THE NORTH BAJA PIPELINE PROJECT: LITHIC ARTIFACT STUDIES

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Based on a consideration of the North Baja assemblage character and context, it is clear that a number of diverse research issues can be addressed through a detailed analysis of the lithic materials. The analysis of these assemblages constitutes an opportunity to conduct a major experimentally-founded study of stone tool technology from the region. The North Baja lithic assemblages vary considerably in terms of size, context, density, integrity, and temporal and cultural association. The majority of these assemblages have been collected from alluvial terraces or desert pavement surfaces, although subsurface components were recovered from a number of locations. While some assemblages occurred in sparse scatters with few or no readily identifiable focused reduction stations, other sites were more extensive, with the distribution of lithic materials being more patterned with clear knapping stations being readily apparent. The debitage and cores from each site were subjected to an intensive attribute and refitting analysis in order to address a number of research issues concerned with the technological and land use practices of the early Native American inhabitants of the region.

Given the overall size of the North Baja assemblage, it was determined that the most practical method by which to conduct refitting and attribute analyses would be to perform these in-depth studies on an appropriate sample of the lithic material (Table 1). Apart from the overall integrity of the individual lithic assemblages, other considerations in sample selection included, but were not necessarily limited to, the following:

- Geographic dispersion. To the degree possible, at least two sites were chosen from each main segment of the north-south trending project area.
- Chronology. In general, most of the recorded sites lacked direct evidence for temporal association. Although it is recognized that associations between ceramics and other artifacts in surface contexts may be somewhat tenuous, the presence or absence of ceramics has been utilized as a potential chronological marker.
- Stratigraphic context. Assemblages have been recovered from surface and subsurface contexts.
- Functional associations. Artifact assemblages may have been deposited as the result of habitation or resource procurement activities.
- Ethnographic data. Present-day Native Americans with intimate knowledge of traditional practices often have information relevant to site formation processes. In addition, sites are often situated along or in the vicinity of established prehistoric trail systems that often exist in a spiritual as well as secular context.
- Gross technological attributes. The character of the lithic assemblages varies on a site-to-site basis with core/tool/debitage ratios and overall artifact counts differing widely.

RESEARCH ISSUES

In general, the strategies utilized in the production of the North Baja assemblages appear to be fairly basic from the standpoint of material acquisition, reduction, and curation. However, further consideration of assemblage character indicates that, while the technology itself may be relatively simple, it does have important implications for research into the technological and subsistence systems of the Native American inhabitants of the North Baja area.

Expedient Tool Technology

While the majority of North Baja sites did serve, in part, as acquisition areas, quarries, or prospect locations (Flenniken and Spencer 2001), the recovery of other materials such as ceramics, the presence of trails, cleared circles, and occasional petroglyphs, and ethnographic data indicate at least some of these sites served numerous domestic and possibly ritual functions as well. Consequently, a wide range of activities appears to have taken place on at least some of these sites but, interestingly, the range of tool forms is quite limited. In general, with the exception of a small number of typed projectile points and smaller bifacial implements, the lithic assemblages consist of three

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Locality	Site	Debitage	Cores	Diagnostics*	Context
Palo Verde Mesa	RIV-5531	162	44	-	surface
	RIV-5534	115	33	-	surface
	RIV-5540	62	15	Patayan I ceramics	surface
Palo Verde Hills	IMP-7009	502	14	Patayan III ceramics	surface
	IMP-7778	105	7	Patayan II ceramics, some Patayan I	surface/subsurface
	IMP-8164	415	3	-	surface
	IMP-8169	173	17	projectile point	surface
	IMP-8187/H	1236	23	Patayan III ceramics, some Patayan I and II, projectile point	surface/subsurface
	P-B-008535	192	7	-	surface
Discovery Sites**	IMP-7911/H	1215	15	-	subsurface
	IMP-8046	181	-	-	subsurface
	IMP-8047	1	-	-	subsurface
Midway	IMP-7249	297	17	Patayan III ceramics	surface
South Central	IMP-396	100	6	Patayan I ceramics, some Patayan II	surface
	IMP-7963/H	185	7	Patayan I ceramics	surface
Ogilby	IMP-8052	145	9	-	surface

Table 1: Lithic assemblages included in this study and their temporal and spatial contexts.
** Ceramic temporal classifications are based on the chronology defined prior to discovery of buried deposits.*
*** Discovery Sites are subsurface assemblages documented during pipeline construction.*

primary forms: cores, flakes, and hammerstones. The scarcity of formal tools suggests that sharp-edged flakes may have been the desired end product of the reduction activities, with the cores being of incidental concern to the prehistoric knappers.

