Stone Tool Traditions in the Contact Era

Edited by
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THE UNIVERSITY OF ALABAMA PRESS
Tuscaloosa and London
2003
Using a Rock in a Hard Place

Native-American Lithic Practices in Colonial California

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There is a frequent assumption among the general public that contact with Europeans and their material technologies prompted all Native Americans to abandon stone tool technology rather quickly. Archaeologists have done a poor job of changing that misperception, but it would be difficult to dispel a myth that many archaeologists hold as part of their own academic worldview. One does not have to look far to see archaeologists writing about how impressed or awed Native-American people must have been at European technological prowess. The underlying premise is that technological choices are related only to functional efficiency, that our notions of functionality were shared by social actors in the past and that rocks must give way to metal. This paper will reveal how problematic such a premise is when it is assumed rather than tested empirically.

Despite the often implicit assumption among many archaeologists that lithic tools were replaced by supposedly superior colonial tools or remained behind as mere vestiges of an indigenous lifeway, several archaeologists have started to overturn these assumptions with more careful studies. The archaeological recovery and analysis of lithic artifacts in Contact-period and historical assemblages have vastly improved the study of colonialism and culture contact in the Americas (Bamforth 1993; Cobb and Ruggiero, chapter 2; Fox 1979; Hester 1977, 1989:219-223; Hudson 1993; Johnson 1997, chapter 4; Nassaney and Volmar, chapter 6; Odell, chapter 3; Whittaker and Fratt 1984). If nothing else, they have given due attention to the indigenous side of colonial interactions and have helped extract Native Americans and others from an assumed role of passivity. Even in cases where chipped-stone tools rapidly disappear, archaeological studies have revealed the material and social complexity of these colonial encounters and the diversity of lithic practices that may or may not continue into post-Contact periods. This volume offers many such cases. Most archaeologists have explored the functional side of lithic technology in Contact-period or colonial
sites, arguing that stone tool use can be seen as an economic response to scarce supplies of metal (Hester 1989:235; Whittaker and Fratt 1984:16–17). Others have interpreted lithic tools as part of material symbolism (Hudson 1993:266; Nassaney and Volmar, chapter 6) or daily politics and identity (Silliman 2001), propelling discussions of lithic practices into explicitly social realms. Some archaeologists have certainly highlighted a shift in perspective to the social context of stone tool use (Gero 1991, Rosen 1996), but few archaeologists working on the historical periods of North America have taken sufficient notice.

In this chapter, I contribute to the growing archaeological literature that contextualizes lithic practices within social relations. My focus is a site in nineteenth-century Northern California associated with the Rancho Petaluma, a large land grant owned by a prominent Mexican-Californian military leader. The archaeological site contains a living area for Native-American people who worked on this Mexican rancho in the 1830s and 1840s. The case offers a unique glimpse of lithic practices in a distinctly colonial setting rather than in a separate “Contact-period” village or community. This means that the site records intense, sustained, daily interactions between Native-American and colonial individuals that hinged predominantly on relations of labor. This also means that many of the indigenous people involved in these contexts endured difficult and oppressive situations. For this reason, lithic technology and stone tools—“using rocks”—represent a salient material and social practice for Native-American people embroiled in a difficult colonial world (see also Cassell, chapter 10). Lithic technology was a practice of political consequence in everyday life (Silliman 2001). My emphasis here is on chipped-stone technology and raw material and the ways that these can be investigated in the context of technology, sourcing studies, and the availability of colonial mass-produced goods. This combination allows a clearer view of how lithic practices were used in colonial settings and how such a perspective might benefit other Contact-period studies.

WESTERN NORTH AMERICA, STONE TOOLS, AND SOCIAL ARCHAEOLOGY

Hunter-gatherer societies of Western North America provide unique opportunities for sorting out issues in Contact-period and post-Contact lithic technology. California is a particularly rich area for addressing this topic because of the diversity of lithic materials in site assemblages and the prevalence of frequently datable and sourceable obsidian raw material across much of the region. Numerous Contact-period sites with lithic artifacts have been recorded and studied, but only a few have been investigated in detail and widely published (e.g., Bamforth 1993; Schiff 1997). Archaeologists have also excavated several eighteenth- and nineteenth-century colonial sites that revealed lithic artifacts in Native-
American living areas. These include Spanish missions (Allen 1998:77–83; Deetz 1963; Hoover and Costello 1985:77–92), Spanish and Mexican ranchos (Frierman 1982:75–84; Silliman 2000:101–262; Wallace and Wallace 1958), and Russian fur-trade colonies (Lightfoot and Silliman 1997; Schiff 1997). These cases are clear examples of Native-American people continuing to make and use stone tools in the face of other options and often burdensome colonial worlds. This is not a ubiquitous response across North America or even the West Coast any more than is the presumed abandonment of all lithic technology, but it is a phenomenon worthy of contextual study. Given that full colonization of California did not begin until 1769 with the arrival of the Spanish, the California cases are also intriguing as very late colonial encounters in the Americas.

