (CA-SBR-363c). The foothills of the Soda Mountains surround the shelter in three directions (north, south, and west). These foothills would have been the prehistoric habitat of many game animals (Roth and Warren, in press).

During the early 1980s, Joesink-Mandeville and his students undertook archaeological investigations of the site. Due to unfortunate circumstances, though, no report has been published on those excavations except for an article on the recovered bifaces. The investigators found that there were "large mounds of dirt" to the "north and south of the lower terrace" that were "removed from the rockshelter during unscientific excavations" (Schroth and Joesink-Mandeville 1987:35). In other words, pothunters had excavated substantial amounts of the deposits within the rockshelter (Roth and Warren, in press). Despite the looting, intact middens were still found and excavated. Joesink-Mandeville and his students found three extramural hearths, faunal remains, two basalt manos, several projectile points, several bifaces of high-quality material, a few scrapers, and a few cores. Brownware and grayware ceramics were also found, suggesting that perhaps trade or contact with the Anasazi occurred (Roth and Warren, in press). As a result, it was concluded that the rockshelter represents a hunting camp where "no long-term habitation took place" (Schroth and Joesink-Mandeville 1987:52).

The point types recovered during this investigation were three Desert Side-notch, seven Cottonwood Triangular, five Rose Spring, one Elko Eared, one Humboldt, and two Pinto points. The presence of these points suggests an occupation that spanned from the Middle Archaic until the Late Prehistoric. Faunal analysis of the bone recovered revealed that the predominant species were pronghorn antelope and bighorn sheep. Smaller amounts of jackrabbit, cottontail, desert tortoise, and a variety of bird and rodent species were also present. The presence of burning and cut marks on the bones show that these animals were being processed and consumed at the rockshelter (Roth and Warren, in press).

A more recent investigation of the site occurred in the spring of 2006, conducted by Barbara Roth and Claude Warren. The original purpose of the project was to "examine prehistoric adaptations" and "how these adaptations changed over time in response to environmental change." In order to do so, an

Table 1. Tool Count by Type

TOOL TYPE	NUMBER
Tabular Knives	2
Side Scrapers	2
Retouched Flakes	2
Possibly Utilized Flakes	4
Choppers	1
Notches	1
Bifaces	4
Projectile Points	2

effort was made to refine the chronological sequence of the rockshelter as well as look for the earliest occupation of the site (Roth and Warren n.d.). Seven 2 m by 1 m units were excavated. Three of them were on the "lower beach terraces" (Units 3, 4, and 5), two on the "high beach line" (Units 6 and 7), and two in front of the rockshelter (Units 1 and 2). It has been determined that Unit 1 was dug in "portions of previously excavated deposits." Two units (2 and 6) were dug in intact middens (Roth and Warren, in press). The rest were dug through looter's piles. In the end, it was found that the stratigraphy was not intact, thus no refinement of the chronological sequence could be accomplished. However, the lithic assemblage makeup can be used to help determine the activities that occurred at the site as well as a general time frame for the site (using projectile point typology). In addition, the use of raw materials and the nature of lithic reduction (whether core reduction, tool production, or both were occurring here) can be somewhat assessed as well by examining the debitage.

TOOL ANALYSIS

The lithic assemblage includes 18 tools, two cores, and 365 pieces of debitage. The tools were primarily found in the intact middens of Units 2 and 6, which are located right next to each other near the front of the rockshelter.

Table 1 contains the counts of each tool type. Tools are defined as such. Scrapers and choppers are large flakes or cobbles that have at least one unifacial retouched edge. They are differentiated by their retouched edge angle. Choppers have steeper edges (60 degrees or more), while scrapers are more acute (45 degrees or less). This classification was confirmed using the thicknesses of the tools. The only chopper (5.29 cm) was thicker than the thickest scraper (3.23 cm). In addition, all the scrapers had continuous retouch, while the choppers did not. Tabular knives are similar to side scrapers except that they are thinner, have a straight retouched edge, and are quite flat. Notches are similar to choppers but have a large notch taken out of them. Retouched flakes are small flakes (complete or not) that have even smaller flakes taken off their edges but not necessarily in a strategic manner. Possibly utilized flakes are flakes showing evidence of edge damage, which could have been caused by usage or by formation processes. Bifaces are any thin tools that are bifacially worked but cannot be definitely classified as projectile points since they are not complete (most are missing a base). Projectile points are bifaces with specific attributes that are either still present or appear to have been present at one time (base, margins that taper to a point, tip, and tangs).