A lithic reduction strategy centered on expedient flake tool production may be an important indicator of the character of the subsistence strategies employed by early Native Americans in the North Baja region. Expedient tool production can be a highly efficient strategy in areas where floral and faunal resources are widely scattered or patchy, and lithic raw materials are comparatively plentiful. With potentially great distances to travel and tool stone at hand, there may have been little incentive to produce refined implements requiring curation. In addition, given the possible travels necessary to obtain floral and faunal resources, the transportation of more and larger tools could have been a hindrance to efficient acquisition and processing of foodstuffs. One solution to the need for simple, effective, and easily transportable implements is to employ an expedient production methodology whereby usable flakes are manufactured on-site, resulting in the production of ad-hoc cores.

Flake Production and Projectile Point Blanks

Based on an in-field analysis of lithic assemblages documented in the McCoy Wash near Blythe, California, Flenniken and Spencer (2001) suggest that the reduction of cores was focused on the production of flake blanks for subsequent knapping into small arrow points that do not appear in the archaeological record until late prehistoric times (approximately 1500-100 B.P.). These flake blanks were obtained through the ad hoc reduction of locally available cobbles and clasts through various techniques. Based on an examination of the North Baja lithic assemblages, it does not appear that any single reduction method prevails on these sites. Instead, specific reduction methods are determined by the initial form of the raw material, and not a mental template employed by the knapper.

During the study of the McCoy Wash materials, Flenniken and Spencer (2001) noted the extensive use of a reduction method termed the Topaz Mountain technique. This method of flake production is solely employed on oblong rounded cobbles from which it can be difficult to strike initial flakes. The attraction of this technique is twofold. First, it enables a knapper to gain access to raw material forms that might not otherwise be usable. In general, it is virtually impossible to detach flakes from cores with edge angles approaching or in excess of 90 degrees. However, on rounded cobbles such as those that often occur in McCoy wash and the North Baja, flakes can be detached by essentially "slicing" the cobble into sections (Figure 1). Secondly, the technique is exceedingly simple and requires little in the way of knapping skill to accomplish.

Lithic Technology and Native American Land Use Patterns

A detailed attribute and refitting analysis of select lithic assemblages can provide important data related to broad patterns of prehistoric landscape utilization. Clearly, the primary incentive for the production of stone implements was for the gathering and processing of floral and faunal foodstuffs. In a largely arid and seasonal environment as found in the North Baja area, various plant and animal species can occur evenly scattered across the landscape or concentrated in discrete patches. This can vary according to the topography, microclimate, soil conditions, and the proximity to perennial and seasonal water sources. As a result, the technological means by which these resources were exploited had to be flexible.

Flexibility in this context applies not only to tool form but also to methods of lithic material acquisition, reduction, and curation. For example, travel routes relating to the gathering of floral species may have been determined not only according to the location of those resources but also to accessibility to tool stone. It has been suggested above that the prehistoric inhabitants of the North Baja may have employed a predominantly expedient technology necessitating little implement curation and transportation. While this system may have been made possible by readily available raw material sources, it also may have been an important factor in determining the extent and range of foraging expeditions and/or the placement of processing centers or habitation sites. Quite simply, if tools were not being transported from site to site, it may have been the better lithic sources themselves that served as "magnets," attracting prehistoric peoples to particular areas on the landscape. In turn, this would have determined, to a great extent, foraging patterns related to the acquisition of floral and faunal resources.

Figure 1: Topaz Mountain single platform core

STUDY METHODOLOGY

In order to select the assemblages most likely to provide the maximum data on any or all of the above research issues, a number of variables were considered (see above). All assemblages selected for refitting and attribute studies do not necessarily possess each of these features. However, these assemblages are representative of the nature of the entire collection of North Baja lithic materials and include both sparse, single-event artifact scatters and denser patches likely indicative of multiple episodes of core reduction and tool manufacture. In addition, the consideration of non-lithic diagnostic materials (ceramics) lends a further dimension of relevance and importance to these selected assemblages, as temporal associations may indicate shifts in stone implement acquisition, utilization, and curation over time.