By studying lithic practices in colonial and Contact-period settings, archaeologists are poised to consider issues of social agency. Rather than enter the debates over agency here (see Dobres and Robb 2000), I use the term simply to mean a focus on individuals living in a socially constituted world, acting with particular projects in mind, and carrying on their daily activities at varying levels of consciousness in a world of practice. My notions draw on the works of Giddens (1984) and Bourdieu (1977, 1990) and archaeologists who follow their lead (e.g., Dobres 2000; Dobres and Hoffman 1994; Johnson 1989; Lightfoot et al. 1998). In particular, I find the discussions of social theory and technology to be particularly relevant for studying colonial-period lithic practices since “technological choices and the organization of production activities are materially grounded but intrinsically social phenomena” (Dobres and Hoffman 1994:247). One may argue that the “contact” experience commonly intensifies or disrupts these social practices, making it a strong candidate for sorting out some theoretical issues (Silliman 2001). Because lithic technology is simultaneously wrapped up in social practices and individual strategies, this theoretical perspective envisons continuity or discontinuity in lithic technology as more than an adaptive interface or a functional concern. For example, instead of seeing artifact replacement and continuity in Contact-period settings as the result of natural selection working on functional traits in an expanded human phenotype (e.g., Ramenofsky 1998), I see them as involved in the production, reproduction, and contestation of daily life. These material practices of daily life are what individuals use to make sense of and to alter their worlds. Similarly, stone tool production and use are often constituted as gendered activities. As Dobres has cogently argued, studying past technology requires paying close attention to social relations and to people (Dobres 2000).

In Contact-period settings, the absence of stone tool technology should not be read simply as functional replacement by metal or other implements, just as the presence of lithic practices should not be construed as straightforward examples of cultural continuity. The ways that Native-American individuals
continued to practice lithic technology, opted to transform or alter it, or sought to replace stone raw material and finished products with other material items should be studied on a contextual basis (Cobb, chapter 7). These otherwise very physical and material aspects make sense only in their broader social context. For instance, material continuity may belie major shifts in social or political relations surrounding the use and production of items that once had different or more neutral political connotations. As I have demonstrated elsewhere, this appears to be the case in nineteenth-century Northern California at the Rancho Petaluma (Silliman 2001).

LITHIC PRACTICES AT THE NINETEENTH-CENTURY RANCHO PETALUMA

The archaeological site of interest lies within the Petaluma Adobe State Historic Park in Northern California, and it is protected as part of the cultural heritage of a nineteenth-century Mexican-California rancho (Figure 9.1). The Rancho Petaluma was a large Mexican land grant, sizing in around 270 km², offered to Mariano G. Vallejo in 1834 as material and symbolic compensation for his service to the provincial colonial government in California during this time (Hoopes 1965). At its inception, the rancho served to block Russian colonial expansion inland from their few settlements on the coast, to obtain land previously controlled by a nearby Franciscan mission for secular use, and to secure the Northern Frontier of Alta California for further colonial settlement (Tays 1937). Much like its contemporaries, the Rancho Petaluma rode on the heels of the dismantled Spanish mission system. Vallejo owned the Rancho Petaluma land into the 1850s, but the operation had diminished rapidly following the American takeover of California between 1846–1850 (Silliman 2000a:65). Throughout its 15 to 20 years of full-scale operation, the rancho was a major center of economic production focused on goods manufacture, agriculture, and livestock, with the latter directed toward the lucrative hide-and-tallow trade (Hoopes 1965; Silliman 2000a).

Like many ranchos across California, the Rancho Petaluma operated by the hard labor of Native-American people (Greenwood 1989; Silliman 1998). At this rancho, hundreds, if not thousands, of Native people served as laborers in and around the large adobe-brick building known as the Petaluma Adobe and out on the large rancho. The 3600 m² of the Petaluma Adobe served as the administrative and residential center. Native people worked as household servants who cooked and served food, artisans who made goods for general distribution and trade, field hands who planted and harvested crops, and vaqueros who herded and butchered livestock. Native-American workers found themselves on
the rancho for extraordinarily diverse reasons, and this diversity complicates a simple interpretation of their experiences (Silliman 2000a:71-76).

At ranchos, workers appeared to have been implicated in a strict system of indebted peonage rather than wage earning (Bancroft 1888:347; Cook 1943:48-51; Rawls 1984:21). Some transferred to the Rancho Petaluma at the demise of the two nearby Franciscan missions in 1834, a type of community that some of them might have lived in for up to 20 years. Other individuals from nonmissionized hunter-gatherer groups joined the rancho to cement political and military alliances between Vallejo and nearby native leaders (Davis 1929:135-136) or to include it on a seasonal round for access to goods and food (Silliman 2000a:76). Although livestock and settlers had infiltrated various regions
of Northern California, some indigenous groups had managed to escape all but
military excursions into their homelands. Still others were dragged to nearby
ranchos as prisoners after Mexican-Californian settlers ransacked their villages
to punish reputed horse-thieves or field-burners (Cook 1941:9; Davis 1929:63;
Lothrop 1932:181, 194).

The study of California Indian people on ranchos is a relatively new phe-
nomenon, although their artifacts have been found intermittently on rancho exca-
vations across California since the late-1950s (Fiereman 1982; Greenwood
1989; Wallace and Wallace 1958; see Silliman 2000a:44–52 for summary). A
recent archaeological project at the Rancho Petaluma has begun to expand
the study of ranchos and colonialism (Silliman 1998, 2000a, 2001). Archival
data for the Rancho Petaluma are not rich, but they sketch general outlines of
Native-American life in and around the rancho (Silliman 2000a:66–71, 88–
100). This includes the likelihood that most, if not all, indigenous laborers lived
outside of the main Petaluma Adobe structure. For this reason, the majority of
archaeological research focused on loci away from the colonial structure. Across
the nearby stream and less than 150 m east of the Petaluma Adobe, a major site,
designated CA-Son-2294/H, was located, mapped, and excavated (Silliman
2000a:106–147).

