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Lithic Raw Material Prospects in the Mojave Desert, California

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THIS paper discusses lithic raw material prospects (or simply "prospects"), places where potentially flakeable tool stone was assayed or tested for quality. It characterizes this site type and contrasts it with quarries, places where stone was obtained consistently and in quantity, and places where stone was picked up, used, and discarded with little modification. We believe prospects represent a major archaeological site type that has received inadequate attention in the literature.

We describe here a prospect site (CA-SBr-5872), characterize its assemblage, and interpret the behavioral context represented by it. We believe the activities represented at the site were fully embedded within some primary (probably subsistence-related) strategy, but that the activity was more structured than the casual selection of useful pieces of stone. We also believe the site is typical of many on the landscape of the western United States and that such assemblages can only be interpreted with respect to the behavioral contexts responsible for them. We also draw comparisons with several other examples of raw material prospects in the Mojave Desert.

The principal site described here is one at which people occupied a short-term camp, probably many times. During such occupations, they tested cobbles and obtained tool stone in limited supplies and of varying quality on the immediately adjacent terrain. Consistent acquisition of high-quality tool stone occurred at actual quarries 1-2 km. away where good-quality chert, chalcedony, and jasper were obtained in quantity.

THEORETICAL BACKGROUND

Acquisition of tool stone by aboriginal peoples was an industry that in terms of scale varied greatly from one situation to another. The large and well-known quarries of the western United States represent one end of the spectrum. These include the Alibates silicified dolomite quarries, Texas; Spanish Diggings quartzite quarries, Wyoming; Tosawihi opalite quarries, Nevada; and Casa Diablo and Coso obsidian quarries, California, to name a few. The thousands of metric tons of tool stone that must have been taken from these and other major quarries suggest formalized acquisition, reduction, and distribution of stone, perhaps in some cases by specialists, throughout much of prehistory. The physical and chemical tracing of stone from such sources to elucidate patterns of prehistoric exchange is a major research effort in archaeology.

At the other end of the spectrum is non-quarried stone, that obtained in a casual and expedient manner as the occasion required by people engaged in other activities. Few studies have focused on such informal industries in the aboriginal western United States. Gould (1977) discussed acquisition of non-quarried stone as a common aspect of Australian aboriginal lithic technology. He wrote:

> At the outset it is important to distinguish between stone materials gathered by the desert Aborigines from definite quarries, that is specific localities where usable stone is available known to the Aborigines and visited by them

> [*sic*], and non-quarried stone, which is obtained from the surface of the ground at or near the spot where it is needed for a particular task. In this latter case, the stone comes from a non-localised source which may be visited only once [Gould 1977:163].

Gould went on to describe the landscape of the Western Desert of Australia as one where stone suitable for tool use generally can be obtained from the surface with little search or effort. He (1977:164) then contrasted the behavioral situation at quarries and non-quarried-stone-acquisition localities where Aborigines obtained stone:

> At quarry sites one sees Aborigines obtaining flakes and small lumps or cores which are carried away and further trimmed for specific uses. . . . At more generalised non-quarry localities, however, stones were used for immediate tasks on the spot. . . . In every case observed the Aborigines always disposed of the tools that were manufactured and used at non-quarry locations at these same places. They were never observed to carry the tools away to a habitation camp or some other locality for further retouch and/or use.

Having built a convincing case for the expedient acquisition, reduction, use, and on-site discard of tool stone, Gould (1977:167) concluded that actual quarried stone represented "only a tiny fraction of the total amount of lithic material used within the cultural system."

Binford (1979:259-261, 270) did not distinguish raw material extracted for transport and use elsewhere from that obtained on the landscape for immediate use. He did say that among the Nunamiut Eskimo, with whom he conducted ethnoarchaeological research, most raw material was obtained in the context of an extractive strategy embedded within some primary subsistence-related strategy:

> Raw materials used in the manufacture of implements are normally obtained incidentally to the normal execution of basic subsistence tasks. Put another way, procurement of raw materials is embedded in basic subsistence schedules. *Very rarely, and then only when things have gone wrong, does one go out into the environment for the express and exclusive purpose of obtaining raw material for tools* [Binford 1979:259, emphasis in original].

The extent to which these comments were intended to be specific to the Nunamiut, or more generally applicable to interpretation of archaeological assemblages, is uncertain.

Binford's ideas *may* approximate Gould's description of nonquarried stone in aboriginal Australia, but we believe his comments were directed more at the "hidden agenda" aspect of stone acquisition. That is to say that we believe his comments referred to side-trips made to quarries to obtain stone while people were en route to some other destination, such as on some subsistence-related pursuit. Whatever the case, Binford's ideas about raw material acquisition are completely at odds with common sense when one stands on any of a hundred renowned aboriginal quarries in the western United States. The number and magnitude of excavated quarry pits at some sites (such as Tosawihi and Alibates), the standardized approach to cobble/boulder reduction, staging of quarry blanks and cores, and long-distance distributional data all point to formalized, highly structured, and intensive stone acquisition in prehistory.

Between these two extremes (organized, industrial, primary-strategy quarrying and distribution vs. casual, expedient, embedded-strategy picking up of stone off the landscape), and certainly closer to the latter, was another strategy by which stone was acquired in prehistory. This strategy was one of intentionally prospecting for stone at places that sometimes yielded useful material but that never did so consistently or in sufficient quantity to result in what most archaeologists would call aboriginal quarries. We doubt anyone consistently went to such places to get tool stone, but people did try to find useful material on occasion when they happened to be at the spot for other reasons. In other cases, they may have located outstanding veins or nodules of material and returned with appropriate tools and attempted, successfully or otherwise, to remove such material. We refer to these places as *lithic raw material prospects*, or simply *prospects*.

Tool stone seldom was quarried at prospects, and it never was quarried at nonquarry sites of the kind described by Gould. Therefore, a clear terminology is needed to distinguish the two site types. We are satisfied with the term "lithic raw material prospect" because it clearly describes the behavior that occurred at such sites. We believe, however, that nonquarried-stone-acquisition sites of the kind discussed by Gould should be identified by a label that more satisfactorily describes the ephemeral and nonredundant activities that occurred at them. Toward that end, we term such places *ephemeral stone acquisition and use sites*.

In the context of the above-referenced discussions, it should be pointed out that neither Gould nor Binford commented on the difficulty of pressure flaking most raw cherts, chalcedonies, and jaspers, and the degree to which the flakeability of such stone is improved by careful heat treatment. With reference to the Australian situation, this is understandable; many (perhaps most) tools were percussion-flaked from raw stone and were intended for rough-service use such as working hardwoods. In the American West, most of the crude quartzes were heat-treated and intended for pressure flaking into small tools. This distinction makes it a bit difficult to apply the ideas offered by Gould and Binford directly to aboriginal California desert contexts. Nevertheless, these models are important for interpreting our research. In part because they fit the aboriginal California desert situation imperfectly, the models force us to explore our own data more fully and thereby better understand these data.

CA-SBR-5872: A LITHIC RAW MATERIAL PROSPECT

SBr-5872 is located at the south end of the Castle Mountains, a small Tertiary volcanic range in eastern San Bernardino County, California, and adjacent parts of Clark County, Nevada (Fig. 1). The geologic history of the range is complex, and involved extensive volcanism and geothermal activity (Linder 1989). Deposits of siliceous sedimentary stone, apparently formed through geothermal activity by replacement of existing rhyolite with chalcedonic quartz, outcrop along the eroded base of the range. Flanking alluvial fans contain chert and chalcedony clasts, which vary widely in occurrence and quality. Extensive use was made of these materials for tool stone by the prehistoric inhabitants of the region. Rhyolite and other rocks suitable for use in tool manufacture occur also, but were sought less often for tool stone.

The site is located on a low ridge (elevation 1,275 m.) that extends south from the range, and consists of a highly discontinuous, light scatter of tested cobbles, cores, debitage, and other artifacts. To the east and west are ephemeral drainages. Erosion on the crest of the ridge has exposed the material that is the focus of the industry reported here. Flakeable stone is not evident on the surface in the area of the flanking washes where it probably is covered by finer-grained alluvium.

Vegetation in the area of the site is open Joshua Tree Woodland. Plants that might be called the "overstory" are Joshua tree (*Yucca brevifolia*) and Mojave yucca (*Y. schidigera*). The "understory" consists of scattered creosote bush (*Larrea tridentata*) and abundant blackbush (*Coleogyne ramosissima*). Also present are silver cholla (*Opuntia echinocarpa*), galleta grass (*Hilaria rigida*), and many other species. Galleta grass is especially

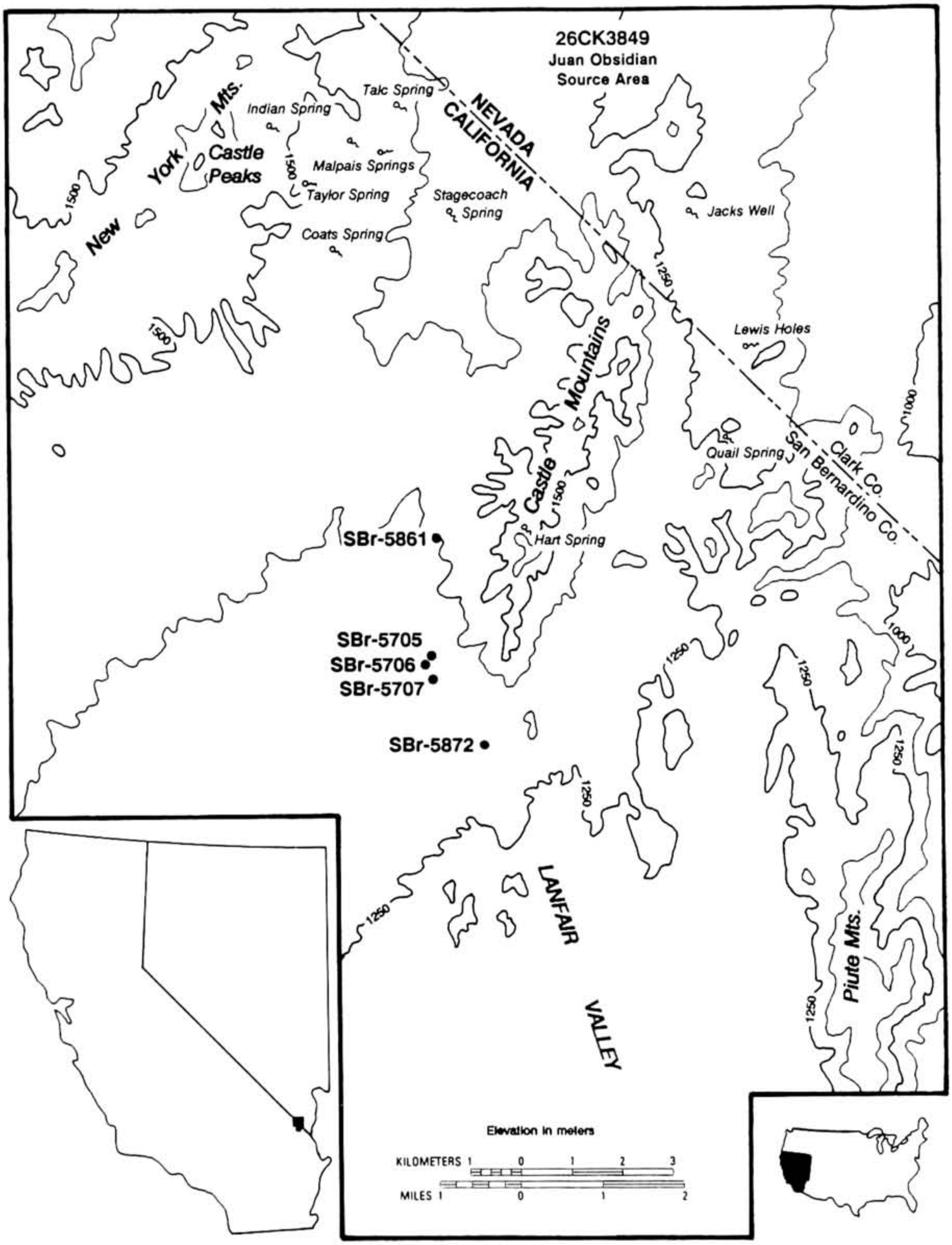

Fig. 1. Location of SBr-5872.