Unifaces

The unifaces consist of scrapers, tabular knives, and retouched/utilized flakes. The attributes of the scrapers differ markedly from the retouched flakes. The scrapers are made of lower-quality material for the most part. They also are much larger in size and have definitive continuous retouched edges, the main factors in distinguishing the two types of tools. There are two side scrapers. One is made up of quartzite, while the other is andesite. The quartzite scraper is quite flat and thin, suggesting it was originally struck off from a larger rock. The material is flaky and cracked, suggesting that it either has flaws in it or it perhaps has been thermally affected. The andesite scraper is blocky and thick (almost three times thicker than the quartzite one) and thus appears to be more of a retouched nodule. Since both scrapers are made of low-quality material, there appears to have been little effort to find good material for making the scrapers, probably because of a scraper's expedient nature.

There are two tabular knives, one made of basalt and one made of slate. They are both thin, being less than 2 cm in thickness, but still long, being greater than 6 cm in length. They also have very straight retouched edges. Both have small portions of cortex on them (from 15 to 25 percent). The basalt one has cortex around where it would have been held, suggesting that the cortex provided some form of natural backing to prevent cutting oneself. It tapers from its "handle" to its retouched edge. It also looks like the basalt knife was struck off from a larger nodule and then reduced somewhat. The slate knife, on the other hand, may have two retouched edges, one of them being where the tool would be handled. It has a steeper retouched angle, but the widths of the edges are very small, both together encompassing less than a fifth of the width of the entire tool. The slate knife looks as if a non-cultural, collected piece of slate was worked on two edges.

The retouched flakes are made of CCS (one of chalcedony, one of heat-treated chert) while the possibly utilized flakes are made up of CCS (two), basalt (one), and andesite (one). The two together represent the tool type with the highest abundance at the site aside from bifacial tools, suggesting the highest discard rate. Two of the utilized flakes and one of the retouched flakes are cortical. Overall, the more expedient tools, utilized flakes, are of lower quality than the less expedient ones, retouched flakes.

Core Tools

This category consists of one chopper and one notch. The chopper is made of quartzite, and the notch is made of andesite. The chopper is large and has few flake scars on it. It appears to be a cobble chopper whereby a large nodule was retouched on one edge to create a tool. Overall, the chopper is a very expedient tool made on low-quality material. The notch is somewhat more reduced but not heavily utilized. It has about 25 percent cortex that is located where it would have been held, meaning the cortex could have served as backing for the tool. It has a large notch taken out of one end of the convex "cutting" edge, with discontinuous retouch along the rest of it.

Bifaces

Six bifacial tools were found: four bifaces and two projectile points. All of the bifacial tools are broken, although one projectile point is almost complete and was probably still usable if it were reworked either as a smaller projectile point or a drill. None of these tools have cortex due to their highly reduced nature. Two of the bifaces are possible projectile point tips, one is a possible incomplete point discarded early in its production, and the other one is a possible drill tip. The bifaces cannot be definitively identified as projectile points or drills, because they are all missing the proximal end (base). Of the four bifaces, three are made of chert and one is made of chalcedony. Both projectile points are made of chert. In the end, all the bifacial tools are made of CCS. Aside from the retouched flakes, most of the informal tools are made of lower-quality materials, suggesting that the higher-quality material was reserved for more formal tools.

Projectile Points

The projectile points are too small to be darts, but instead must be arrowheads. The two points have all or most of their base present and thus can be given preliminary designations. Identifications of the projectile points are based on online images of projectile points housed at the Idaho Museum of Natural History in the Crandall and Wasden Collections (http://www.imnh.isu.edu/digitalatlas/arch/Prehist/C-Hist/CH_Proj.htm). Temporal designations of the points are taken from Waechter and Fenenga (n.d.) of the Far Western Anthropological Research Group. One of the projectile points is a Cottonwood Triangular point, which was used from 600 B.P. until historic times. This time period has been called the Late Prehistoric period by Sutton (1996) and the Shoshonean period by Warren and Crabtree (1986). In this report, Sutton's terminology will be used. The other one is a Rose Spring Corner-notched point, which was used from 1500 to 600 B.P. (Late Archaic).

Summation

The presence of unifacial and bifacial tools indicates that hunting, processing, and woodworking were occurring at the site. The bifaces were all made of CCS, while the unifaces were more variable (high- and low-quality materials). The projectile points indicate an occupation span from the Late Archaic through the Late Prehistoric.