Attribute Analysis

The attribute-based portion of this analysis was based on a methodology that, while employing basic variables present in both typological and technological analyses, incorporated numerous factors derived solely from previously conducted experimental studies.

However, all of the utilized variables, including those from non-experimental contexts, have been tested for not only their practicality for laboratory work but also as to whether or not they actually contribute to a behaviorally oriented inquiry (Ludwig 1999).

A total of 14 separate observations were recorded for cores and core fragments and 13 for flakes and angular fragments. These variables fall into five general categories. These include raw material type, artifact type in relation to overall assemblage composition, dimensional features, reduction technique, and other attributes. The applicability of such attributes to archaeological and experimental assemblages has been discussed in numerous studies (Andrefsky 1994a, 1994b; Callahan 1979; Flenniken and Spencer 2001;Gramly 1980; Jones 1979; Ludwig 1999; Toth 1982; Jeff Noll, personal communication 1996).

Refitting Analysis

The study of lithic reduction strategies and practices through the refitting of cores and flakes is a practice well established in the Old and New World lithic studies (Bodu et al. 1987; Cahen 1989; Flenniken and Spencer 2001; Hofman 1981; Marks and Volkman 1989; Morrow 1996; Toth 1982). In order to be an effective analytical tool, however, refitting studies are most effective when constructed within an experimental framework. One of the prime objectives of refitting studies is to determine exactly what is missing from the archaeological record. By conjoining cores and flakes, an analyst can determine which elements of a reduction strategy have been removed from an assemblage and transported to other locations on a landscape.

Attribute Analysis Findings

At virtually all of the prehistoric sites documented during the North Baja project, raw lithic material is available on-site or in the immediate vicinity. The local availability of largely unlimited, suitable raw material was one of the driving forces affecting the ultimate character of the lithic assemblages noted in the archaeological record. Numerous studies have shown how differing levels of access to tool stone can affect a wide variety of core and debitage attributes, the density of artifactual materials, and the distribution of sites on landscapes (Andrefsky 1991, 1994a; Bamforth 1990; Dibble 1991; Jones 1979; Ludwig 1999; Schick 1984).

For the purposes of this study, the stated research issues relate in many ways to the distribution of sites on temporal and spatial planes. As a result, sites will be discussed in terms of their physical locations within the project area, and their distribution along certain segments of the pipeline route (e.g., South Central, Midway, Ogilby, etc.). In addition, the temporal/cultural affiliations of each assemblage according to associated ceramics (from the Patayan I, II, and III, based on a chronology defined prior to the discovery of the buried deposits) are noted when applicable and the presence or absence of trails by site is included in each table.

Regardless of their spatial distribution within the project area, temporal and cultural affiliations, or location in relation to documented prehistoric trails, there is, in general, little discernable technological variation between the assemblages included in this study. Although a great deal of variability exists within the technological data, few statistically significant distributional patterns were noted as a result of the analysis. In large part, the significant occurrences that were noted are likely related to the nature of the raw materials present on individual sites within the project area. For example, the predominant core blanks represented in every assemblage consist of rounded cobbles and pebbles, and irregular clasts. According to the "least effort" method of flake production (Toth 1982), core reduction that is focused on the production of usable flakes results in cores whose ultimate form is dictated not by a preconceived mental template but rather by the raw material type and initial form of the unworked blank.

In the case of the North Baja materials, virtually no evidence of refined tool production was noted in the lithic artifact assemblages. Features such as flaked and/or ground striking platforms, multidirectional dorsal scars, or pressure flakes were not present on the sites included in this study. The general paucity of bifaces, scrapers, projectile points, or other refined forms strongly suggests that usable sharp-edged flakes were the primary focus of the North Baja knappers and that these flakes constituted the bulk of the prehistoric tool kit in the region.

The frequencies of cobble-derived cores reflects the natural occurrence of this material form on the North Baja sites, indicating that immediately available materials were utilized for flake production. More importantly, least-effort reduction strategies geared towards successful flake production tend to result, in general, in the production of a limited range of technologically definable core types per raw material form. Single platform cores (SPCs) showing removal of flakes from only one platform (Figures 1 and 2) (such as those definable as Topaz Mountain cores [Flenniken and Spencer 2001]), and test and random cores (with only one or two flake removals) tend to be the predominant types in the North Baja assemblages. This is particularly true of sites in the Palo Verde Mesa area where cobble blanks occur with great frequency and SPCs occur in generally greater numbers than in most other North Baja assemblages.