common across the minor drainage that borders the site on the east side. There are no weather stations in the immediate area, but rainfall is very low, probably under 20 cm. per year. In the winter, frosts are common and snowfall occasionally occurs. Water sources in the region consist of isolated springs. Piute Spring, ca. 20 km. to the southeast, gives rise to a permanent stream that flows for a kilometer or more before disappearing in the sand.

The site is in the area occupied by the historic Chemehuevi (Laird 1976; Kelly and Fowler 1986). These people, an offshoot of the Southern Paiute, foraged in the area during the last several hundred years. No substantive archaeological work has been conducted in the region to adequately characterize their prehistoric lifeway or that of their Archaic predecessors. However, for a synthesis of the archaeology of the California deserts, see Warren (1984).

Field Procedures

Fieldwork at SBr-5872 was undertaken in advance of a proposed mining project. The procedures followed in fieldwork included establishing a permanent datum point,[1] identifying areas of artifact concentrations, mapping the site, collecting a representative sample of lithic detritus and all formed flaked stone artifacts, and sampling for subsurface cultural remains with 50-cm.^{2} shovel test units using a 1/8th-inch screen.

Total site area is about 5,000 m.^{2} when an oval is drawn around all observed site loci (Fig. 2). The overall site measures about 110 m. NW-SE by 70 m. NE-SW. The actual site configuration is, however, perhaps better described by the occurrence of the site loci than by a perimeter line that encloses them.

Seventeen surface concentrations or loci of lithic detritus were identified during a series of initial transect walks. Examination of collected material later revealed that the objects from Locus 10 consisted entirely of rhyolite fractured by natural weathering processes. Part of the material collected at that locus was employed in experiments and the remainder was discarded, leaving a total of 16 loci. Most were small clusters not over 2-3 m. across, and represent places where raw material was found and tested for quality.

Following the initial surface examination, collection of artifacts by locus began at the southeast end of the site and proceeded toward the northwest. The loci were numbered in the order collected. At each locus, the center point was plotted and all artifacts within 2 m. of that point were collected for analysis. Following the completion of the surface collection, subsurface testing was conducted by the excavation of six shovel test units. Four were placed in the general site area and two at Locus 12. No cultural remains were found below 10 cm. depth in any of the test units. Two shovel test units yielded no cultural material at all. We concluded that the entire assemblage was confined essentially to the surface.

This procedure was used for loci 1 through 9, 11, and 13 through 17. These loci constitute what is termed hereafter "the main site area." At Locus 12, during the surface collection, several aboriginal ceramic sherds and fragments of at least three block millingstones were found. More extensive mapping and collecting occurred at this locus. While we have no way of demonstrating that all these site loci were used at approximately the same time, we assume they were.

Whereas the loci with debris resulting from material testing essentially determined the extent of SBr-5872, it is important to realize that tested cobbles and a few associated flakes occur as isolated archaeological occurrences throughout the immediate region. How often such cobble testing resulted in the

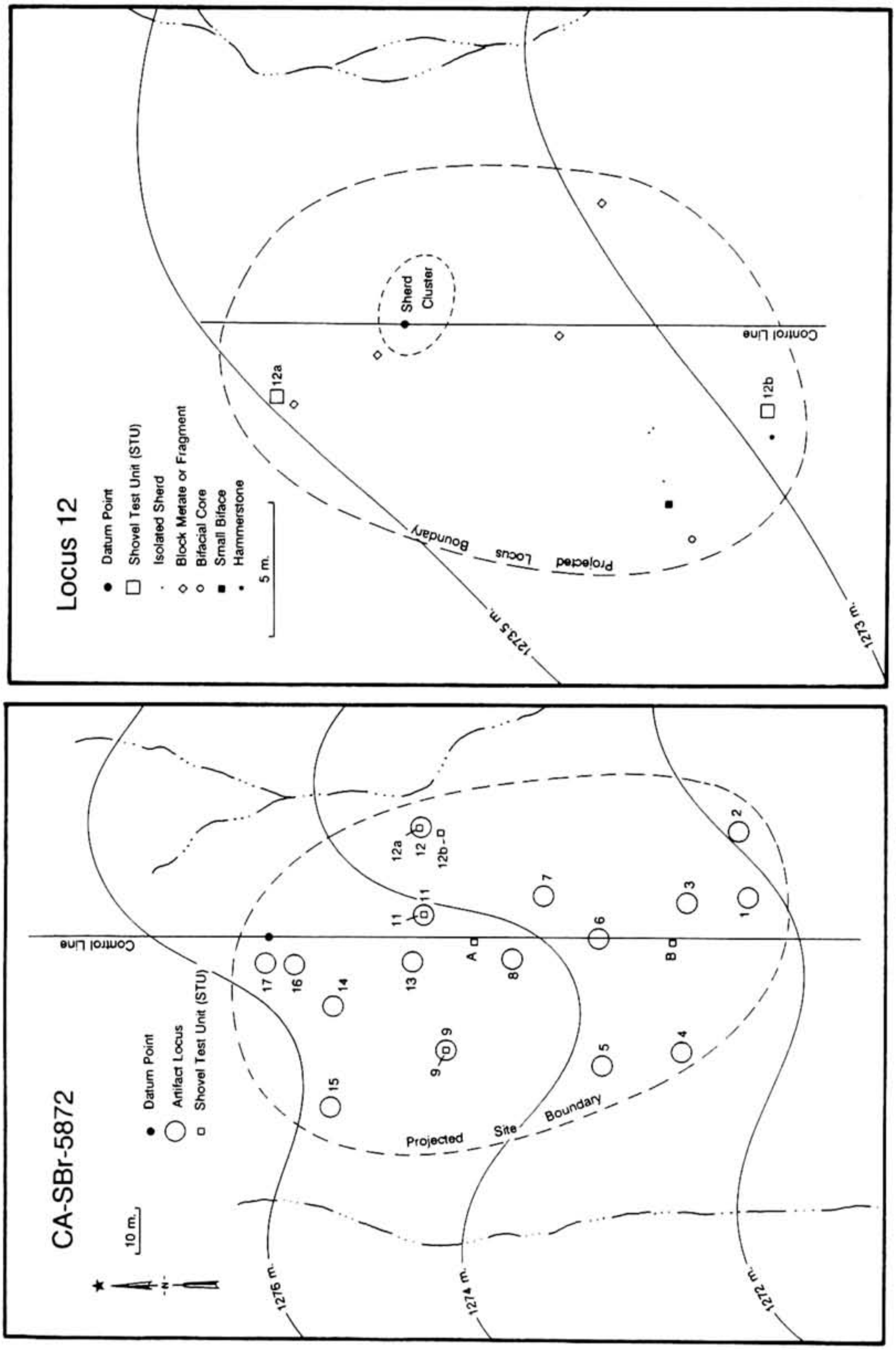

Fig. 2. Maps of SBr-5872 and Locus 12 of SBr-5872.

successful discovery of quality stone is not known, but the number of frustrated attempts is considerable.

Analysis and Discussion

In this report, the term *artifact* refers to any object displaying evidence of having been altered by human activity. Artifacts found at the main site area include cobbles of raw chert and chalcedony, and occasionally of rhyolite, tested for quality by the removal of one or more flakes; flake cores of bifacial or multidirectional form; and flakes removed from tested cobbles and cores. Tested cobbles were very common; formed artifacts were rare. Large boulders still embedded in soil matrix had been struck in attempts to test the quality of the stone or to detach usable pieces. No evidence was seen of attempts to excavate and remove such boulders from the site or further reduce them; apparently the quality of stone in them did not warrant such efforts. No evidence of quarry pits, heat-treatment facilities, or intensive-reduction loci was observed.

Characteristics of the Raw Stone. Naturally occurring chert and chalcedony at SBr-5872 are highly variable in quality. Incipient-cone cortex is absent, indicating that the material has not been transported any great distance from its primary geologic context. In general, the surfaces of such material are heavily weather-checked, and flakes detached from them either contain fractures or were broken on detachment from the parent clast. Internally, most clasts contain vugs or crystal pockets. Testing cobbles by detachment of flakes enabled quality control, permitted selection of the best stone for tool use, and resulted in discarding substantial quantities of poor-quality material. Presumably, the best material was removed from the site for further reduction elsewhere, perhaps where its flaking quality could be enhanced by heat treatment.

Raw chert and chalcedony are exceedingly tough and produce a stronger cutting edge for simple flake tools than can be obtained from heat-treated material. Raw material is, however, difficult to pressure flake. As with most siliceous sedimentary rocks, raw chert and chalcedony such as occurs at SBr-5872 fractures conchoidally, but flake scars usually display a sugary texture that lacks luster. As these crude quartzes fracture, the force rebounds around microcrystalline or cryptocrystalline structures and impurities. The fracture scar therefore is not smooth. (True flints, with higher SiO_2 content, display better fracture properties, but still can be improved by heat treatment.)

Substantial force is required to detach flakes from raw chert and chalcedony. When flakes are detached from such material, they sometimes display split cones of force[2]; they have heavily battered and crushed platforms; the platforms often break away as the flake bends during detachment; and such flakes may have overshot (*outrepassé*), hinge, or step terminations. Hinge and step terminations indicate that the force applied to the stone was inadequate, or improperly directed, to carry the flake through to a feather termination. Overshot terminations usually indicate excessive force. All of these characteristics are common in the assemblage from SBr-5872 and illustrate the difficulty of working the raw stone that occurs there.

Stone obtained on the surface usually has numerous weather checks and cracks, caused by wetting and freezing. Elsewhere in the western United States, where stone of good quality occurred in abundance, it was extensively quarried, and quarry pits mark the efforts of aboriginal miners to obtain high-quality stone at depths where weathering by frost action was minimal. The quality and abundance of stone at SBr-5872 did not warrant such effort. All stone obtained there was surface material, and therefore its quality was compromised to one degree or another by weathering.