Excavation at the site uncovered an array of refuse features and deposits
that are markedly residential and Native in character (Silliman 2000a). Found
amidst the removal of approximately 23 m³ of sediment and relatively dense
residential midden were several cultural features: three pits of burned artific-
tual, floral, and faunal material; two basins of thermally affected rock and wood
charcoal; and one large, extensive refuse pile full of animal bones, seeds, shell-
fish, glass beads, glass, groundstones, lithic artifacts, thermally affected rocks,
and other materials. A distinct midden area a few meters toward the stream
contained these same kinds of materials—faunal remains, burned seeds and
other plant parts, shellfish, rocks, chipped-stone and groundstone artifacts, glass
beads, glass, ceramics, nails, and other metal artifacts—in much higher quanti-
ties and densities. No residential structures of any sort were discovered; however,
the occupants of the missing structures undoubtedly dumped much of their de-
bris into the areas excavated. These materials provide unique insights into the
daily lives of California Indian people implicated in the rancho labor regime.

STONE TOOLS ON THE RANCHO:
AN ANALYTICAL APPROACH

For the remainder of this chapter, I focus on the ubiquitous lithic artifacts and
their relationships with other material and social practices. The lithic artifacts
provide solid evidence of distinctly indigenous practices in this colonial world
and the high quantities of chipped-stone artifacts warrant full attention here. I do not mean to imply that colonial settlers of Hispanic heritage, especially those with antecedent ties to Mexico, did not practice various forms of lithic manufacture—the evidence is clear that some did (e.g., Moore 1992). However, there is presently no evidence that Vallejo, his family, or his non-Indian employees ever engaged in such a practice.

I consider the lithic assemblage as a whole rather than by site locus, but I have documented intrasite spatial differences elsewhere (Silliman 2000a:230–234). This site-level coarseness is justified here since all loci represent refuse deposits of one form or another and since there is currently no way to separate the artifacts per household or other similar analytical unit. Similarly, I do not summarize all of the finer details of lithic analysis from the Rancho Petaluma site. The details on technological analysis, lithic sourcing and dating, and presentation can be found elsewhere (Silliman 2000a:192–262).

I draw on obsidian sourcing and dating information, but I will not elaborate on the methods and results (Silliman 2000a:216–224, 2002). Suffice it to say that the obsidian-hydration analysis revealed some pre-Contact obsidian artifacts in the assemblage, but I can currently offer no temporal comparison (or separation) since unequivocal pre-Contact artifacts are recognized by only 33 artifacts out of 111 viable obsidian-hydration samples. Non-viable obsidian-hydration readings mean that they revealed no visible hydration. Given their prevalence in this collection, these specimens may well reflect nineteenth-century use since the lack of hydration band may indicate a very young age. If true, this addition would drive the artifacts into a smaller percentage of the total and make the assemblage even more strongly contemporaneous. There is also minor evidence for individuals recycling and reusing “prehistoric” tools in the 1800s (Silliman 2000a:224). Yet, I could detect no significant differences in lithic types present in the small pre-Contact obsidian collection versus the entire site subassemblage, with the exception of formal tools occupying a higher proportion of the “prehistoric” (42.4 percent) than “historical” (20.5 percent) artifacts (Silliman 2002). Most importantly, virtually all obsidian artifacts were directly associated with colonial mass-produced artifacts such as glass bottle fragments, glass beads, and metal. Excavation also revealed not a single pre-Contact feature or unambiguous deposit. For these reasons, I consider all lithic material as contemporaneous and as nineteenth-century in date in the following discussion.

To structure my lithic analysis, I primarily followed guidelines suggested by Andrews (1993) with some attention to the diversity of recommendations and caveats provided by Shott (1994), Morrow (1997), and the contributors to Amick and Mauldin (1989). This methodology established a minimum set of analytical attributes and a hierarchical classification of debitage and tools. In my
version of an appropriate analytical strategy, I focused on formal and flake tools, cores, and debitage with the latter divided into technological products such as complete flakes, proximal flakes, flake shatter, and angular shatter. No debitage was identified as to its presumed function (e.g., biface thinning flake) or production method (e.g., percussion versus pressure) due to the ambiguities surrounding such identifications. Instead, following recommendations in Andrefsky (1998), I recorded the following replicable attributes for debitage: a) size, monitored by ordinal rankings for all debitage and ratio measurements for complete flakes; b) flake termination, classified as feather, step, or hinge; c) platform type, divided into flat, complex (meaning multiple facets), cortex, and abraded; d) dorsal cortex, recorded in a four-rank ordinal scale of percentage; e) dorsal flake scars, noted as none, one, two, or multiple; and f) thermal alteration, indicated by potlids, differential luster, crazing, or a combination (Silliman 2000a:196–200). Weight was not recorded, although it might have offered further resolution of the patterns. With the exception of thermal alteration, the other attributes should give some indication, when juxtaposed with each other, of lithic reduction strategies. Any one of these attributes may not clearly distinguish lithic production stages or types, given the controversies raging among archaeologists over how to analyze and interpret debitage. Therefore, I combined many attributes to generate more robust interpretations.

RESULTS

The following raw materials exist in the Rancho Petaluma lithic assemblage: obsidian; chert, chaledony, and other microcrystalline silicates (referred to as chert for the remainder of the chapter); felsite and other igneous materials; quartz; petrified wood; and others such as schist, basalt, and sedimentary rock (Table 9.1). The list reflects order of abundance in the assemblage. Obsidian and chert together occupy 82.7 percent of the total of 3,009 lithic artifacts. Obsidian (43.3 percent) outnumber chert (39.4 percent) artifacts only slightly, but their relative position shifts depending on the particular site locus. Of the total assemblage, igneous/felsite and quartz hold less than 10 percent each, petrified wood slightly over 2 percent, schist only .4 percent, and basalt and sedimentary stones barely .1 percent. For this analysis, I restrict my discussion to the numerically dominant obsidian and chert artifacts, which, despite some overlap in form and use, individuals at the Rancho Petaluma put to quite different uses.