There is a great deal of variability within the technological features of the debitage and cores from the North Baja sites, and certain distributional patterns of some technological features can be noted. A notable example of this variability can be seen in the higher frequencies of non-cortical flakes and of flakes with only cortical platforms in Palo Verde Hills sites and in the Discovery Site assemblages. Such flakes are the result of more intensive levels of flaking than seen in any other group of sites from the project area. More intensive reduction in these areas could be related to two main factors. The Palo Verde Hills sites are situated some distance from the Palo Verde Mesa area where greater quantities of higher-quality lithic materials are found in cobble and clast forms. The Mesa sites, consequently, probably represent material acquisition areas, and this tendency may be exhibited in the relatively high core-to-debitage ratios seen in Table 1, and generally low indications of reduction intensity.

At the Discovery Sites, situated at the base of Palo Verde Mesa, distance to raw stone may not necessarily have been a factor in the occurrence of more intensively worked materials. Based on ceramic associations and the recovery of considerable quantities of small mammal bone, it would appear that these sites represent more intensive, longer-term occupation sites (possibly as long as 1,500 years) than those documented in the Palo Verde Hills. As such, more intensive habitation of this limited area, coupled with the apparent duration of occupation, may have led to the increased reduction of cores over long periods of time by multiple knappers. Evidence for such multiple site visits over time can be found in the documentation of several flakes and cores exhibiting differential degrees of desert varnish patination. Cores with patinated scars and relatively fresh flake scars or flakes with fresh ventral surfaces and flaked but patinated dorsal surfaces indicate the repeated reduction of previously worked and abandoned cores over long periods of time. Artifacts exhibiting such evidence are scarce in the North Baja assemblages but clearly demonstrate the repeated use of individual site locations and indicate that more intensively occupied sites like CA-IMP-7911/H would be expected to show higher degrees of core reduction.

Although little attribute-based variation was identified in the North Baja assemblages, the consistency between sites and groups of sites may be indicative of long-lasting technological adaptations to the natural setting of the region. The relatively minimal nature of core reduction, wide variety of core forms, and absence of flake tool curation or the production of refined tools, indicate that minimal effort was required to produce a took kit suitable to the land use patterns of the inhabitants of the region.

These methods of tool production and utilization render sites difficult to date based on lithic assemblage character. The lack of typologically distinct forms such as projectile points effectively eliminates relative dating of the sites although somewhat tenuous ceramic associations can be applied. Although Flenniken and Spencer's 2001 study of the McCoy Wash materials seemed to indicate that certain methods of core reduction (Topaz Mountain) could be related to temporally and culturally discrete occurrences, no such evidence was noted in the North Baja assemblages. In

Figure 2: Single platform cores produced on water-worn cobbles

general, the Topaz Mountain technique represents a simple least-effort approach to the production of flakes likely intended as tools in and of themselves and not necessarily as blanks for subsequent projectile point manufacture. The Topaz Mountain technique, in addition, is not spatially or temporally restricted to later prehistoric times in the McCoy Wash area. In fact, this basic reduction technique can be seen in the single-platform cores produced as early as 2.5 million years ago at the dawn of human tool-making behaviors. The single-platform technique is also well-represented at North Baja and is the result of a technologically expedient approach to producing usable flakes, the primary goal of the North Baja knappers over a broad geographical area and extended period of time.

Refitting Analysis Findings

The refitting of cores and flakes recovered from the North Baja sites was expedited by the presence of discreet surface knapping loci in most assemblages, complete with associated cobble or boulder cores and debitage representing various reduction stages. Although no formal refitting analysis was conducted in the field, visual observations suggested that such a study could be accomplished with some degree of success. This likelihood was confirmed in part by refitting studies carried out on some flaking stations in 2001 (Apple et al. 2001).