Cores vs. Tested Raw Material. In the discussion that follows, *cores* are defined as formed artifacts reduced from raw material, and that served, or could have served, as sources for the detachment of flakes for cutting tools or flake blanks for tool production. Many archaeologists consider the term "core" to describe any mass of stone from which flakes or blades are struck (including what we term "tested raw material"), whether or not the mass has been prepared as a core. We equate the term "core" with "prepared core," and distinguish objects so labelled from "tested raw material." The latter refers specifically to masses of naturally occurring stone from which one or more flakes have been struck, not for use as tools, but to assess the quality of the stone.

Our distinction between cores and tested raw material admittedly is not satisfactory with reference to ephemeral stone acquisition and use sites discussed above, at which pieces of raw stone are picked up, flaked to a functional edge, used, and discarded on site. This situation, however, points to the need for more sophisticated terminology as the study of lithic technology grows.

We reject the notion that cores often served as rough-service tools, such as choppers or cleavers. Impact from use likely would have emplaced incipient cone fractures in such cores, compromising the quality and intended function of stone to supply flakes useful for tools or blanks.

At SBr-5872, cores are small and are either generally bifacial or of multidirectional form (i.e., flakes were struck from almost any available platform). Bifacial cores simply have two faces; apparently no deliberate attempt was made to standardize their form or size, and they should not be considered equivalent to large bifacial flake cores common throughout the prehistory of western North America (Wilke and Flenniken 1988). Quality and configuration of the raw stone were controlling factors in core production. Presence of vugs, crystal pockets, weather-checks, and variable lithology all precluded the production of large cores of bifacial form. While these imperfections may have led to their being discarded on the site without being used for tool production, cores retain little cortex, display evidence of platform preparation, have numerous flake-detachment scars, and convey the impression of attempts at intentional flake production. Once produced, a core could have been removed from the site or discarded there because of imperfections that became apparent while it was being produced or reduced. Presumably the cores recovered represent those discarded because of poor-quality stone or those expended by the detachment of flakes for use as tools or to be made into tools.

Tested raw material is stone that displays flake detachment scars but still exhibits substantial cortex. Examples of these artifacts at SBr-5872 are not considered cores because their quality precluded the production of cores. They were discarded because they could not be reduced into useful cores. The distinction obviously is one of degree, and no operational definition can be formulated to consistently distinguish tested raw material from cores. Some investigators consider "tested raw material" synonymous with "incipient core" (J. Binning, personal communication 1989). We do not favor this usage because the term implies that the material actually was in the process of being reduced into a core. The material was not in the process of being so reduced; it was partially reduced in an attempt to discover if it was of adequate quality to warrant further reduction into a core. (One other alternative is that the material we term "tested cobbles" represents clasts from which flakes were struck to be used as expedient tools. Had this been the case, the situation would closely resemble that described in Australia by Gould [1977], and we believe the amount of worked material at the site would be minor. We do not accept this interpretation because of the large amount of worked material at the site and the lack of observable evidence of use-wear on the flakes. We note, however, that agencies such as trampling can grossly alter surface assemblages and lead to erroneous conclusions of tool use based on edge-wear studies [Flenniken and Haggarty 1979].)

Aside from cores and a few formed artifacts found at Locus 12, all specimens recovered from SBr-5872 are debitage. Four are glossy with a waxy luster, suggesting detachment from cores that had been heat-treated and presumably brought to the site as supplies of tool stone for daily use. All other debitage specimens lack the waxy luster that usually results when siliceous stone is heat-treated (see below). They are flakes and shatter that resulted from the testing of raw material and the production of cores. The cores themselves likely would have been transported for heat treatment to a place that offered more firewood.

Loci 1-9, 11, 13-17. Table 1 lists the characteristics of the flaked stone assemblage collected at each of the various site loci and at each of the shovel tests in the main site area.

Debitage. The debitage analysis presented here employs, with minor revisions in nomenclature and description, technological types commonly employed in lithic technology (Crabtree 1982; Lithic Analysts MS).

Overall, the assemblages from the surface loci and the shovel test units are similar in that the same debitage types are represented in approximately the same ratios. Of all debitage recovered, 64.8% is over 4 cm. in maximum dimension. Specimens measuring between 2 and 4 cm. amount to 33.4% of all debitage recovered (Table 2). The tendency toward larger size in part reflects the fact that no pressure flakes were recovered.

Common debitage categories include (in decreasing order of frequency) interior flakes, secondary decortication flakes, and primary decortication flakes. Also, shatter and nonclassifiable flake fragments are well represented. These debitage categories, together with the overall size of individual pieces, indicate or are expected in the course of early stages in the testing and reduction of raw material. A single edge-preparation flake suggests biface reduction.

Tested Raw Material. Tested raw material includes clasts and clast fragments from which one or more flakes were detached, but which were discarded without having been reduced into cores (Fig. 3). (Larger boulders tested for quality were not collected.) Examples of tested raw material (30 specimens) represent the early-stage nature of the lithic industry in the main site area.

Cores. Although seven of the 10 cores are small and of rough bifacial configuration (Fig. 4), there is no clear evidence of a preferred core form. The material would not consistently yield good bifacial cores, and multidirectional ones may have been obtained as often as, or more often than, those of other configurations. A small core remnant of chalcedony is lustrous and waxy, possibly from heat treatment. The remaining cores are of unstandardized form, most being multidirectional (Fig. 5). Dimensions of these are given in Table 3.

Cortex. As noted, a common occurrence in the recovered assemblage is raw material tested for quality by the detachment of one or more flakes (7.9% of the total assemblage). Debitage categories support this idea by

Table 1
FLAKED STONE ARTIFACTS FROM SBr-5872, EXCLUSIVE OF LOCUS 12

Artifact Type	Locus 1	2	3	4	5	6	7	8	9	11	13	14	15	16	17	STU[a] 11	STU B	Sub-total	Total	Percent of Total
Primary decortication flakes																			33	8.7
Natural platform	2	–	–	–	1	1	1	1	–	–	1	1	–	–	–	–	–	8		
Single-facet platform	1	–	4	–	–	1	1	–	–	1	–	–	–	–	–	3	–	11		
Platform absent	1	–	1	–	–	1	1	2	–	3	2	1	–	–	–	1	–	13		
Outrepassé termination	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1		
Secondary decortication flakes																			104	27.5
Natural platform	–	–	1	–	1	2	1	1	–	8	2	1	–	–	–	1	–	18		
Single-facet platform	1	2	1	–	3	7	5	2	1	7	3[b]	2	1	–	2	–	–	37		
Platform absent	2	2	4	–	2	7	2	3	1	13	1	6	–	–	1	4	–	48		
Outrepassé termination	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1		
Interior flakes																			122	32.3
Natural platform	–	–	1	–	–	1	–	1	2	3	–	1	–	–	–	–	–	9		
Single-facet platform	3	–	5	–	–	4	17	1	4	13	2	–	–	–	2	1[b]	1	53		
Platform absent	8	–	4	–	1	2	12	1	1	21	5[b]	–	–	–	3	1	1	60		
Biface reduction																			1	0.3
Edge preparation	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1		
Shatter																			31	8.2
With cortex	–	–	2	–	–	–	1	–	–	1	1	3	–	–	–	3	–	11		
Without cortex	–	–	1	–	–	–	6	1	–	3	–	1	–	–	–	7	1	20		
Undiagnostic flake fragment																			47	12.4
With cortex	2	–	–	–	–	–	2	–	1	6	2	–	–	–	1	–	–	14		
Without cortex	5	–	4	–	2	0	6	1	–	7	5	1	–	–	2	–	–	33		
Tested raw material	3	1	4	–	–	3	2	2	2	8	–	2	–	1	2	–	–	30	30	7.9
Cores																			10	2.6
Bifacial	–	–	–	1	–	–	2	2[b]	–	–	–	–	1	1	–	–	–	7		
Multidirectional	–	1	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	3		
Total	30	6	32	1	10	29	59	18	12	95	24	21	2	2	13	21	3	378	378	100.0
Percent of Total	7.9	1.6	8.5	0.3	2.6	7.7	15.6	4.8	3.2	25.1	6.3	5.6	0.5	0.5	3.4	5.6	0.8			100.0

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[a] STU = Shovel Test Unit, 50 cm. square.

[b] The quantity includes one probable heat-treated specimen.

Table 2
SIZE RANGE OF DEBITAGE FROM SBr-5872, MAIN SITE AREA[a]

	Chert/Chalcedony Size Range (cm.)					Rhyolite Size Range (cm.)						
Locus	<1	1-2	2-4	>4	Sub-total	<1	1-2	2-4	>4	Sub-total	Total Debitage	Percent of Total
1	–	–	12	14	26	–	–	–	1	1	27	8.0
2	–	–	2	1	3	–	–	1	–	1	4	1.2
3	–	–	9	16	25	–	–	–	3	3	28	8.3
5	–	–	3	7	10	–	–	–	–	0	10	3.0
6	–	–	4	22	26	–	–	–	–	0	26	7.7
7	–	3	23	29	55	–	–	–	–	0	55	16.3
8	–	–	1	13	14	–	–	–	–	0	14	4.1
9	–	–	1	–	1	–	–	1	8	9	10	3.0
11	–	1	30	51	82	–	–	–	5	5	87	25.7
13	–	–	7	16	23	–	–	–	1	1	24	7.1
14	–	–	3	14	17	–	–	–	–	0	17	5.0
15	–	–	–	–	0	–	–	–	1	1	1	0.3
17	–	–	3	8	11	–	–	–	–	0	11	3.3
STU 11[b]	–	1	12	8	21	–	–	–	–	0	21	6.2
STU B	–	1	–	1	2	–	–	1	–	1	3	0.9
Total	0	6	110	200	316	0	0	3	19	22	338	100.0
Percent	0.0	1.8	32.5	59.2	93.5	0.0	0.0	0.9	5.6	6.5		100.0

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[a] Locus 4 and Locus 16 have been omitted because neither contained debitage.

[b] STU = Shovel Test Unit, 50 cm. square.

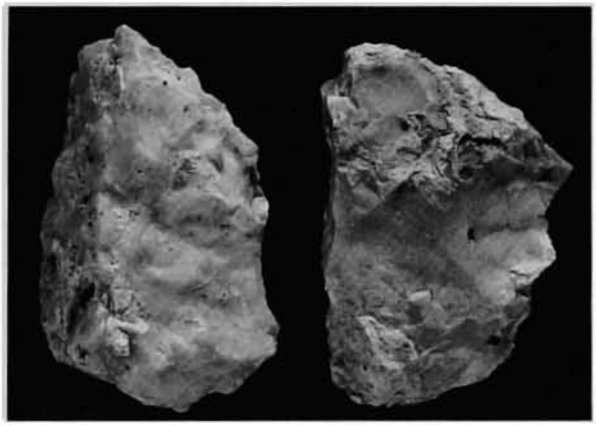

Fig. 3. Tested raw material, SBr-5872. Length of left specimen, 10 cm.

documenting material assaying or early-stage reduction. Of the 338 pieces of debitage in the collection, those with cortex include primary decortication flakes (9.8% of the debitage), secondary decortication flakes (30.8%), shatter with cortex (3.3%), and undiagnostic flake fragments with cortex (4.1%); 48% of the debitage has cortex. Combined, artifacts displaying some degree of cortex amount to 50.7% of the assemblage.