CORES AND DEBITAGE

Cores

There are two cores present in the assemblage. Cores are any cobbles that have flakes removed but have no retouch. One is made of basalt, while the other is made of andesite. The basalt core has about 50 percent cortex. Both cores are multi-facial and multidirectional, but neither is exhausted (perhaps due to the low quality of the material).

Debitage

The assemblage consists of 365 pieces of debitage. There are complete flakes, split flakes, proximal flakes, flake fragments, and shatter. Complete flakes have a platform, flake margins, and a proper termination, meaning it was feathered, hinged, or an overshoot as defined by Andrefsky (1994). Split flakes are flakes broken in half lengthwise (from platform to termination). Proximal flakes are flakes lacking a proper termination (or have a step fracture) but still retain a platform and margins. Flake fragments are missing the platform but retain intact margins. Shatter is angular debris that was struck off a core or tool and contains no flake attributes.

Debitage Analysis

The debitage attributes recorded were presence/absence of cortex, size class, and raw material makeup. The size ranges were <1 cm, 1-2 cm, 2-4 cm, and >4 cm. The platforms of complete and proximal flakes were then assessed.

Flake Completeness. Table 2 presents data on completeness. Flake fragments make up almost half of the debitage assemblage from Soda Springs Rockshelter, with shatter and complete flakes making up smaller but still substantial portions. Proximal and split flakes did not make up a substantial portion of the assemblage. Flake fragments and shatter are more common with hard-hammer percussion, and their high incidence in the assemblage could suggest that considerable hard-hammer percussion was taking place. However, there is a low incidence of split or proximal flakes, which are also more common with hard-hammer percussion.

Cortex. It was found that 52 pieces of debitage (14 percent of the overall assemblage) were cortical. The low amount of cortex suggests that most of the debitage was produced during later stages of core reduction or during tool production.

Table 2. Debitage Type by Count

Debitage Type	Number
Complete Flakes	72
Split Flakes	5
Proximal Flakes	31
Flake Fragments	173
Shatter	84

Table 3. Count of Platform Type

Platform Type	Number
Cortical	3
Crushed	5
Faceted	21
Plain	59
Absent	11
Unknown	2
Split	5

Platforms. An analysis of the intact platforms of complete, split, and proximal flakes was performed. Table 3 shows the number of each type of platform. The platforms that were absent, unknown, or split were counted but then excluded from the rest of the analysis. Thus only 88 platforms were analyzed. As can be seen from the table, of the 88 complete and proximal flakes with intact platforms, plain platforms dominate. Faceted platform also make up a sizeable portion. Cortical and crushed platforms, on the other hand, are not common. It was also found that 27, or 31 percent, of the present and intact platforms were lipped.

According to Hayden and Hutchings (1989), lipping is more common with soft-hammer percussion than hard-hammer percussion. However, they also argue that lipping is not sufficient to distinguish soft-hammer, or billet, flakes. Instead, the combination of attributes, such as lipping and faceting or lipping and lack of crushing, are better distinguishing factors. Slightly less than half the faceted platforms and more than a quarter of the plain platforms are lipped, which are indicative of a significant amount of soft-hammer percussion occurring. According to Andrefsky (2005:1), a soft, light hammer produces a smaller “load application” than a hard hammer. Andrefsky (2005) also states that when less force is involved in producing a flake, the flaking is more accurate. Therefore, soft-hammer percussion is the technique more often used during tool production and repair, which requires more control and accuracy. Overall the amount of lipping and platform preparation along with the lack of crushed platforms shows the preponderance of billet flakes at the site. The platform analysis thus indicates that tool production and maintenance/repair appear to be the primary activities at the rockshelter.

Size. Size ranges were determined for the assemblage at large. Table 4 gives a count of the debitage by size class. The size classes show that most debitage is in the 1-2 cm size class, with a

Table 4. Debitage Count by Size Class

SIZE CLASS (IN CM)	NUMBER
<1	109
1-2	163
2-4	87
>4	6

significant amount in the <1 cm range. The smaller sizes of debitage, which tend to be produced during later stages of reduction, suggest that mostly tool production and tool repair were occurring.