Clusters of identical lithic material (refit clusters) consisting of discreet concentrations of cryptocrystalline silicates (CCS), quartz, quartzite, or metavolcanics were recorded in virtually every surface and subsurface assemblage (Figure 3). A total of 92 such concentrations were noted during the attribute analysis which preceded the refitting study. These clusters included 43 of CCS, 14 of quartzite, and 35 of various metavolcanics. In general, the numbers of these concentrations conform roughly to the frequency of these raw materials represented in the debitage of each site. Simply, if, for example, a total of 20 debitage clusters were noted on a particular site and those concentrations consisted of 80 percent CCS, 10 percent quartzite, and 10 percent metavolcanic, the overall raw material frequencies for the remainder of the debitage were similar. This suggests that only those raw materials available on or near the individual North Baja sites were being reduced and that no significant quantities of any of the three primary raw material categories were being transported onto or away from the sites. Had these roughly comparable patch (dense concentration of the same material) vs. scatter (deposit of diffuse, varying raw material) frequencies exhibited a considerable discrepancy in their overall occurrence, it could have indicated that materials not found locally were being reduced and transported to and from individual sites.

Figure 3: Typical refit cluster of chert flakes and core.

Comparatively, while the proportions of refit clusters largely reflect the percentages of each respective raw material on a per-site basis, there appears to be little relationship between the size of the individual assemblages and the occurrence of refit clusters. The largest sites do not necessarily exhibit the highest numbers of refit clusters. This seems to indicate the deposition of discrete knapping stations had little to do with the overall intensity of core reduction in any given assemblage and such patterns may reflect varying reduction strategies carried out at various sites. Higher numbers of refit clusters would occur from the intensive reduction of individual cores within a limited spatial extent. Fewer occurrences of refit clusters at a site indicate a tendency towards less intensive core reduction, possibly including minimal flaking on a large number of cobbles or clasts. Although additional technological and behavioral patterns may come into play as well, low intensity reduction on multiple cores may indicate:

- land use patterns stressing short-term site habitation;
- multiple short-duration occupations of individual sites;
- activities necessitating minimal utilization of expedient flake tools;
- the presence of plentiful raw material on or near the site, or;
- the site was a stone "prospect" location, where surface materials were tested for knapping suitability.

The occurrence of refit clusters on individual sites does not appear to have any relationship to frequencies of various core forms or initial blanks, raw material type, or the degree to which cores have been reduced. This lack of patterning is best exemplified by the large number of refit clusters (21) documented at IMP-7009, located in the Palo Verde Hills area. Although some degree of technological patterning might be expected to be present in the occurrence of various core and/or debitage features, none of any statistical significance was noted. Consequently, the in situ flake clusters on this site may have more to offer in terms of assessing site integrity rather than patterns of lithic reduction.

Apart from the lack of any significant relationship between refit clusters and various core and debitage variables, the refitting analysis also did not result in the documentation of extensive occurrences of core and flake refits. While several flakes from most of the clusters could be refit and could, in several cases, be matched with individual cores, significant elements of the reduction trajectory appear to be absent from most if not all of the North Baja sites. This holds true for all of the project area segments and applies to both surface and excavated assemblages. To a certain degree, some of lack of refitting artifacts could be related to the surface context of most of the sites, where natural and human-induced postdepositional disturbances (e.g., erosion, animal trampling, artifact collecting, etc.) could have scattered some flakes outside of the refit clusters or removed them from the assemblage altogether. While some of this could be related to the curation and transportation of select flakes away from sites, comparisons of surface and excavated assemblages discussed in the attribute analysis section above suggests that disturbances such as erosion and winnowing by sheet wash may have had an impact on the integrity of surface sites. Although winnowing tends to affect smaller debitage fragments in particular, larger and more technologically useful and diagnostic flakes may have been removed as well.

According to the attribute analysis, flakes and fragments bearing little or no dorsal cortex constitute the most common type of debitage from each North Baja site. Although a certain percentage of the debitage from every site consists of flakes with some dorsal cortex, or flakes with full cortical platforms and dorsal surfaces, such flakes, typical of the initial stages of core reduction, are largely absent from most assemblages. The absence of these elements of the reduction trajectory suggests that such flakes were purposefully transported away from the North Baja sites. As little in the way of evidence for extensive refined tool manufacture was noted in the project area, it is likely that these initial reduction flakes (which tend to be larger than flakes produced during later reduction stages bearing less dorsal cortex) were chosen for their size. Given the expedient nature of the North Baja lithic technology and the generally minimal nature of core reduction, it appears that the subsistence tasks engaged in by the Native American populations in the region were best performed with a specific size range of sharp-edged flakes and these were purposefully chosen and utilized.