These data indicate that the primary behavior represented by the assemblage involved work directed more toward the acquisition of raw stone and to the *pro*duction of cores, than to the *re*duction of cores into flake tools or flake blanks intended for the production of finished tools.

Apache Tear. A single residual obsidian clast, or "apache tear," measuring ca. 23 x 20 mm., was found as an isolated specimen near the south end of the site. Such clasts are common on alluvial surfaces and in intermittent stream beds ca. 10 km. to the northeast just across the California/Nevada state line. This dispersed source area apparently derives from an obsidian flow no longer extant at the northern end of the Castle Mountains. Extensive deposits of perlite containing occasional residual obsidian clasts, as remnants of

Fig. 4. Bifacial cores, SBr-5872. Left three specimens were rejected because of inferior quality. The right specimen is an expended core that appears to have been heat treated. Length of left specimen, 9.5 cm.

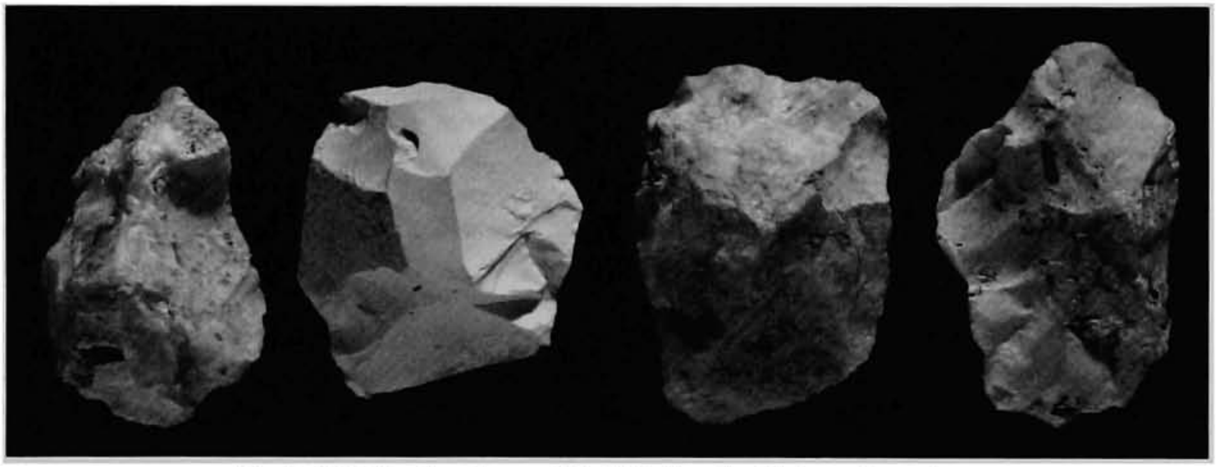

Fig. 5. Multidirectional cores, SBr-5872. Length of left specimen, 8 cm.

Table 3
DIMENSIONS OF CORES FROM SBr-5872, EXCLUSIVE OF LOCUS 12

Catalog Number	Artifact	Length (cm.)	Width (cm.)	Thick. (cm.)	Weight (g.)
138-2-1	Unstandardized core	6.14	6.07	3.02	108.1
138-4-1	Bifacial core	7.96	5.75	2.32	106.6
138-7-4	Bifacial core	9.38	5.92	3.04	158.1
138-7-7	Bifacial core	7.78	4.94	3.36	83.9
138-8-3	Bifacial core	6.14	5.16	3.11	83.3
138-8-4	Bifacial core	4.89	5.03	2.05	53.6
138-14-2	Unstandardized core	6.98	4.72	3.20	84.4
138-14-3	Unstandardized core	7.45	5.39	2.65	103.1
138-15-1	Bifacial core	9.55	5.91	3.73	170.0
138-16-2	Bifacial core	12.42	9.67	3.64	403.6

weathering, occur in this area. The scatter has been named the Juan obsidian source area (Wilke and Schroth 1988b). Apparently it was the source of local obsidian for many late prehistoric sites in the area of the Castle Mountains. Many such sites have surface assemblages containing these small obsidian clasts or the bipolarly reduced remnants of them. The specimen found at SBr-5872 is believed to be a lost object.

Locus 12. Cultural remains from this locus (Fig. 2) include debitage, cores, formed flaked-stone artifacts, a hammerstone, block millingstones, and ceramics. The assemblage suggests a seed-collection camp.

Debitage. Debitage types generally mirror those from the other site loci except for the absence of primary decortication flakes (Table 4). Secondary decortication flakes are present in low frequency. This suggests that the locus contains products of behavior somewhat different from that represented elsewhere on the site. The only two readily evident biface-thinning flakes found at the site occurred at this locus.

In addition to local chert and chalcedony, three flakes of red jasper and two of black jaspagate, material not seen elsewhere at the site, were recovered. The black jaspagate appears waxy and lustrous, suggesting heat treatment; the red jasper lacks these properties, but may have been heat treated. (Even after heat treatment, red jasper from Lavic, near Ludlow, 100 km. to the southwest, often fails to fracture with a shiny luster and a waxy texture.) Approximately the same percentages of sizes of debitage pieces occur at Locus 12 as at the remainder of the site (Table 5).

Cores. One bifacial core of chalcedony and one expended multidirectional core of rhyolite were recovered. Dimensions of the cores and other formed artifacts are given in Table 6.

Other Formed Flaked-stone Artifacts. Other formed artifacts include one preform fragment, two undiagnostic biface fragments, and one complete unifacial tool or edge-modified flake of apparently heat-treated chalcedony (Fig. 6). The long pressure-flake scars on the preform fragment suggest that the specimen had been subjected to heat treatment. Pressure flaking of this kind cannot be accomplished on raw stone from the area.

Hammerstone. The only hammerstone found at the site came from Locus 12. It is a smooth, discoidal, quartzite stream cobble measuring 11.8 x 10.6 x 3.5 cm., with battering on the edges (Fig. 7). Cobbles of this nature are foreign to the local environment.

Millingstones. Large block metates, or millingstones, of basalt are represented by fragments only. One specimen (Fig. 8) consists of six fragments and originally measured about 40 x 30 x 12 cm. with a nearly flat milling surface. The remaining fragments could represent as few as one or as many as three individual millingstones. No manos were found. Apparently, blocks of basalt, or prepared millingstones, were brought to the site and left there; they were too cumbersome to have been carried about the landscape on a daily basis. This suggests that the millingstones were left at the site as site furniture (Binford 1979) intended for use on subsequent trips, and that repeated visits occurred. We cannot account for the breakage of the block millingstones, but it does not appear to be the result of natural weathering processes.

Ceramics. Fifty-four ceramic sherds probably came from two vessels. Most sherds occurred in a cluster measuring about 3 x 4 m. All but one appear to be from a bowl decorated on the interior with a black-on-gray design. The exterior is reddish brown. Rim profile and decoration indicate a bowl that was straight-sided, neither incurvate nor excurvate to any large degree, of undetermined height, and with an estimated diameter of 40 cm. The rim sherds are somewhat flattened.

The sherds were examined by Margaret Lyneis (personal communication 1988), and the results of her analysis suggest that the vessel represented by most of the sherds was manufactured in the general tradition of Lower Colorado Buff Ware, but the design is reminiscent of the western Anasazi. Heavy black lines, finer lines, lines with pendant dots, and a design that is not distributed evenly about the rim all reflect Black Mesa style

Table 4
FLAKED STONE ARTIFACTS FROM SBr-5872, LOCUS 12

Artifact Category and Type	Surface	STU[a] 12a	STU 12b	Sub-total	Total	Percent of Total
Secondary decortication flakes					13	19.4
Natural platform	–	1	–	1		
Single-facet platform	3	–	–	3		
Platform absent	8	–	1	9		
Interior flakes					27	40.3
Natural platform	1	–	–	1		
Single-facet platform	10	–	–	10		
Multifacet platform	2	–	–	2		
Platform absent	14	–	–	14		
Biface flakes					2	3.0
Early stage percussion	1	–	–	1		
Late stage percussion	1	–	–	1		
Shatter					9	13.4
With cortex	2	–	1	3		
Without cortex	2	2	2	6		
Undiagnostic flake fragment					6	9.0
With cortex	1	–	–	1		
Without cortex	5	–	–	5		
Tested raw material	4	–	–	4	4	6.0
Cores					2	3.0
Bifacial	1	–	–	1		
Multidirectional, expended	1	–	–	1		
Other formed artifacts					4	6.0
Preform fragments	1	–	–	1		
Undiagnostic biface fragment	2	–	–	2		
Complete unifacial tool	1	–	–	1		
Locus 12 Total	60	3	4	67	67	100.1
Percent of Total	89.6	4.5	6.0			100.1

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[a] STU = Shovel Test Unit, 50 cm. square.

Table 5
SIZE RANGE OF DEBITAGE FROM SBR-5872, LOCUS 12

	Chert/Chalcedony					Jasper/Jaspagate						
	Size Range (cm.)					Size Range (cm.)						
	<1	1-2	2-4	>4	Subtotal	<1	1-2	2-4	>4	Subtotal	Total Debitage	Percent of Total
Surface	–	–	20	25	45	–	–	4	1	5	50	87.7
STU 12a	–	1	2	–	3	–	–	–	–	0	3	5.3
STU 12b	–	–	2	2	4	–	–	–	–	0	4	7.0
Total	0	1	24	27	52	0	0	4	1	5	57	100.0
Percent	0.0	1.8	42.1	47.4	91.2	0.0	0.0	7.0	1.8	8.8		100.0

STU = Shovel Test Unit, 50 cm. square.