Tool production and repair appear to have been common activities because of the high percentage of plain and faceted platforms, the small size of the debitage, and the low percentage of cortex. The high incidence of flake fragments and shatter, which tend to be more common with hard-hammer percussion, could have instead been the result of raw material characteristics or differential core reduction. The low number of cores (two) along with their low quality raw material makeup, could also be indicative of a small amount of core reduction/hard hammer percussion occurring. However, many cores could also have been transported or converted into tools. Overall, tool production/repair appears to be the main flintknapping activity that was occurring at the site.

RAW MATERIAL

In the previous investigation of the site, it was found that the only local material was a chert mixed with limestone (what will be considered low-quality CCS). Due to the rockshelter being located on the east side of Limestone Hill (Schroth and Joesink-Mandeville 1987), such material would be locally abundant. According to Schroth and Joesink-Mandeville (1987:37), other materials such as jasper, chalcedony, obsidian, and basalt are not available in the "immediate vicinity of the site and transportation to the site from other, possibly near-by, locations would have been necessary." According to the archaeological investigation of a neighboring locus (West Pond), the local geology suggests that basalt was available a short distance away. The Soda Mountains are composed of volcanic rocks including dark-colored basalts, as well as light-colored granite (Cameron 1984). The basalt in the collection is primarily dark gray/black, although there is some green basalt present. The green is likely a result of some chemical process that could have occurred at either the place of procurement or when buried in the rockshelter (Brett McLaurin, personal communication 2007). The nature of the rocks in nearby hills, as noted by the field crew, suggests that rhyolite is also local. Quartzite is present in the assemblage, but it is not known whether it is local or not. It makes up a very small portion of the assemblage, suggesting that it might not have been local and instead was transported. Further investigation of the surrounding geology needs to be performed in order to determine the availability and accessibility of quartzite in the region.

Table 5 presents the raw material makeup of the debitage. CCS (chert and chalcedony) makes up the largest percentage of the assemblage, with basalt a close second. Rhyolite/andesite make up a sizeable portion of the assemblage as well. The remaining raw materials make up a rather insignificant portion of the assemblage. Basalt, rhyolite, and andesite are fairly low-quality materials, and combined, they represent 50 percent of the assemblage (greater than that of CCS). This large presence suggests that these materials were available locally, which is confirmed by the local geology. Much of the chert was of poor quality. This poor-quality chert probably came from Limestone Hill, where it is often in the form of cherty limestone. The high-quality chert was much less abundant, although there was still a good

Table 5. Raw Material Makeup of Debitage

RAW MATERIAL	NUMBER
CCS	151
Basalt	118
Andesite/Rhyolite	65
Quartzite	9
Obsidian	1
Unknown	21

proportion of it present. It is possible that high-quality chert was not available within the vicinity of the rockshelter, but it could be obtained, either through seasonal rounds or trade. The ranking of the quality of raw material comes from Whittaker (1994) who states that CCS is not as good as obsidian, which fractures easily and has very sharp edges and extremely smooth surfaces, but is better than tougher and less amorphous materials like basalt and quartzite which are rough, grainy, and hard to work.

Quartzite is somewhat well represented in the tools, but is not very well represented in the debitage. This finding suggests that finished quartzite tools were brought into the site. It is possible that small amounts of quartzite are located nearby and are easily accessible, meaning that tools of quartzite would have been made at the source and then brought into the rockshelter as finished tools instead of cobbles or performs. Another possibility is that quartzite was the highest-quality material available at a different site in the inhabitants' seasonal rounds, and so most of the tools that they carried with them were made of quartzite. Until the nature of quartzite in the surrounding area is determined, no definite conclusion can be made.

As previously mentioned, low-quality materials were confined to unifacial technology, while the bifacial technology made use of high-quality materials. According to Andrefsky (1994:21), "Poor-quality raw materials tend to be manufactured into informal-tool designs. High-quality lithic raw materials tend to be manufactured into formal-tool designs when such materials occur in low abundance. When high-quality materials occur in great abundance both formal- and informal-tool designs are manufactured."

This site appears to correlate with the latter situation. CCS is in high abundance and thus is used to make both formal tools (bifaces) and informal tools (retouched/utilized flakes). Low-quality materials, regardless of abundance, are primarily used for informal tools. Retouching of more high-quality material makes sense if one is trying to conserve it. A possible conclusion is that large flakes made during the manufacture of tools were then retouched in order to conserve valuable material, while only flakes of lower-quality materials made during core reduction were utilized or turned into scrapers or knives.