Despite the fact the significant quantities of flakes, predominantly from the refit clusters, and cores could not be refit to any great extent, a significant number of refits were noted on a particular core form. Test cores (typically quartzite cobbles or pebbles with one or two flake removals) (Figure 4) were noted in all of the analyzed assemblages with the exception of those excavated from IMP-8047 (which contained no cores). A total of 25 of these core forms could be refit with at least one fully cortical flake (Table 2).

The relatively commonplace nature of refitting test cores within the North Baja assemblages could be a factor of the distinctive character of the cores and flakes themselves and their raw materials which made refitting a relatively simple task. However, the fact that so many of these refits were documented may suggest patterns of reduction and curation at these sites specific to this core form. Such limited reduction and a tendency for the associated flake(s) and cores to remain in situ could reflect the occurrence of one of several technological and behavioral patterns on each of these sites. As has been discussed in the section outlining the research issues, tool expediency and varying subsistence and land use patterns could all impact the character of archaeological lithic assemblages. Given the overall expedient nature of lithic technology on the North Baja sites noted as a result of the attribute analysis, the refitting associations are probably the result of the one-time use of flakes with a low incidence of curation and transport from the site or the immediate area of manufacture and/or utilization.

Locality	Site	Cores (#)	Test Cores (%)	Total Refits
Palo Verde Mesa	RIV-5531	44	57.1	6
	RIV-5534	33	38.2	4
	RIV-5540	15	40.0	3
Palo Verde Hills	IMP-7778	7	14.3	1
	IMP-8169	17	23.5	2
	IMP-8187/H	23	34.0	4
	P-B-008535	7	42.9	1
Midway	IMP-7249	17	41.2	3
Ogilby	IMP-8052	9	66.7	1

Table 2: Test cores, by site, exhibiting at least one refitting flake.

Discussion

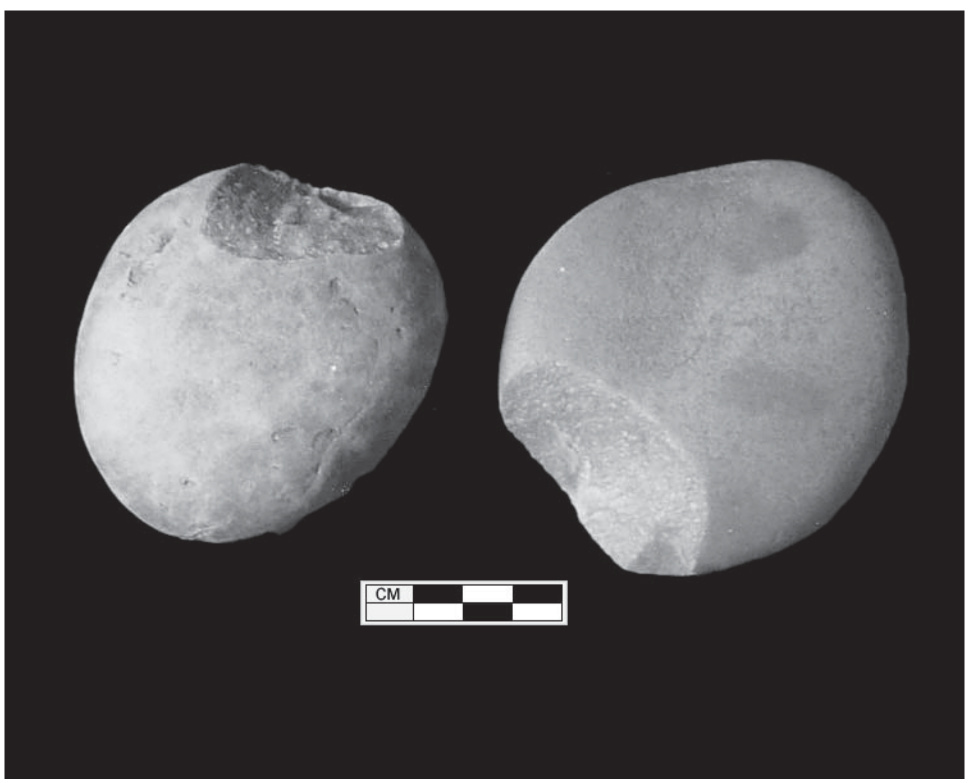
The refitting analysis of the North Baja lithic assemblages compliments the attribute analysis and also demonstrates the degree to which the predominant reduction technology within the project area was focused on the production of usable flakes. The general scarcity of core and flake refits, despite the preponderance of refit clusters present on many sites, suggests a certain degree of disturbance in surface contexts and that specific elements of the reduction trajectories were removed from the sites. Core and flake refits and the presence of numerous refit clusters also demonstrate that the least-effort approach was taken towards flake production and that the manufacture of stone tools was restricted exclusively to raw materials available immediately on or in the vicinity of the North Baja sites.