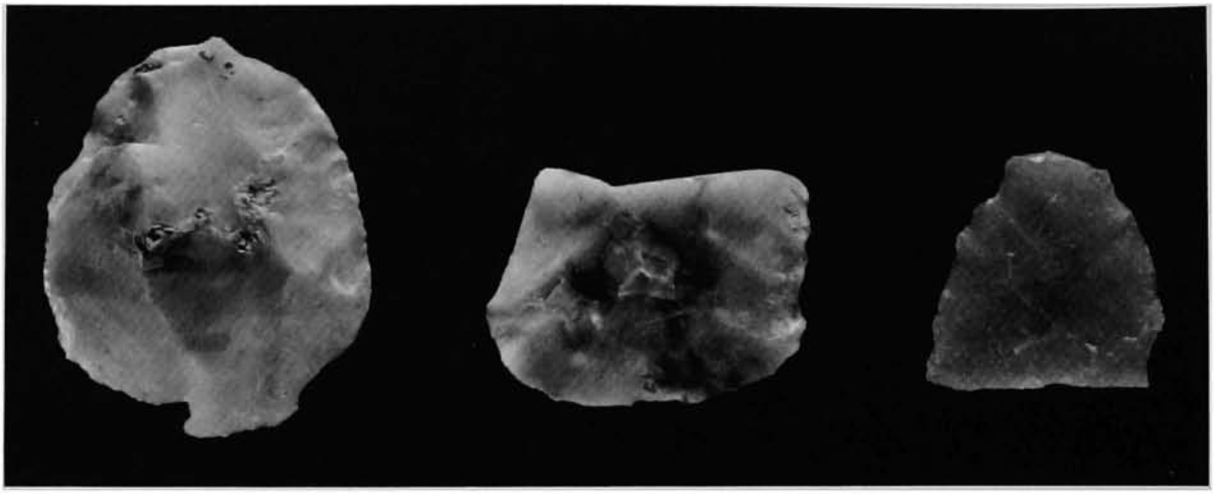

Fig. 6. Formed artifacts from Locus 12, SBr-5872. Left, uniface; center, early-stage biface tool fragment; right, late-stage (pressure-flaked) biface fragment. Right specimen is of a material not found elsewhere at the site. All appear to have been heat treated. Length of right specimen, 30 mm.

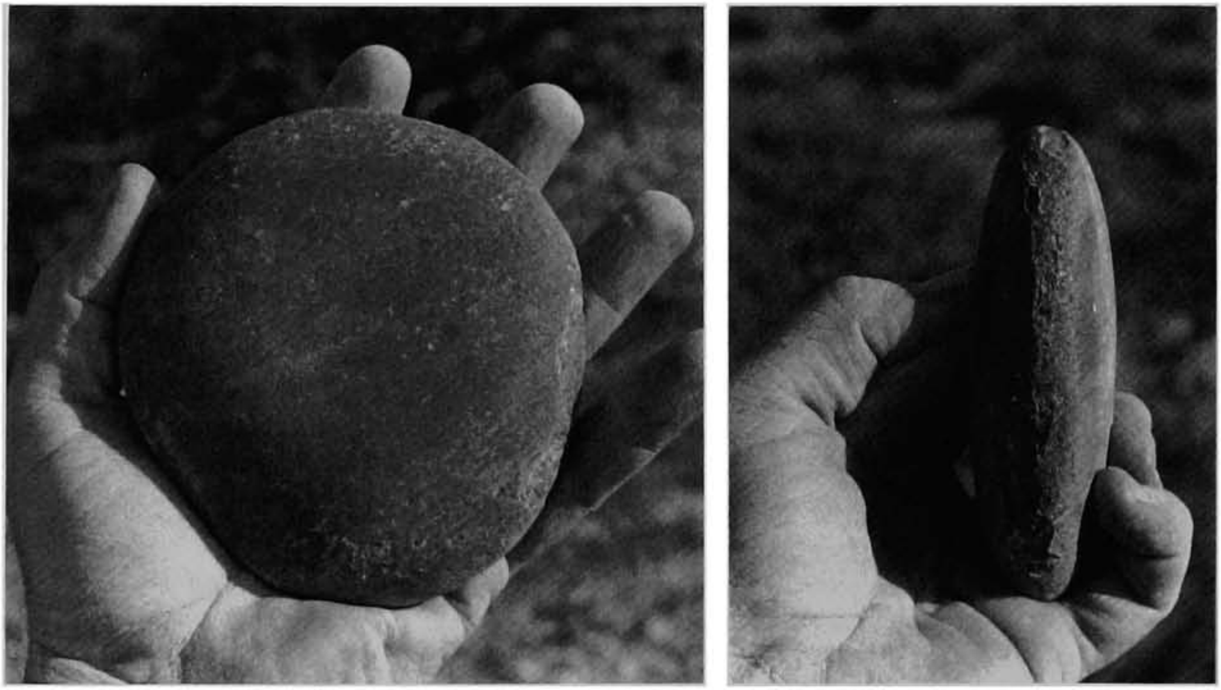

Fig. 7. Hammerstone from Locus 12, SBr-5872. Maximum dimension, 11.8 cm.

(Fig. 9). Temper is coarse, angular feldspars and probably some quartz. Although the sherds cannot be identified to specific type, Black Mesa Black-on-White was thought by Colton (1955) to date about A.D. 900-1000, and Ambler (1985) assigned it a beginning date perhaps as much as 100 years later. Lyneis suggested that some potter trained in the ceramic tradition of the Lower Colorado River may have been inspired by, and attempted to mimic, western Anasazi pottery, perhaps with imperfect results because good

Table 6
DIMENSIONS OF FORMED ARTIFACTS
FROM SBr-5872, LOCUS 12

Catalog Number	Artifact	Length (cm.)	Width (cm.)	Thickness (cm.)	Weight (g.)
138-12-2	Preform fragment	>2.71	2.51	0.51	4.7
138-12-4	Hammerstone	11.72	10.61	3.51	540.0
138-12-6	Multidirectional core, expended	3.46	3.29	1.68	18.5
138-12-8	Bifacial core	7.36	5.70	1.81	90.3
138-12-10	Biface fragment, unfinished	>2.56	3.50	0.97	8.9
138-12-11	Biface fragment, unfinished	>2.34	3.21	0.74	4.8
138-12-17	Uniface	4.33	3.56	0.65	10.0

Fig. 8. Fragments of block millingstones at Locus 12, SBr-5872. Original dimensions of right specimen, approximately 40 x 30 x 12 cm.

clay was not available. Anasazi inspiration for some of the ceramic designs in the northern Lower Colorado area is suggested by designs on the type Parker Red-on-Buff. A suggested date for this type is from before A.D. 900 to after A.D. 1900 (Schroeder 1958).

An additional undecorated sherd was buff on the exterior and black on the interior, and displays a broken and then weakly ground and smoothed edge. It is suggested that a large jar was broken, and that a large sherd of that jar served as some form of open container, which was then broken.

Comparison of Flaked Stone Assemblages

Comparison of the flaked stone artifact assemblage from the main site area with that from Locus 12 reveals several important differences. Locus 12 yielded no primary decortication flakes and a lower percentage of secondary decortication flakes. Although the numbers are small, Locus 12 yielded greater percentages of biface-reduction flakes, interior flakes, and shatter, as well as the only formed flaked stone artifacts (Fig. 10). These differences suggest that activities on the main site area were directed more toward stone acquisition and early-stage reduction, and that those at Locus 12 were directed more toward core reduction and tool production, in association with subsistence activities.

Heat-treatment Experiments

Because of the tough nature of the chert and chalcedony at SBr-5872, heat treatment would have been necessary to render the material more readily workable by pressure flaking. Prior experience in heat treatment of cherts and chalcedonies indicated that slowly increasing the temperature to about 240° C. over the course of 10-15 hours, and then slowly cooling it, accomplishes the desired end. Exactly what happens to stone during heat treatment is not known, but the fracture qualities are markedly altered (Mandeville 1973). The stone loses weight as interstitial water is driven off, myriads of tiny fractures are believed to be created in the crystal latticework or in the fibrous intercrystalline matrix, and the strength and toughness of the stone are substantially reduced. Following heat treatment, the stone fractures far more readily, and fresh fracture scars display a waxy texture and a shiny luster (Rick and Chappell 1983).

Experiments in replicative heat treatment and flintknapping were undertaken to better assess the likelihood that the material could have been used as tool stone in antiquity. For

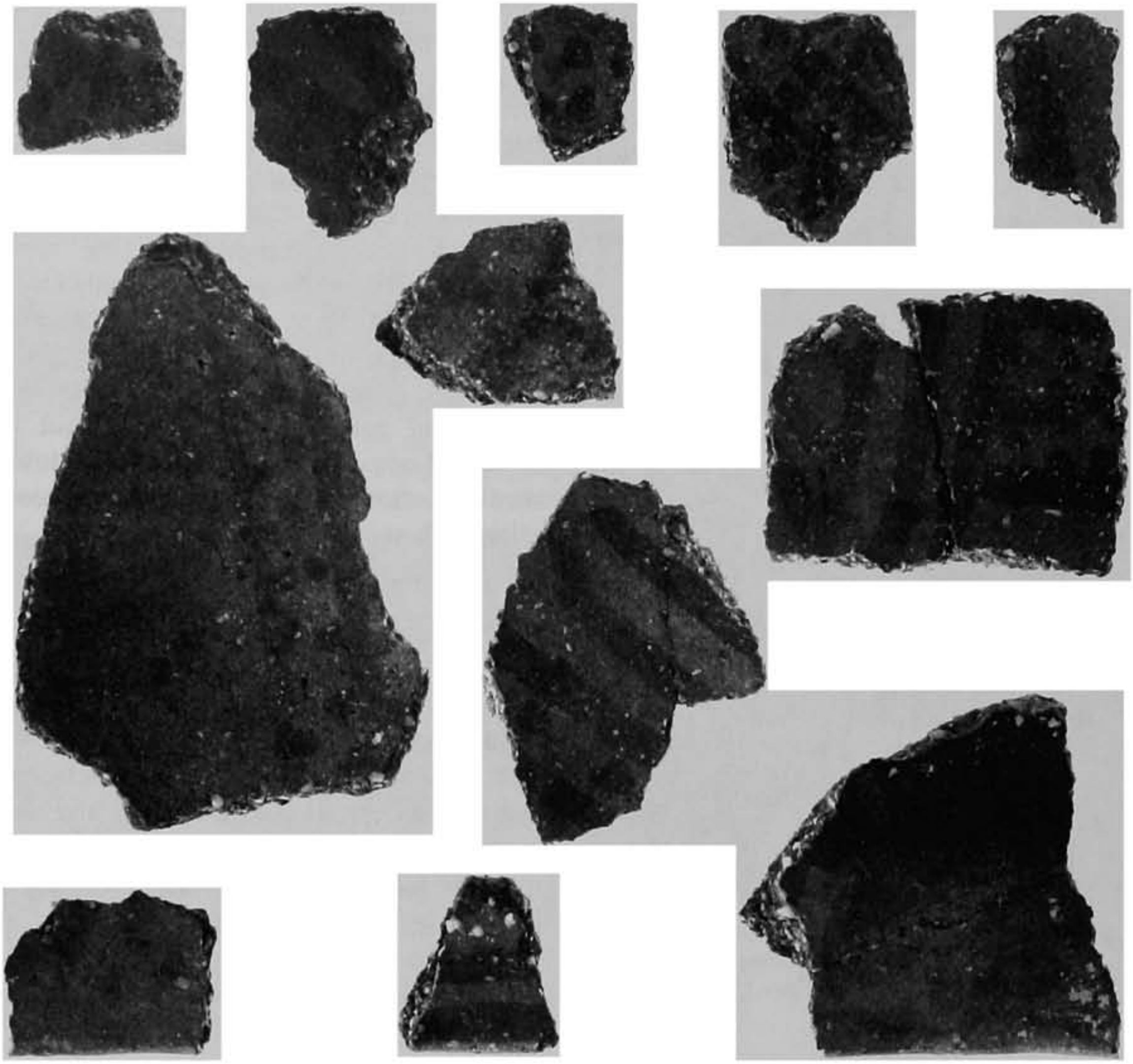

Fig. 9. Decorated ceramic sherds (interior surface) from Locus 12, SBr-5872. Actual size.

these experiments, unworked clasts of raw stone were collected from the surface of the site. In addition, material from the initially recorded Locus 10 (later determined to have been fractured by natural processes) was used in the experiments.