Obsidian

Obsidian artifacts number 1,303 (see Table 9.2). Although predominantly debitage, the collection includes 9 (.7 percent) cores, 5 (.4 percent) unmodified nodules, and 64 (4.9 percent) formal tools including bifaces, projectile points, and...
Table 9.1 Frequency, Percentage, and Density of Chipped-stone Lithics

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>N</th>
<th>Percentage</th>
<th>Density (N/M')</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obsidian</td>
<td>1,303</td>
<td>43.3</td>
<td>53.6</td>
</tr>
<tr>
<td>Chert, Chaledony, Other Silicates</td>
<td>1,187</td>
<td>39.4</td>
<td>50.1</td>
</tr>
<tr>
<td>Igneous/Felsite</td>
<td>266</td>
<td>8.8</td>
<td>11.4</td>
</tr>
<tr>
<td>Quartz</td>
<td>165</td>
<td>5.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Petrified wood</td>
<td>71</td>
<td>2.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Basalt</td>
<td>2</td>
<td>0.1</td>
<td>0.09</td>
</tr>
<tr>
<td>Sedimentary</td>
<td>3</td>
<td>0.1</td>
<td>0.13</td>
</tr>
<tr>
<td>Schist</td>
<td>12</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,009</td>
<td>100</td>
<td><strong>125.62</strong></td>
</tr>
</tbody>
</table>

their fragments. Obsidian materials record the full spectrum of lithic production from cores to finished tools. Obsidian cores are primarily multidirectional and small, but some examples of unidirectional working and bipolar reduction are present. All nodules excavated from the site are similarly small. In contrast to the primary cortex evident on some of the actual cores (meaning quarried specimens with weathering), the unmodified nodules display characteristic secondary cortex from fluvial transport and weathering.

Unhafted bifaces (N=46) occur predominantly as small fragments of larger tools (Figure 9.2). In most cases, these bifaces are in early or middle stages of bifacial thinning, as defined by Whittaker (1994) and Callahan (1979), with width/thickness ratios for all reliably measured bifaces ranging from 1.9 to 3.8. It is currently unclear how many of these bifaces might have served as preforms or as final tools, but both functions seem likely. At least seven bifaces show macroscopic signs of use damage on one or more margins, but breakage patterns include a combination of bending, perverse, and radial fractures. These seem to suggest at least some manufacturing failures. Included in this biface category is the only drill fragment (Figure 9.2b). The use of the term, drill, reflects the long, narrow shape of the bifacial implement rather than any microscopic examination of use-wear. These bifacial tools date to both Contact and pre-Contact periods based on the obsidian-hydration analysis.

The excavations produced 18 projectile points and point fragments (Figure 9.3). Unlike the biface collection, some projectile points (N=7, 38.9 percent) are complete or nearly complete artifacts, but the collection is still rather fragmented. Other than three indeterminate point forms, all projectile points with enough of the tool remaining to identify are corner-notch points (Figure 9.3b-h, j, i-n). These are common in late pre-Contact sequences in the region (Frederickson 1984). Several examples show unworked margins or faces, incomplete
<table>
<thead>
<tr>
<th>Material</th>
<th>Niche</th>
<th>Core</th>
<th>Flake</th>
<th>Shatter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>5</td>
<td>0.4</td>
<td>9</td>
<td>0.7</td>
</tr>
<tr>
<td>Obsidian</td>
<td>5</td>
<td>0.4</td>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td>Nettl</td>
<td>1</td>
<td>0.1</td>
<td>0.8</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Table 9.7: Frequency and Percentage of Obsidian and Chert Lithic Types
Fig. 9.2. Obsidian unhafted bifaces and biface fragments

thinning, and unformed point sections. Therefore, point fragmentation might have been at least partly the result of manufacturing complications on the not-yet-finished tools. The archaeofaunal and archaeobotanical remains indicate substantial hunting and gathering by Native people on the rancho, despite the abundance of evidence for cultigens and livestock in the site’s deposits. Presumably, individuals made these points for hunting, given the variety of wild fauna such as black-tailed deer in the associated faunal debris (Silliman 2000a:286), but it is possible that individuals designed these arrowheads for conflict on the colonial frontier.

Obsidian debitage falls into the broad categories of angular shatter, complete flake, proximal flake, and flake shatter (see Table 9.2). At a gross level, the entire obsidian assemblage (N=1,303) can be summarized as 16.5 percent angular shatter, 41.7 percent complete flake, 2.6 percent proximal flake, and 33.2 percent flake shatter. The tools, cores, and unmodified nodules comprise the other 6.0 percent. I reserve discussion of debitage size, dorsal cortex, and dorsal flake scars
for a comparison of obsidian and chert debitage in a later section. Flake tools (i.e., debitage with retouch or use damage) are 9.9 percent \( (N=128) \) of the obsidian debitage.