While neither attribute analyses nor refitting studies may be a panacea for any shortcomings inherently present in lithic analysis techniques, by combining the two approaches within the study of a single assemblage or group of assemblages, a much clearer picture of prehistoric technological and behavior patterns can be achieved. In the case of the North Baja assemblages, both techniques indicated many of the same patterns of technological similarity between most sites. This similarity, and a few notable cases of variation between assemblages, suggests the presence of what amounts to a technological stasis over a wide geographical area during prehistoric times. This stasis persisted despite the fact that shifting subsistence patterns involving increased floodplain horticulture apparently took place during the Patayan II ceramic period. Clearly, although staple foods changed over time, basic approaches to at least some aspects of economic and subsistence needs did not change beyond the basic technological requirements filled by simple core and flake production.

Expedient Tool Technology

Analysis of the core and debitage assemblages from the North Baja sites clearly demonstrates that little in the way of refined tool production was taking place and

Figure 4: Test cores on water-worn quartzite pebbles.



that the least-effort, ad hoc reduction of locally available materials dominated the technological systems of the Native American inhabitants of the region. The core forms, many of them distinctive in terms of morphology and reduction technique, were not the result of culturally determined knapper's templates but rather resulted from the nature of the available raw material itself. This least-effort approach to tool manufacture generated basic tool kits, typically consisting of little more than cores, flakes, and hammerstones.

Virtually all of the North Baja sites, aside from serving as reduction areas, were also important to the prehistoric inhabitants as prospect and material acquisition sites where local raw materials were utilized for tool manufacture. While clear evidence of non-tool-manufacturing activities can be found at many sites (ceramics, shelter clearings, evidence for ritual practices, etc.), little or no technological variation was noted in comparing sites or groups of sites exhibiting only evidence for tool manufacture and those that may have been centers for a more diverse range of activities. As it is reasonable to surmise that the primary reason for tool manufacture was to assist in subsistence-related activities, this suggests that the technological requirements of food acquisition changed little over time. This consistency prevails through periods during which maize agriculture expanded in the region as a whole, suggesting that activities at the North Baja sites may have been centered on the acquisition of natural and possibly seasonal food sources.

Seasonal floral food sources, particularly in a highly arid environment, tend to be very patchy or located in the riparian biotic communities situated along the Colorado River. Access to these patches along the river or in other areas would have been facilitated by the presence of trails on or near sites. These trails occur with some frequency, and inhabitants of the region may have periodically traveled fairly long distances to exploit seasonally available patches of resources. In such a subsistence pattern, an expedient tool kit produced from materials available along established trail systems would be highly advantageous. Travels to and from gathering areas would have been facilitated if the long-distance transport of tool stone was unnecessary due to the predictable availability of suitable raw material along transit routes. One result of a cyclic exploitation of seasonally-available floral food stuffs could be the kind of ad hoc core reduction found at what are likely short-term habitation and resource exploitation sites situated along travel corridors in the North Baja area.

Flake Production and Projectile Point Blanks

Flenniken and Spencer, in their 2001 study of the McCoy Wash lithic artifacts, suggested that the Topaz Mountain method of core reduction was integrally related to the production of flake blanks for the production of small projectile point types that appear in the archaeological record during late prehistoric times (approximately 1500-150 B.P.). The hypothesis suggests that this method of flake production is sufficiently distinctive that even in the absence of typologically-defined projectile points, a general assessment as to site age can be inferred from the presence of the Topaz Mountain technique. During the course of the attribute and refitting analyses of the North Baja materials, some cores characteristic of this technique were noted and could have been the result of projectile point blank production. However, classic Topaz Mountain cores as per Flenniken and Spencer's study were scarce, and the methods used to produce this type of core are identical to those that result in single-platform cores which constitute a major component of the core assemblage. As there is little or no technological differentiation between Topaz Mountain and single platform cores produced on rounded cobbles, there do not appear to be any valid reasons to differentiate between the two, as they are all simply the result of the least-effort strategy towards flake production from locally-available raw materials.