The heat treatment was conducted in a ceramic enameling kiln. Temperature was controlled with a variable autotransformer and monitored with a thermocouple attached to a temperature gauge. Stone selected for the experiments was placed in a sand bath in an iron box. Although it is not possible to achieve good temperature control under a campfire, experience has shown that heat treatment often can be accomplished by burying the stone 10-15 cm. in dry soil and maintaining a small fire over it for 10-15 hours. This probably is the way stone was heat treated in antiquity (Mandeville 1973).

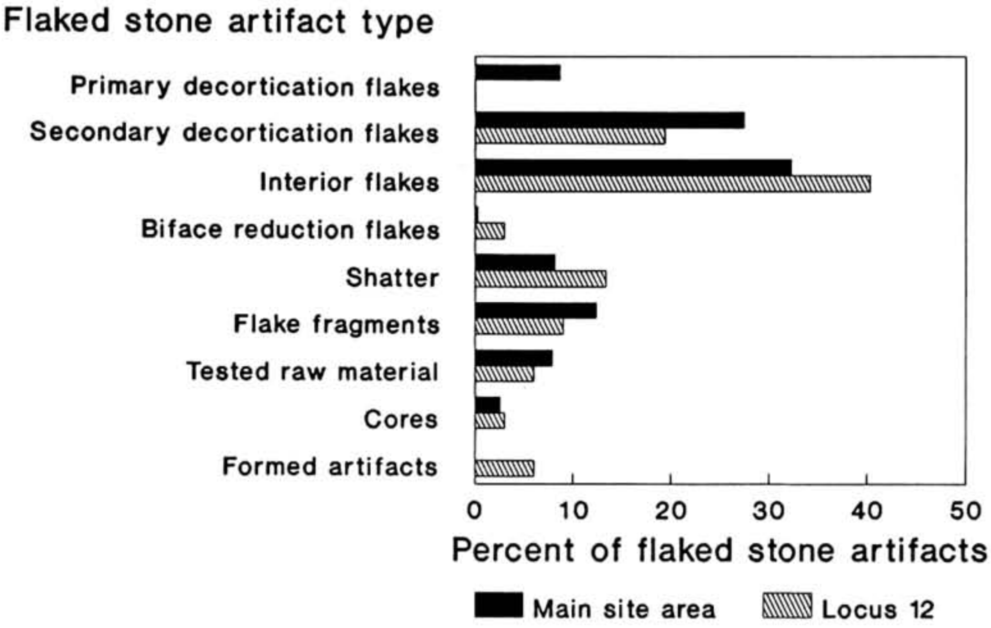

Fig. 10. Comparison of flaked stone assemblages from the main site area and from Locus 12.

If the stone is heated excessively or too rapidly, it is ruined. If not heated enough, it can be reheated to a higher temperature, often with satisfactory results. Although there is little timber in the area, creosote bush (*Larrea tridentata*), catclaw (*Acacia greggii*), and California juniper (*Juniperus californica*, common 3 km. to the north) could have provided the necessary fuel for heat treatment. Because of the amount of fuel needed to sustain a heat-treatment fire for a period of hours, stone likely would have been transported to a place where fuel was available.

Most samples of chert and chalcedony subjected to heat treatment showed pronounced improvement in flaking quality. Some (containing more impurities) showed only minor improvement. Figure 11 shows samples of raw and heat-treated stone, and the increased luster and waxy texture of the latter are clearly evident. Whereas it was all but impossible to pressure flake the raw stone, much of it is readily worked after heat treatment. Examples of replicated tools made from the heat-treated stone from SBr-5872 are shown in Figure 12. The figure also shows one example that failed; not all of the stone improved substantially in quality as a result of heat treatment.

The results of this replicative exercise suggest that, for use in tool production that involved pressure flaking, all of the raw chert and chalcedony occurring naturally at SBr-5872 probably required heat treatment. The luster and texture of only several specimens recovered at the site match the properties of the experimentally heat-treated stone. The few examples that display these qualities suggest aboriginal heat treatment, but the process may have taken place elsewhere, with a core of prepared tool stone having been brought to the site already heat-treated. No features indicative of fires or hearths were noted anywhere at the site.

A final observation is that the presence of crystal pockets within Mojave Desert crude quartzes will sometimes cause the stone to explode during heat treatment. One piece of

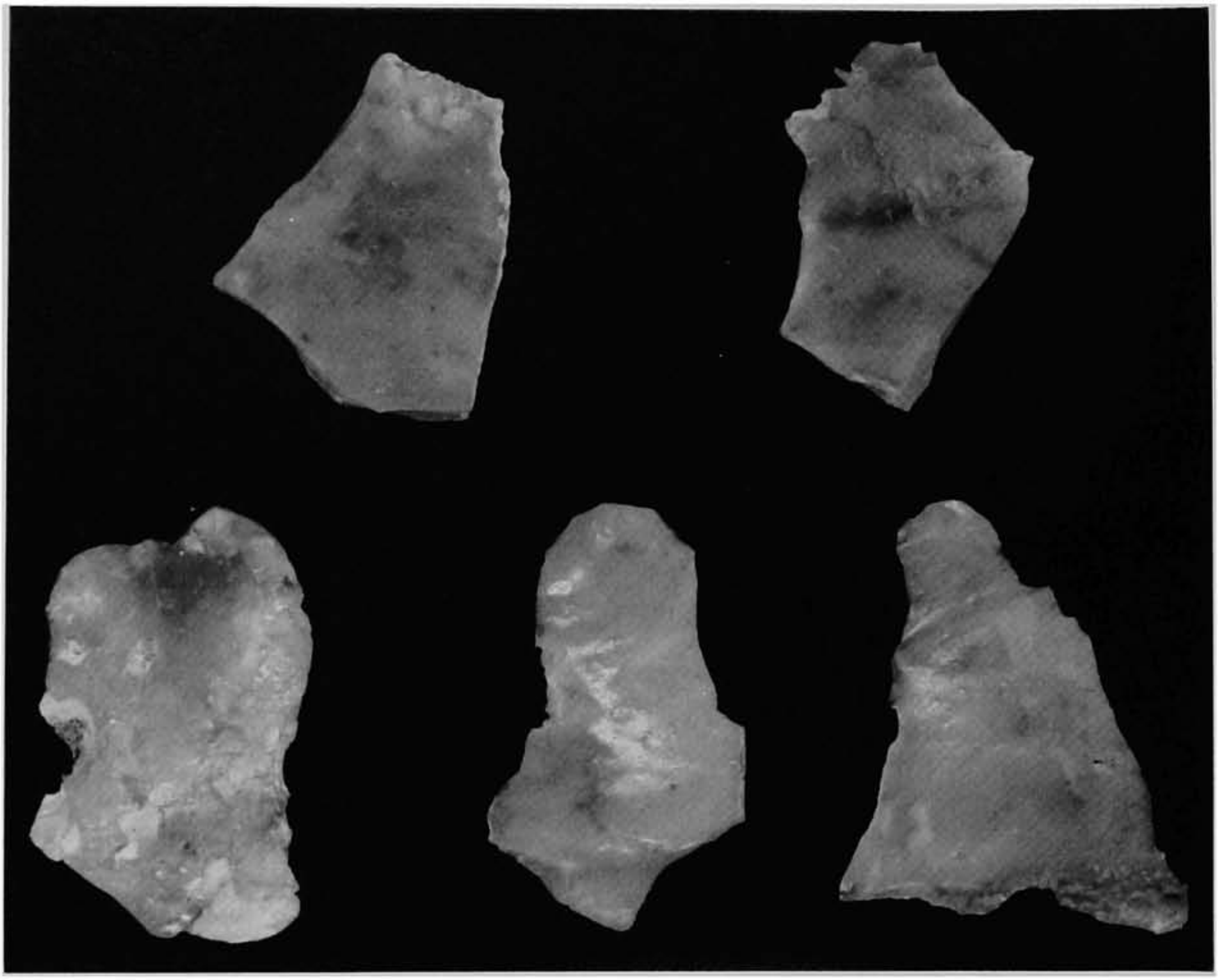

Fig. 11. Raw and heat-treated stone from SBr-5872. Upper row, raw material; lower row, heat-treated material from same clast. Length of lower left specimen, 55 mm.

chalcedony with a crystal pocket inclusion did explode during the heat-treatment experiments (Fig. 13). Such flaws are common in the chert and chalcedony from SBr-5872. Examples of cores and tested raw material from the site show that stone sometimes was discarded after discovery of such crystal pockets when the material had been substantially reduced and was nearly ready for transport from the site.

Interpretations

The data permit interpretations regarding the kinds of prehistoric behavior represented at SBr-5872. These can be discussed with respect to what occurred at the site and how those inferred activities may have related to activities at the other sites in the region.

Data presented above suggest that the original identification of the site as a lithic raw material prospect was correct. All of the evidence from loci 1-9, 11, and 13-17 suggests nonintensive but probably repeated prospecting for usable tool stone. That the naturally occurring stone was not intensively quarried is evident by the sparseness of the surface scatter of quarry detritus. That some of the material was of tool quality is evident by the

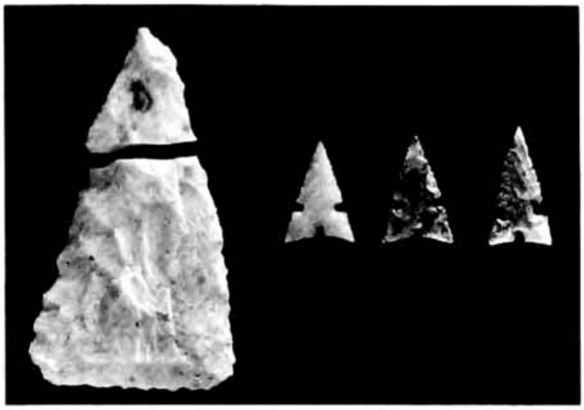

Fig. 12. Experimentally knapped, heat-treated stone from SBr-5872. Left, failed dart point preform. The flaking characteristics of the stone improved little as a result of heat treatment. Right, three arrow points. The left two are of stone that became waxy and lustrous as a result of heat treatment; the right specimen was not noticeably improved. Length of right specimen, 22 mm.

surface assemblage, which includes homogeneous chalcedony, and by the results of the heat-treatment experiments. Sharp flakes detached from naturally occurring clasts of raw chert and chalcedony could have been used to perform a variety of cutting and scraping tasks. Such stone cannot, however, be pressure flaked easily into formed tools such as projectile points. Following heat treatment to about 240 ° C., most of the stone can be pressure flaked easily; other pieces are not improved by heating.