Chert and Related Silicates

Chert artifacts number 1,187 across all site loci (see Table 9.2). The assemblage differs notably from the obsidian in its almost complete lack of formal tools, more angular shatter, and more abundant cores. Only 2.6 percent of the entire sub-assemblage are anything other than debitage. This proportion includes 25 (2.3 percent) cores, 5 (.4 percent) nodules, and only 1 (.1 percent) formal tool, a rough biface.
The 25 cores and 5 unworked nodules range in size, but they are much larger than those in the obsidian subassemblage. Several of these cores appear to be exhausted (five are less than 30 mm in maximum dimension), whereas others are large cobbles with minimal reduction. Reduction trajectories are exclusively multidirectional. Four cores have evidence of thermal alteration with potlids or differential luster. Only one chert artifact qualifies for inclusion as a formal biface tool, and it is in very early stages of manufacture based on short flake scars and no significant thinning.

As with obsidian, I classified the chert debitage into angular shatter, complete flake, proximal flake, and flake shatter (see Table 9.2). Other than the 2.6 percent as nondebitage discussed above, summary percentages for the site as a whole reveal the remaining 1,156 artifacts to be 50.4 percent angular shatter, 24.4 percent complete flake, 26 percent proximal flake, and 22.1 percent flake shatter of the total 1,187 artifacts. It is noteworthy that the chert subassemblage displays a significant percentage (15.9 percent) of artifacts with thermal alteration. Differential luster accounts for 6.8 percent, potlids for 4.5 percent, crazing for 1.0 percent, and a combination of two or more of these for 3.5 percent. Whether or not this thermal alteration on chert is from controlled heating, accidental exposure to fire, or purposeful refuse burning is currently unclear, although I suspect at least some of it relates to heat treatment. The lack of unambiguous burning on the obsidian artifacts lends further credibility to this interpretation.

Comparison of Obsidian and Chert Artifacts

Lithic reduction and use for the obsidian and chert raw material differ significantly. Initial stages of reduction are present in both raw materials with flakes at 100 percent dorsal cortex, cores, and unmodified nodules. However, evidence points to individuals focusing on obsidian for the full range of production from cores to formal tools while using chert primarily for early-stage reduction of cores. At the terminal end of the sequence, the presence of numerous broken obsidian bifaces and projectile points confirms the production of formal tools, but only one rough chert biface exists. So, were obsidian bifaces traded in or manufactured on-site, and were chert bifaces manufactured on-site and traded out?

Some obsidian bifaces might have been manufactured elsewhere, but the debitage size, number of dorsal flake scars, and platform preparation suggests that, in contrast to chert, on-site obsidian reduction was devoted in large part to later stages of reduction and biface production. For one, obsidian debitage is consistently smaller than chert debitage (Figure 9.4). This pattern also relates strongly to a smaller hypothesized size of original nuclei (discussed below), so I offer it only hesitantly. In addition, percentages of dorsal flake scar counts reveal that obsidian flakes possess far greater dorsal flake scarring (Figure 9.5). I made no attempt to determine scar complexity or the number of flake scar directions. Perhaps most importantly, the complexity of platform preparation in obsidian
Fig. 9.4. Percentage of debitage size for obsidian and chert

Fig. 9.5. Percentage of dorsal flake scars for complete obsidian and chert flakes
Fig. 9.6. Combined percentage of dorsal cortex and size for complete obsidian flakes.

Table 9.3 Platform Frequency and Percentage for Obsidian and Chert Complete and Proximal Flakes

<table>
<thead>
<tr>
<th>Material</th>
<th>Flat</th>
<th>%</th>
<th>Cortex</th>
<th>%</th>
<th>Complex</th>
<th>%</th>
<th>Abraded</th>
<th>%</th>
<th>Indef</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obsidian</td>
<td>323</td>
<td>56.9</td>
<td>61</td>
<td>10.7</td>
<td>180</td>
<td>31.7</td>
<td>4</td>
<td>0.7</td>
<td>9</td>
<td>577</td>
</tr>
<tr>
<td>Chert</td>
<td>221</td>
<td>75.7</td>
<td>35</td>
<td>12.0</td>
<td>36</td>
<td>12.3</td>
<td>0</td>
<td>0.0</td>
<td>3</td>
<td>295</td>
</tr>
</tbody>
</table>

far exceeds that in chert (Table 9.3). Obsidian possesses 31.7 percent of complete and proximal flakes with complex platforms, and chert possesses only 12.3 percent. Similarly, only 56.9 percent of obsidian flakes have simple flat platforms, but 75.7 percent of chert flakes have them. Obsidian flakes show an additional 10.7 percent cortex-bearing platforms; chert has a similar proportion of 12.0 percent (Stillman 2000a:Table 6.8, 6.10). Finally, Figure 9.6 yields support to the interpretation of obsidian formal tool production and the relative lack thereof in chert. Almost 70 percent of all obsidian flakes having no dorsal cortex are in the smallest size category, but less than 30 percent of chert flakes with no cortex are of such small size. In total, these data suggest that chert and obsidian underwent different production sequences.
However, the amount of dorsal cortex on flakes requires further commentary (Figure 9.7). Had obsidian possessed consistently less dorsal cortex than chert across the site, then it might have served as another line of evidence for the interpretation of late-stage reduction on obsidian rather than chert. Yet, 78.4 percent (N=543) of complete obsidian flakes have no cortex while 80.6 percent (N=289) of complete chert flakes have none. Rather than these similar values undermining the other evidence for later-stage obsidian reduction, the higher amounts of dorsal cortex on obsidian flakes indicate a smaller size of core from which these flakes were produced rather than a stage of reduction. Figure 9.4, introduced above, demonstrates the likely correlation of small nuclei and small size of debitage. If chert cores are larger than obsidian cores, then the likelihood of obtaining cortex-bearing flakes from the latter increases because of the greater ratio of surface area to mass. In the Rancho Petaluma collection, chert cores and unworked nodules are decidedly larger than obsidian cores and nodules. In addition, a currently unquantified amount of obsidian debitage displays evidence (e.g., impact fractures at both ends) of bipolar reduction. This indicates the probable small size of initial obsidian cores since knappers generally use bipolar technology to reduce small nuclei. The smaller size of obsidian raw
materials makes even more telling the previously noted higher percentage of small cortex-free flakes compared to chert.