The low quantity of obsidian at the site suggests that it was not used to make tools. It is possible that obsidian tools were brought in and then transported, either by the inhabitants or by looters, but it is more likely that the inhabitants had little access to it. Thus, the small amount present is probably an indication of trade due to its "preferred status." The low quantity of obsidian may be related to temporal patterns. Sutton (1996) has documented a substantial decrease in obsidian used from the Rose Spring through the Late Prehistoric period in the western Mojave Desert. The single obsidian projectile point found in earlier investigations of Soda Springs Rockshelter is a Rose Spring point (Schroth and Joesink-Mandeville 1987). The low overall percentage of obsidian may be tied to this same decrease in use over time. Unfortunately, the disturbed nature of the deposits and lack of stratigraphic context precludes making any definitive conclusions regarding obsidian use at the site.

DISCUSSION

The results of the tool and debitage analysis from the latest excavation at Soda Springs Rockshelter generally support earlier conclusions by Schroth and Joesink-Mandeville (1987) that the site was used as a temporary hunting camp, perhaps as early as the Middle Archaic period.

While previous excavations did find evidence for a Middle Archaic presence, projectile points that would represent very early occupations were not found, although a fluted point was supposedly recovered on the hill above the rockshelter. At a neighboring locus, West Pond, the elevation is such (932 ft.) that it "precludes its use during Pleistocene times when it was covered by Lake Mojave." Thus there is evidence for only the "most recent cultural period" (Cameron 1984:8). The other loci, thus, do not show evidence of early occupation either. Overall, there is, as yet, no evidence of an early Holocene or late Pleistocene occupation at the site. While occupations dating from this time have been found at other sites around the lakebed, the most likely conclusion is that Soda Springs Rockshelter is a later occupation site.

The ephemeral nature of the site and the lack of evidence of permanent habitation (very small amount of ground stone) suggest that the site was occupied by mobile hunter-gatherers. This conclusion is consistent with Mojave occupations in general. According to Cameron (1984:10), the Mojave Desert was "sparsely inhabited" with only "small family groups moving in a round of hunting and gathering." The mobility aspect is further evidenced by the nature of the tool assemblage. All of the bifacial tools are broken, so it is likely that finished tools were transported (either by the prehistoric inhabitants or looters), while broken tools were discarded because they were no longer usable. According to Parry and Kelly (1987:300), mobility "plays a part in dictating tool needs" since "neither tool needs nor raw material availability can always be precisely anticipated." As such, if a group is nomadic, it is best to transport important tools, because sufficient raw material may not be available at the next site. In addition, one can encounter situations requiring such tools while moving. This trend might explain the presence of quartzite tools but little quartzite debitage. Because few tools were recovered from the site, it suggests that most were transported away. However, the previous looting may have greatly lowered the tool abundance. Overall, the small sample size and the nature of the site make it difficult to derive any definitive conclusions regarding tool production and use at the site by just using the tool assemblage.

The debitage assemblage can shed some light on stone tool use. The makeup of the debitage, in particular the platform characteristics, the small size, and the low amount of cortex, along with the low number and makeup of the cores, suggest that more tool production/repair was occurring than core reduction. More formal tools and small flakes are made of high-quality CCS. Therefore, it appears that high-quality CCS was reserved for formal tool production. Lower-quality, local materials such as basalt, rhyolite, andesite, and possibly quartzite appear to have been more utilized in the production of expedient tools. Overall, this site produces evidence of significant tool production and tool maintenance and repair as well as a small amount of core reduction.

In the previous excavation, only two ground stone fragments were found, and no groundstone was found during the latest excavations. Granite is present in the nearby Soda Mountains, so it is unlikely that the lack of grinding stones reflects a lack of good material from which to make them. The excavations of the site have primarily found lithics and faunal remains, but little else in regards to prehistoric artifacts. As noted earlier, the most likely conclusion is that the rockshelter represents a hunting camp where no "long-term habitation took place" (Schroth and Joesink-Mandeville 1987:52). Since informal tools such as scrapers, choppers, knives, and retouched flakes are often used for cutting meat and scraping hides, it is possible that this hunting camp was used for processing game as well.

In sum, the evidence that could be garnered from the stone tool assemblage collected at the rockshelter during the most recent excavations supports other data suggesting the shelter was a hunting and processing camp seasonally occupied from the Middle/Late Archaic through Late Prehistoric times. The former inhabitants during those time periods primarily engaged in tool production and repair with some core reduction.

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