The observations suggest that the limited volume of quality stone available at the site precluded the development of an extensive quarry. The age of the prospecting activity in the main site area cannot be determined from evidence now available, but it is believed to date from late prehistoric time.

The data from Locus 12 provide some information on site function and chronology. If the activities represented there are contemporaneous with those at the remainder of the site, these data suggest one of two alternatives:

(1) the locus represents the base of support activities of persons whose primary intention was prospecting for tool stone at the remainder of SBr-5872; or

(2) the remainder of SBr-5872 represents ancillary activities by persons drawn for some particular reason to Locus 12.

The first of these alternatives would suggest that the possibility of obtaining quality tool stone brought persons to SBr-5872 in prehistory. This alternative would be supported if no outstanding tool stone source areas occurred in the immediate region. This is not the case; several extensively used aboriginal stone quarries (SBr-5705, -5706, and -5707) occur about 1.5 km. to the northwest (Fig. 1). All contain tool stone of higher quality and in greater abundance than occurs at SBr-5872. It seems highly unlikely, given the proximity to these quarries, that anyone in the area seeking tool stone would have made special trips to SBr-5872. Therefore, this alternative is not supported.

The second alternative is more strongly supported. The evidence at Locus 12 suggests that, at some time in the past, persons carried large blocks of basalt suitable for use as millingstones, or already-made large block millingstones, to Locus 12. The millingstones were left there as site furniture (Binford 1979) for use whenever people reoccupied the immediate area. Here they engaged in the gathering and milling of some seed resource, perhaps galleta grass (*Hilaria rigida*), which grows abundantly just across the drainage to the east. If the present distribution of this grass reflects conditions in the past, people occupying Locus 12 may have collected it. Ethnobotanical information on use of galleta grass is almost nonexistent, but one reference (Weight 1978) suggests that the seeds were collected and eaten by Indians of the Mojave Desert. Given that few other natural seed crops occur in any abundance in the region, galleta grass, even if less esteemed, may have

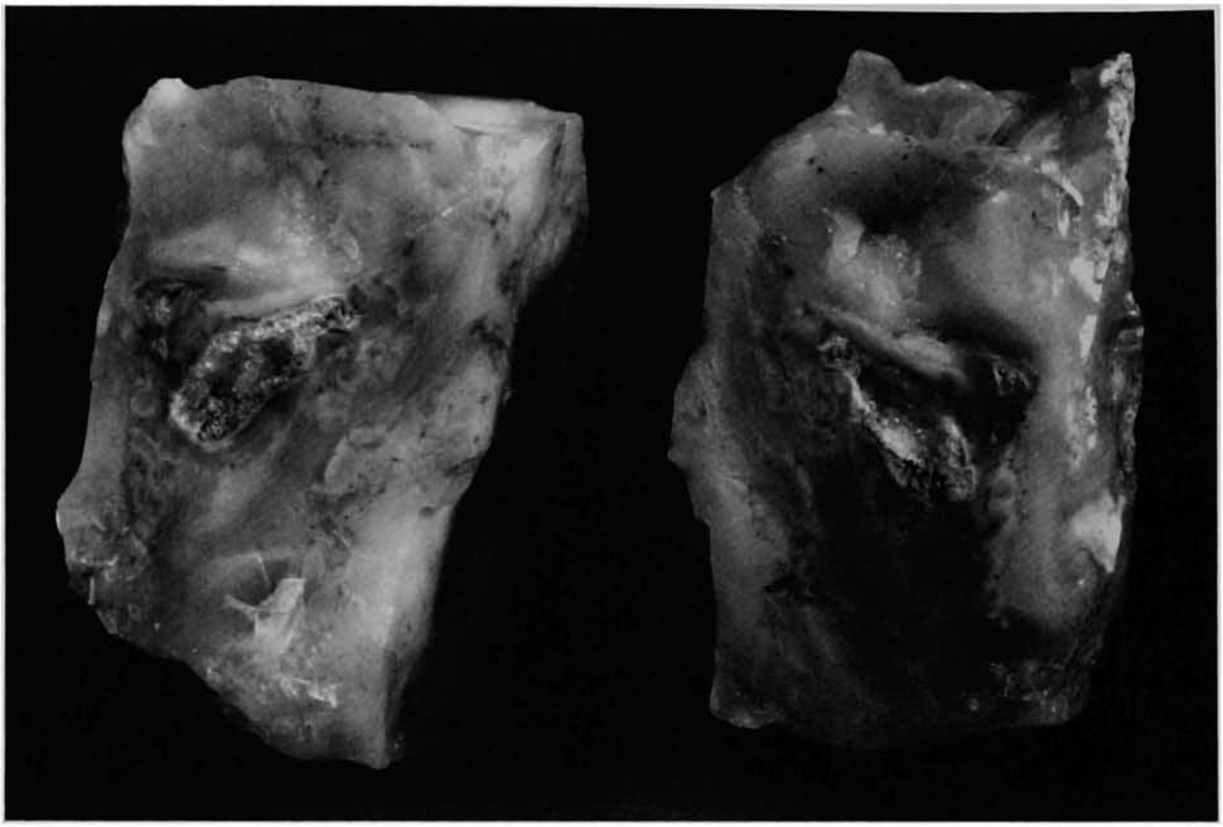

Fig. 13. Chalcedony from SBr-5872 destroyed by differential expansion through a crystal pocket during the heat-treatment experiment. Book-matched split; maximum dimension, 6 cm.

been collected and ground. Other economically important species may have been common in the past.

The persons that used Locus 12 had ceramic containers, at least two of which were broken there. The ceramic artifacts date at least some of the activity at Locus 12 to some portion of the last 1,000 years. Occupants of the locus had heat-treated chalcedony, a preform of which broke there, and they detached flakes from an apparently heat-treated piece of black jaspagate and from a probably raw piece of red jasper. The latter materials were not found elsewhere on the site, but had to have been brought there.

The seed collecting probably reflects the activities of women, to judge from the sexual division of labor known historically to have existed in arid and semiarid western America (Steward 1938). Persons attached to the group may have prospected the immediate area for tool stone on a nonintensive basis. The remaining site loci may represent the residue of this prospecting activity. If this interpretation is correct, the prospecting is best seen as an embedded strategy (cf. Binford 1979) within a direct strategy focused on seed gathering. All the activity represented at SBr-5872 may have occurred within a series of short visits that individually lasted no more than one to several days.

It probably was necessary to transport water to the site each time it was occupied. The activity represented at the site ultimately must have been tethered to one of the very few water sources in the area, such as Hart Spring, located 4.5 km. to the northeast. Abundant sites occur on the east side of the

Castle Mountains not far from this water source and appear to be linked to it. Persons using SBr-5872 may have resided for brief periods at some of these sites.

More intensive quarrying of stone at nearby quarry sites such as SBr-5705, -5706, and -5707 might best be viewed as a direct strategy that involved no use of SBr-5872. Because of the greater abundance of stone and its higher quality, persons seeking quality tool stone may have made trips to these quarries specifically to procure it. We would, therefore, expect some kinds of support activities to be present at these sites. This situation would contrast strongly with that interpreted here for SBr-5872.

OTHER EXAMPLES OF PROSPECTS

Other sites in the immediate region document patterns of lithic raw material prospecting in prehistory. The sites vary in terms of behavioral context, yield of useful tool stone, and overall scale. They permit a broader understanding of the range of sites represented by prospects.

Blue Eye (CA-SBr-5861)

Blue Eye is the name we have given to a site along the west base of the Castle Mountains about 3.5 km. north of SBr-5872. The site occurs at an exposed, tilted vein of chert and chalcedony, probably precipitated by silicic geothermal waters in a fissure in volcanic rock that has since weathered away. The vein is less than a meter in thickness and is exposed on the surface for a linear distance of perhaps 150 m. The material is of varying quality but generally rather poor, compromised by numerous weathering cracks and probably a relatively low SiO_2 content. Interpretation of the site is made difficult by the fact that a road has been bladed through the exposure, and modern prospectors apparently hammered away here and there at the exposed crude quartz searching for traces of gold. Thus, not all of the broken and spalled material at the site can be attributed to aboriginal stone prospectors.

One locus of the site, however, contains evidence of attempts to dislodge a clear inclusion or "eye" of blue chalcedony about 15 cm. in diameter. Part of this outstanding piece of stone is exposed in a clean, naturally fractured face of the vein; the remaining portion weathered away in geologic time. Indians prospecting the vein for quality tool stone found the inclusion and went to considerable effort to dislodge it. They brought to the site a large, elongate, basalt cobble. Using this cobble as a hammerstone, they pounded away on the surrounding chert matrix in an attempt to free the inclusion. All attempts failed, as did the hammerstone, and the frustrated effort is told clearly by the evidence that remains (Fig. 14). A broken ceramic jar of a gritty buff ware with a patchy, red, exterior wash, probably a water container, is represented by a sherd scatter under a large Mojave yucca 25 m. away. No other artifacts were seen at the site. It would appear that in whatever agenda the aborigines were involved at the time, considerable effort was expended in an unsuccessful attempt to obtain an outstanding piece of stone.

St. Joe American (CA-SBr-5090)

The Hackberry Mountains are a small Tertiary volcanic range about 30 km. southwest of the Castle Mountains. An exposed outcrop of gray chert-like material at the St. Joe American site in a small pass in this range was prospected in aboriginal times for tool stone, but only minor amounts were ever removed, to judge from the surface scatter of debris. Much of this material displayed cortex, and there were no formed artifacts. Physically, the material appeared to be a slightly grainy chert, and samples were col-

Fig. 14. Broken basalt hammerstone next to an inclusion of blue chalcedony (arrow) in chert vein at the Blue Eye site (SBr-5861). The hammerstone is a weathered cobble of material foreign to the locality. It broke during aboriginal attempts to break down the surrounding matrix and free the inclusion.

lected and taken to the laboratory for heat-treatment experiments. The flakeability of the material was not improved by heat treatment at 250 ° C. Possibly similar experiments were run in antiquity with similar results, and for that reason the exposure never was exploited to any significant degree (Pinto 1987). The site has since been destroyed by construction of a mining road.

Manix Lake Lithic Industry Sites

A widespread occurrence of quarry and prospect detritus in the central Mojave Desert has been alleged by some (e.g., Simpson 1958) to represent a Pleistocene lithic industry. Attention was first called to the evidence at sites in the area of the Mojave River east of Barstow, around the shores of ancient lakes Troy and Coyote (together comprising the Manix Lake Basin). A presumed association with Pleistocene Lake Manix, and abundant broken or otherwise discarded bifaces, called handaxes by some, led to definition of the industry. The sites also contain abundant tested cobbles of raw chert, jasper, and chalcedony, and extensive scatters of debitage.

Examination of tested raw material clasts and discarded bifaces clearly reveals the imperfections or failure breaks that led to their abandonment. Pieces of debitage generally are of large size, and primary and secondary decortication flakes are both abundant and typical. Weathering cracks, crystal pockets, and vugs occur throughout much of the material.