To complement these data, technological types help support the conclusion of obsidian and chert reduction patterns discussed above (see Table 9.2). Angular shatter provides the clearest evidence. For the site as a whole, obsidian contains only 16.5 percent angular shatter, whereas chert contains 50.4 percent. Angular shatter can be produced during numerous stages of lithic production, but it is strongly associated with core reduction. Some percentage differences between the two raw materials may be explained by the ease of recognizing flake features on obsidian or the typically less isotropic qualities of chert, but these aspects cannot explain this large of a difference. Raw material type and quality have a tremendous influence on the types of debitage produced during lithic reduction, and this aspect can complicate the relationships proposed between debitage morphology and reduction strategy. For this reason, I use this line of evidence as only secondary support for these interpretations, and I do so only because of the large discrepancy in percentages between obsidian and chert debitage classes. Although not as extreme, percentages also indicate that obsidian (41.7 percent) contains substantially more complete flakes than chert (24.4 percent). More complete flakes could indicate core reduction (Sullivan and Rozen 1985), but it is likely that they represent later stages of lithic production, if they show any relationship at all (Mauldin and Amick 1985:84-85). The combined effects of more cores in chert and more tools in obsidian further support the conclusion.

Finally, the obsidian-hydration data clarify the obsidian patterns slightly (Silliman 2002). Of the 111 obsidian artifacts returning a reliable hydration value, 75.3 percent of all debitage sampled for obsidian hydration derived from the historical period, while only 51.7 percent of formal tools did. This discrepancy suggests that more full-scale lithic production, rather than only trade in or use of formal tools, occurred at the site in the 1800s than had in pre-Contact times. It also seems to hint at a nineteenth-century proclivity of site residents to pick up and perhaps rework ancient tools found on or near the site.

In sum, then, the lithic data suggest that individuals used obsidian and chert for a variety of tools but that they directed these raw materials toward different intensities and uses. Obsidian was clearly preferred as the raw material for the production of formal bifaces and projectile points, a claim based on the discrepancies in tool representation and the debitage patterns between chert and obsidian. It is worth reiterating that I forward the conclusions based on debitage only after finding corroboration between different attribute constellations. Data on flake platforms, size, cortex, and dorsal scarring offer a clearer picture of stone tool production than do the typologies of shatter and flake, but the combination of them all seems to offer an enriched interpretation. Any one of these attributes
alone would have been insufficient, and there would have been ample room for
the classic logical error of affirming the consequent. Together, however, the vari-
able point strongly toward these particular interpretations.

INTERPRETATIONS AND IMPLICATIONS

Evidence is abundant that Native-American people on the Rancho Petahuma
continued their lithic technology, using obsidian and chert in quite different
ways. The former conclusion did not require detailed lithic production analysis
to demonstrate, but the latter did. However, what does this material and techno-
logical continuity mean? Is it evidence of metal scarcity, cultural “conservatism,”
a vestigial “pastime,” resistance, negotiations of gender relations, or an expression
of Native identity? Depending on one’s theoretical stripe, any of these may seem
like viable explanations. A related question is: How do these lithic practices
demarcate social agents working through the colonial world of the California
rancho? To produce or acquire stone tools as a Native American in such a colo-
nial context is to make a statement. Even being “conservative” or having a fa-
vorite “pastime” is not a neutral or passive position—it is an active choice within
the past and present conditions of one’s social world. In addressing these ques-
tions here, I seek less of a single answer and more of a path that opens the
possibility of tracing out continuity and discontinuity in lithic practices. This
requires placing the rancho lithic practices in a broader context, one that in-
cludes the availability of and access to 1) lithic raw material and products in the
wider landscape and 2) colonial mass-produced goods, particularly metal, in the
rancho setting.

Lithic Raw Material Sourcing

The origins of the lithic materials at this rancho form the social and physical pa-
rameters for the on-site technical choices and practices. These factors implicate
issues of raw material availability, social or physical effort involved in retriev-
ing the material, and trading relations. Such aspects are as important in post-
Contact archaeology as they are in pre-Contact ones where they are more tra-
donitionally studied.

As demonstrated above, Native individuals devoted obsidian to a variety of
technological uses, from expedient flake tools to fully formed bifacial tools and
projectile points. There is little evidence for this full range of production on the
chert and other silicates, marked by the presence of only one chert formal tool
and the debitage patterns vis-à-vis those in obsidian. This is intriguing because
chert sources are relatively accessible around San Francisco Bay and northward,
meaning that the raw material would not have been difficult to acquire. Many,
small outcrops are located within several kilometers of the Petaluma Adobe, although no direct sourcing efforts have been attempted.

On the other hand, the nearest known obsidian source is at least 20 km away and off the Rancho Petaluma proper (see Jackson 1986, 1989). Yet, this raw material proved to be the more important for manufacturing formal tools and other items for everyday use. It certainly offers better quality of raw material for knapping than the cherts and felsites discovered in the assemblage. Given the number of broken obsidian tools discarded into the refuse deposits, individuals must not have considered obsidian raw material scarce enough to conserve or rework extensively. The debitage evidence clearly suggests that individuals frequently manufactured obsidian bifaces and tools on-site rather than always trading in fully formed objects. This indicates that cores or rough blanks had to have been transported to the site for future working—but from where? The type of cortex suggests that these materials came from both primary sources and secondary stream deposits.