In addition, as the North Baja assemblages included in this study represent an extensive geographical and temporal sample of prehistoric habitation and other activities in the North Baja region, questions arise as to the locations of presumed projectile point manufacture. If a Topaz Mountain core-based argument is made for the production of flakes for further reduction into points, then where are the sites where this point production was actually taking place? The scarcity of points or even any other kind of refined form in the North Baja assemblages combined with the virtual total lack of debitage characteristic of such reduction strongly suggests that this sort of tool manufacture was relatively scarce. Given similar patterns of stone procurement and tool production in the region (Pendleton 1984; Schaefer 1987), an argument of transportation of flake blanks to other points on the landscape for later stages of manufacture may not be valid. When considered together, the North Baja assemblages, Pendleton's Picacho Basin materials (Pendleton 1984), and Schaefer's Mesquite Mine project sites situated to the west of the North Baja project area constitute an excellent sample of sites from a wide geographic expanse. The virtually non-existent evidence of point production on these sites indicates that lithic reduction was probably almost exclusively focused on the least-effort production of expedient flake tools resulting in ad hoc cores whose form is determined almost exclusively by the nature of locally available raw materials. Consequently, the presence of Topaz Mountain-like cores in the North Baja region at least cannot be used to infer temporal and cultural associations to individual locations or groups of sites.

Lithic Technology and Land Use Patterns

An integral element in any discussion of Native American land use patterns in the North Baja project area has already been largely addressed from the perspective of a consideration of the expedient nature of the tool kits and how this technology could have facilitated the exploitation of patchy, seasonal resources. To what extent raw material sources such as those commonly available at the sites included in this study may have influenced the travels of prehistoric inhabitants of the area cannot be determined solely through an examination of the lithic materials. A much broader examination of the natural resources of the region and how Native peoples exploited them would be necessary. However, the proximity of many sites in the study area to trails may suggest that the placement of these pathways directly within or near lithic material sources was no accident. In a subsistence system utilizing a highly expedient tool technology, easy access to tool stone would have been essential, and encountering this material at predictable locations on the landscape would have been an important element within a broader economic system.

Conclusions

The experimentally-based analysis of the North Baja lithic assemblages has provided a clearer picture of the character of prehistoric tool manufacturing and utilization practices in the region. It has been demonstrated that the prehistoric inhabitants of the area engaged in a simple, least-effort approach to flake tool production in which the manufacture of usable flakes was of paramount importance. Archaeologically, this technique emphasizing consistently successful flake production resulted in the production of ad hoc cores whose ultimate form depended solely on raw material form and type, and not on a knapper's arbitrary mental template.

The expedient nature of the prehistoric North Baja tool kit is exemplified by the near total lack of refined implements such as projectile points, scrapers, or drills in the lithic assemblages. It appears that the vast majority of the technological requirements of the prehistoric Native American's lifeways necessitated little more than sharp-edged flakes. Although a simple technology may suggest a relatively uncomplicated lifeway, such appearances can be deceiving. In practice, a minimal tool kit is uniquely suited to the arid environment prevalent in the North Baja region. Patchy and seasonal floral resources, long distances between habitation and resource procurement sites, and the rugged nature of much of the territory make an easily transportable technology a necessity.

While an expedient tool production and utilization technology may have served the early inhabitants of the area well, it is difficult, in the absence of typologically distinct forms, to date sites exhibiting simple least-effort reduction strategies. Although analysis of particular core forms noted on sites in the McCoy Wash area suggests that specific core forms may be the result of temporally distinct reduction and projectile point production, no such reduction patterns were noted in the North Baja assemblages, further complicating the building of regional chronologies.

The recovery and analysis of the North Baja lithic assemblages has presented a unique opportunity for the study of the technological patterns of a later prehistoric occupation from a broad and varied geographical setting. While not all the research questions initially posed in this study could be addressed in detail, a great deal of insight into the practices of the Native American populations has been achieved. Filling data gaps and gaining a more detailed appreciation of the technological, economic, and land use patterns of the prehistoric inhabitants of the North Baja region will only be achieved through continued research.

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