There is no question that some of the important sites attributed to the Manix Lake Lithic Industry are actual quarries; they contain considerable good-quality material. The surface assemblages at some sites also document extensive quarrying activity in prehistory, but the activities of recent rockhounds make it impossible to determine if actual quarry pits are present at most of them. We think subsurface quarrying generally was not carried out at these sites, but that material was obtained from the surface. Known quarries in the vicinity of Manix Lake include, among others, those at Hector Hills, Desert Oasis, Agate Hill, East Rim, and Toomey Hills.

Credibility of the Manix Lake Lithic Industry as a record of Pleistocene activity around now-extinct lakes can be questioned on the basis of dating applications (Dorn et al. 1986, 1987; Bamforth and Dorn 1988). It is marred also by several technological considerations.

First, aboriginal use of the lithic deposits occurred wherever the Miocene marine deposits outcrop in the Mojave Desert, including the Jasper Hill and Lavic jasper outcrops, the Sidewinder chalcedony quarry, and extensive chalcedony quarries in the Kramer Hills, all localities far distant from Manix Lake.

Second, the alleged handaxes are interpretable as bifacial cores, or attempts to make such cores, and those that occur at quarries can be seen to have been abandoned due to the presence of checks, vugs, or crystal pockets, or due to breakage caused by endshock or otherwise unsuccessful knapping efforts.

Third, there is no compelling reason not to conclude that these various stone sources have been used throughout the entire period of human occupation of western North America, including the last century.

Fourth, and most significant, a very widespread occurrence of raw material prospecting is indicated throughout the entire central Mojave Desert region. Major quarries grade imperceptibly into ubiquitous minor raw material prospects with no objectifiable change in the nature of the lithic detritus. At the latter sites, overall poor quality and inability to consistently obtain large pieces of good stone are clearly evident. Thus, much of the allegedly very ancient Manix Lake Lithic Industry would appear attributable to raw material prospecting throughout the full range of prehistory, whatever that may entail.

Site 26-CK-2375, Near Lake Mead

Kamp and Whitaker (1986) discussed what they termed "unproductive lithic resources" based on an analysis of a surface assemblage from the Nevada side of Lake Mead. They interpreted site 26-CK-2375 as a procurement area where Virgin Branch Anasazi peoples (and possibly earlier groups) gathered tool stone. Based on refitting of flakes to nodules from which they came, the authors concluded that usable flakes and occasional cores of chalcedony were produced and transported elsewhere. We believe that the archaeological situation described by Kamp and Whitaker closely parallels that described here. However, we question their interpretation of the patterning of the behavior implied by the surface assemblages. Although no support facilities nor associated base camps were reported (they may now be submerged under the nearby waters of Lake Mead), quality stone was rare and probably never was obtained in quantity. No quarry pits or hammerstones, and very few formed artifacts were found. This suggests that the area was not an attractive and reliable place to go to obtain quality tool stone, but that the assemblage may instead represent the cumulative result of many isolated prospecting episodes embedded within some subsistence-related activity. Further work emphasizing experimental reduction and heat treatment of stone from this area may provide information on the behavioral context responsible for the assemblage.

DISCUSSION

In the foregoing section, we have presented information and interpretations suggesting that SBr-5872 is a lithic raw material prospect. How do such sites compare behaviorally and archaeologically with quarries where stone was obtained consistently and in quantity, and with ephemeral stone acquisition and use sites where stone simply was picked up, flaked to a useful configuration, used, and discarded on site? To answer this question, it is necessary to characterize the nature and extent of activity represented by these site types. It also is necessary to identify the role of each in the prehistoric lithic technology and the way the activity represented at each site type was integrated into the overall pattern of aboriginal use of landscapes.

Quarries

Most often, quarries are reckoned as places that yielded stone for flaking (Bryan 1950). Other kinds of quarries, however, yielded soapstone or steatite for containers, arrowshaft straighteners, and ornaments (Holmes 1890); turquoise for ornaments (Leonard and Drover 1980); blocks or slabs of andesite, basalt, or other material for millingstones and handstones (Huckell 1986); sandstone for abrading tools (Flenniken and Ozbun 1988); and pipestone for pipes and carved ornaments (Sigstad 1973). The important property about all quarries is that they offered desired material of a quality and in quantities that warranted its exploitation.

Behavioral Aspects. Quarries are places where people obtained raw stone in quantity, presumably on a fairly consistent basis. At major quarries, the quality and quantity of desired material often warranted intentional trips to procure it as a direct procurement strategy, although stone also may have been obtained from quarries as an embedded procurement strategy in conjunction with other activities, such as hunting, gathering, or travel (Binford 1979; Holen 1983). Some quarries were the beginning points of vigorous industries that involved the long-distance transport and trade of desired commodities. The intensive activity represented at quarries where people procured stone for flaking can be seen as the beginning of a lithic technological continuum. Transport, processing (including heat treatment where appropriate and necessary), and caching of stone can be seen as intermediate activities in this continuum.

Archaeological Aspects. Raw stone may have been transported from quarries, but generally it was spalled or sectioned into quarry blanks or further reduced into cores at such sites to ensure quality and decrease weight. Core production permitted the quality control necessary to ensure maximum yield of useful material. An exception would be removal of small clasts of obsidian from areas where this material occurs naturally. Obsidian requires no heat treatment, and reduction of such pebbles most often required bipolar sectioning. Quarries typically display the following: (1) large quantities of raw (not heat-treated) debitage, much of it of large size and with cortical surfaces; (2) cores broken in the course of production; (3) hammerstones used in reduction of raw material; (4) pits dug to obtain stone not damaged by weathering;

and (5) support facilities such as associated camp areas and caches. Minor quarries characterized by stone of lesser quality grade imperceptibly into prospects.

Lithic Raw Material Prospects

Prospects, or assay sites, occur any place material normally quarried elsewhere was occasionally obtained. The distinction between these sites and quarries is one of scale; prospects never became quarries because of limitations in the quality and quantity of material available.

Behavioral Aspects. Prospects are places that were visited by people following a strategy that we believe was in most cases fully embedded within some direct procurement strategy; it was this direct strategy that actually determined the positioning of people on the landscape. We expect that raw material prospects often may be recognizably linked to some other site in the immediate area that reflects a direct procurement strategy focused on some important resource, such as a seasonally available seed crop. It may be difficult to identify the primary exploitative strategy of persons or groups responsible for raw material prospects if associated camps or exploitation sites or loci cannot be found.

Intentional stone-gathering trips seldom were made to prospect sites because the quality and quantity of raw material did not warrant such effort. A probable exception discussed above is the Blue Eye site, where deliberate but unsuccessful attempts were made to extract a single piece of outstanding chalcedony from an exposed vein of chert. Raw material prospects may document single or multiple events.

Archaeological Aspects. Quantities of raw waste stone litter the surface of prospect sites to one degree or another. Most of this material is of poor quality. Substantial reduction of individual clasts reveals attempts to eliminate weather checks, vugs, crystal pockets, and other imperfections. Heat-treated stone is rare or absent. Prospects generally lack quarry pits, abundant hammerstones, heat-treatment hearths, or support facilities. We do not believe that support facilities typify prospects. Subsistence-related base camps, to which prospects may be linked, should contain assemblages reflecting the acquisition, processing, or storage of resources other than stone, but such assemblages are not expected at isolated prospect sites.

Ephemeral Stone Acquisition and Use Sites

Our ideas on sites of this type are based on Gould's (1977) characterization of Australian lithic technology discussed at the beginning of this paper.

Behavioral Aspects. Obtaining expedient stone tools at ephemeral stone acquisition and use sites was casual and dictated solely by the needs of the moment. It was not necessarily redundant, and it always occurred in the context of other activities. Stone used in this context was quickly flaked to the desired edge, used as a tool, and discarded on site.

Archaeological Aspects. Sites of this type are likely to be difficult to characterize without a clear impression of the behavior responsible for them. They will occur where at least some flakeable stone is present, coupled with where people happened to be in the course of their daily activities. Isolated, expedient tools occur here and there, but the spatial patterning of these artifacts reflects use of the tools rather than acquisition of stone for them. Stone obtained on site and displaying evidence of use as tools should show no evidence of heat treatment.

CONCLUDING REMARKS

In areas where high-quality tool stone occurs in abundance, lithic raw material prospects are expected to be rare. But in areas where sources of quality tool stone are widely dispersed, which includes most of the western United States, raw material prospects actually may be the most common site type documenting lithic procurement and may have provided much of the tool stone used in antiquity.

Only through careful characterization of the archaeological assemblages at sites representing prehistoric lithic industries can the site types discussed here ever be identified, differentiated, and functionally interpreted. Simplistic approaches to lithic analysis, such as that of Sullivan and Rozen (1985), and which are growing in popularity, add nothing to our understanding of past behavior. Sullivan and Rozen's approach, which employs debitage categories that are "interpretation-free," fails even to recognize the difference between percussion and pressure flakes, between raw and heat-treated stone, or between initial stone acquisition and core production and subsequent core reduction and stone expenditure. It cannot distinguish reduction strategies based on different core forms. It can characterize certain gross morphological differences between assemblages, but it cannot characterize the human behavior responsible for assemblages or sites. Instead, it creates a false impression that lithic analysis is easily accomplished by persons not trained in lithic technology, which it is not.

Our discussion of prospects has gone into considerable detail, but this is necessary for a proper characterization of such sites and their role in prehistory. We have tried to show that lithic raw material prospects, quarries, and ephemeral stone acquisition and use sites, all of which represent early stages in lithic technology, are very different behaviorally and archaeologically. Other lithic reduction sites documenting core production, core reduction through flake detachment, tool production from detached flake blanks, tool resharpening, and ultimate discard of expended tools also differ behaviorally and archaeologically. The commonly applied term "lithic scatter" fails to differentiate any of these site or assemblage types. Proper characterization of lithic technology and site function to explain prehistoric behavior requires a more sophisticated analytical approach to lithic assemblages than archaeologists have traditionally employed.

NOTES

1. The datum point was established with reference to a black PVC pipe marking the SE corner of mining claim Roy 244 and the SW corner of claim Roy 249. From this corner, the datum point is 74° east of true north at a distance of 40 m.

2. Our use of the term "split cone" should not be confused with "sheared cone," which describes a typical failure of the mass of a pebble during bipolar reduction. We use the term "split" to describe cones of force that are "split" dorsoventrally from the platform toward the distal flake termination. This condition seems to occur when the platform is struck too hard, or with too great a velocity, and especially when the flake platform is relatively broad. The exact nature of the fracture that causes the split is not known, but one of us (PJW) believes it occurs only on rather broad flakes. It is believed to occur in the course of flake detachment when the center of the bulb is bent away from the core before the fracture expands laterally to the edges of the bulb area. While this situation describes a bending of the flake, it results in a perverse fracture that "splits" the cone of force. The fact that split cones, or whatever they are termed, do not appear to have been specifically characterized in literature reflects the elementary nature of the science of lithic technology.

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