Energy-dispersive x-ray fluorescence analysis pinpointed the specific sources for these artifacts and the secondary “float” areas possibly associated with them (Silliman 2000b). For this discussion, I rely on a sample of 239 obsidian artifacts subjected to this geochronological technique, of which 111 have been subsequently dated by obsidian-hydration analysis (Silliman 2000a:219–225). Of the 78 dating to the historic period, the results indicate the presence of ten different obsidian sources in the sampled assemblage, with two sources—Annadel (38.5 percent) and Napa Valley (41.0 percent)—in particularly high proportions (Table 9.4). These two well-represented sources are the closest large obsidian sources to the Petaluma Adobe (Figure 9.8). These two sources also comprise the majority of pre-Contact obsidian artifacts subjected to sourcing analysis in the general area (Jackson 1986) and all artifacts from the Petaluma Adobe State Historic Park (Silliman 1999a:108, 2000a:224). The other large, regional obsidian sources of Mt. Konocti and Borax Lake are represented in the obsidian-hydration collection but as only one specimen each (1.3 percent), a cortex-free interior flake and a broken projectile point, respectively. The rest of the sourced obsidian includes a regionally restricted and little-recognized source (Franz Valley, 2.6 percent), a previously undiscovered source (Oakmont, 10.3

*Full discussion of this can be found in Silliman (2002). Percentages reflect a selection of already-sourced obsidian artifacts for hydration analysis. I boosted the representation of the rarer sources for hydration analysis to fine-tune chronology. In the original sample, Annadel and Napa Valley each occupied approximately 3–4 percent more with Oakmont dropping to about half of the percentage here. In other words, Annadel and Napa Valley obsidiants are more common and the others slightly more rare than they appear here.
percent), and currently unidentified sources that probably derive from the general area (Unknowns, 5.1 percent) (Silliman 2002). Other than a Franz Valley projectile point, these latter source samples are all debitage.

When compared to sequences at this site and in the area, the source representation is intriguing. New sources appeared in the archaeological record during the 1800s that are uncommon in the local cultural traditions or are completely novel for any Northern California archaeological site. In addition to raising a red flag about visual sourcing methods in California (Silliman 2000b), the sourcing data indicate a radical reshuffling of obsidian procurement and exchange. The shifts may indicate individuals from different homelands living in the area during the rancho period, individuals from villages far afield rotating through the Rancho Petaluma on seasonal rounds, laborers at the rancho altering their trade relations with outlying groups, or individuals modifying their
<table>
<thead>
<tr>
<th>Source</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Borax Lake</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Franz Valley</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>Mt. Konocti</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Napa Valley</td>
<td>32</td>
<td>41.0</td>
</tr>
<tr>
<td>Oakmont</td>
<td>8</td>
<td>10.3</td>
</tr>
<tr>
<td>Unknowns</td>
<td>4</td>
<td>5.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>78</td>
<td>100.1</td>
</tr>
</tbody>
</table>

procurement in the obsidian landscape. Whatever the reasons, the residents on the Rancho Petaluma acquired obsidian in quite different ways than those who had resided in the area before, whether or not they were actual biological ancestors. They made active efforts to do so as part of their routine practices amidst required colonial duties, and it probably served as a node of social and economic connection among Native people in the rapidly changing colonial world. Native workers did not exclusively seek local cherts, indicating that obsidian retained or gained a high social and symbolic value.

**Colonial Mass-Produced Goods**

The acquisition of lithic raw material and the use of stone tools are particularly important when contextualized with the availability of colonial mass-produced goods. Numerous metal artifacts were recovered in the site deposits, and these indicate the general availability of this material to Native-American workers (Silliman 2000a:341–348, 360–363). Vallejo was a wealthy landowner who would have been well stocked with metal tools for use in cattle butchery, which, according to several descriptions across Mexican California, was an activity performed with metal knives (e.g., Robinson 1891:96; Sanchez 1929:47). This type of activity formed a core experience for many California Indian people, especially men, at colonial ranchos. Stone tools, whether formal or expedient, could have been used in the butchery process, but they would not have been the primary implements in the “production-line” nature of mass slaughter.

However, the lack of butchery tools such as knives or cleavers in the residential deposits is striking. I have argued that rather than these metal tools being completely unavailable to workers, the Native men who handled them as part of their required duties on the rancho did not opt to bring them into the household (Silliman 2000a:416–420). That is, they did not conscript the metal items
as marks of affiliation with the colonial setting. Instead, Native individuals, primarily men, might have forged their way through the mid-1800s by staying connected to lithic procurement, manufacture, and use. It is certainly clear that stone tool use, primarily in obsidian form, ushered in a new political spin on a previously mundane activity. This strategy seems to have differed from that followed by some Native women at the Rancho Petaluma who brought colonial metal tools of their everyday required tasks, such as sewing, into the household (Silliman 2000a:416–420).

The trading relationships with outlying Native groups, the trips to obsidian sources for collection, and the use of stone implements for hunting helped constitute a response to the rancho labor regime. It might have been a strongly male response. With the amount of beef wasted after livestock were slaughtered by the thousands and the large quantities of harvested grains stored at the Petaluma Adobe, Native workers could have potentially subsisted on provisioned foods alone. Yet, hunting, gathering, and lithic raw material acquisition gave opportunities for getting out from under the yoke of colonial labor, for maintaining connections to the indigenous social and environmental landscape. These activities undoubtedly transpired in gendered ways.

In addition, the importance of lithic raw material cannot be overstated when one considers the relatively low percentage (4.9 percent) of the 2,896 glass artifacts that show unequivocal, intentional flaking (Silliman 2000a:339–340). The worked glass artifacts show no sign of formal tool manufacture, although some do have bifacial flaking to produce a sharp edge. In contrast to California’s Spanish mission settings (Allen 1998; Hoover and Costello 1985) and the nearby coastal Russian colony of Ross (Silliman 1997) where formal tools had been crafted from bottle and window glass, glass-knapping technology at this Northern California rancho was focused more on expedient flakes and retouched bottle bases. The implication is that although handy for expedient use from time to time, glass came nowhere close to replacing obsidian or chert as a preferred raw material for making durable and sharp tools. That is, Native-American individuals wanted the rocks themselves and perhaps all the social connotations of their acquisition and use. Also, the Rancho Petaluma case with a mixture of formal and expedient obsidian tools contrasts sharply with the seemingly consistent preference for lithic flake and expedient tools in mission contexts (Allen 1998:82). The partiality for rocks seems to have been made possible by the availability of obsidian and chert, either as freshly quarried or gathered material or as objects recycled from sites, and by the focused efforts of Native-American workers to maintain the trading, access, and mobility patterns necessary to obtain the raw material. As demonstrated earlier, obsidian clearly garnered primary attention from the Native-American workers.
In conclusion, the analyses conducted for this paper attest to the continuity of lithic practices by Native-American people in this rancho context. The data make it clear that Native individuals remained committed to the practice of lithic technology in the face of new materials and social relations. However, this commitment was not a passive response to colonialism; it was an active negotiation. As Bamforth (1993:50) has stated: “Just having metal available does not determine how native people used it.” Metal objects were surely available to Native laborers on the Rancho Petaluma, but individuals were selective in their choice of, or restricted in their access to, them. Any hope of addressing this issue must include a focus on indigenous choice and agency, which is made clearer by juxtaposing the selection and production of lithic tools with sourcing studies and colonial goods.

At the Rancho Petaluma, lithic use and manufacture were daily practices that became entangled in colonialism. This contrasts sharply with many Contact-period sites where Native Americans were not implicated in colonial labor regimes, at least on a daily basis. The entanglement in colonialism stems from the fact that labor regimentation directly impacted the times and opportunities for lithic production and use. However, given their abundance in the excavated areas, lithic artifacts frequently must have been the tools of choice in residential contexts. This is made more evident by the lack of certain metal tools—cleavers, knives, axes, etc.—that could have functionally replaced chipped-stone tools. Unless stone tools were employed in the daily required work duties on the rancho (and there is circumstantial evidence that metal tools probably served this purpose, although stone tools might have been conscripted occasionally for jobs that had more people to work than metal tools to work with), lithic practices served to demarcate materially the colonial working world from domestic spaces. At least, they seemed to do so for men since their rancho activities involving metal objects are the ones missing from the site record. On the other hand, Native women’s rancho activities that took place with metal tools are visible in the form of needles, scissors, thimbles, and tableware. This means that the situation is doubly complex since gendered workers used stone tools perhaps in, but definitely in spite of, colonial work duties, and the continued use of stone tools for domestic and residential practices might have become a material expression of a gendered Native identity.

The Rancho Petaluma case has two serious implications for Contact-period and colonial lithic studies on the West Coast and elsewhere. First, considering lithic artifacts not as a stand-alone material class but as one component of a suite of material practices broadens archaeological interpretations. The details of lithic
practice make more sense when compared and contrasted with other material
goods and their uses than when considered in isolation. As demonstrated by the
Petaluma case study, such a contextual approach is needed in historic-period set-
tings where Native-American people were working through new colonial worlds.
This contextual approach can help decipher not only lithic continuity but also
the dissolution of lithic practices in Contact and post-Contact contexts. Sec-
ond, lithic artifacts in Contact, colonial, or even post-Contact periods must be
seen as something more than just functional responses or adaptations. This does
not mean neglecting the realm of functionality, but it does mean not prioritizing
it. This perspective on lithic technology casts the Petaluma materials in a new
light. Lithics are part of material, social, and sometimes political practices, and
they should be researched in that way (Bayman, chapter 7; Rosen 1996). Hud-
son (1993), in her study of Pawnee lithic practices, concluded that utilitarian
lithic tools can take on symbolic meanings in episodes of culture contact. I con-
cur, but I must modify that conclusion to say that lithics can take on new sym-
iotic as well as social meanings in these Contact-period or colonial contexts. It
is unlikely that lithic artifacts have ever been strictly utilitarian.

ACKNOWLEDGMENTS

My thanks go to a number of people who are unfortunately too numerous to
name individually. I particularly want to thank Charlie Cobb for his invitation
to join the “Liminal Lithics” session at the 2001 Society for American Archae-
ology meetings and for his dedication in collecting the papers for publication. I
appreciate the comments offered on my presented paper by Doug Bamforth, my
subsequent discussions with Jay Johnson and Mark Cassell, and the helpful com-
mentaries and suggestions on the final version by Michael Nassaney and the
anonymous manuscript reviewers. I also acknowledge Steve Shackley, Kathleen
Hull, and Kent Lightfoot for their advice and discussion as I completed my lithic
analyses. As always, I am indebted to the many students and volunteers who
assisted in the field excavations between 1996 and 1998 and the laboratory
processing between 1996 and 2000, the personnel of the California Department
of Parks and Recreation who made this work possible, and the Federated Indians
of Graton Rancheria for their continued support for this archaeological project.