San Nicolas Island Bifaces: A Distinctive Stone Tool Manufacturing Technique

E. JANE ROSENTHAL
Petra Resources, Inc., 15 Corporate Park, Irvine, CA 92606.

Recent archaeological investigations on San Nicolas Island resulted in the discovery and analysis of 14 abraded cherty shale bifaces from CA-SNI-214. Because of their atypical material, forms, and manufacturing technique, these bifaces represent a unusual artifact association (at least three point types). Several explanations for the occurrence and function of the bifaces are explored.

SAN NICOLAS, the farthest offshore of the four southern Channel Islands, lies 98 km. (61 mi.) from the California mainland and is part of the Pt. Mugu Naval Air Weapons Station (Fig. 1). The Navy has an ongoing environmental program on San Nicolas Island that is committed to both preserving and enhancing its unique biological and cultural resources. Because the island landscape was heavily impacted by intensive sheep ranching before the military base was constructed, archaeological research results are being used to understand long-term cultural/environmental relationships as well as to characterize the past environment. Since the late 1980s, archaeologists representing several regional colleges and universities have been investigating middens and analyzing artifacts and fauna from the island's prehistoric sites. The joint research goal is to learn about the technology and resource procurement activities of the maritime hunter-gatherers of San Nicolas during the past six thousand years (Schwartz and Martz 1992).

At the time of Spanish contact, the Chumash along the Santa Barbara Channel coast resided at estuaries, intensively fishing nearshore waters and collecting shellfish, while to the northwest and southeast more mixed economies developed (Glassow and Wilcoxon 1988:47). Peoples on southern California's Channel Islands, however, apparently had a maritime economy from the time of their initial colonization until they were removed to mainland missions shortly after 1800. This economy at first emphasized sea mammal hunting and shellfish collecting, but eventually fishing predominated (Raab and Yatsko 1990:19; Raab et al. 1995). Logically, this changing maritime subsistence orientation required specialized tools and technology. Were the maritime technologies of the islanders distinctive? Did they develop a characteristic stone technology or simply use typical mainland stone tools to perform fishing, sea mammal hunting, or shellfish collecting and processing tasks?

In order to identify research, management, and preservation options for San Nicolas Island, Martz (1994) developed a research design. As part of this design, I examined artifact collections and previous stone artifact studies. My review indicated that stone technology is a key factor in understanding not only the maritime adaptation on San Nicolas Island, but also its cultural tradition. Material resources and maritime tasks were also identified as two variables affecting stone artifact technology (Rosenthal 1994). Specialized stone procurement, tool manufacture, and hafting technologies could compensate for limited and variable stone resources. Unique tools and special technological innovations might occur in such isolated circumstances.

SAN NICOLAS ISLAND RESOURCES

San Nicolas Island was first occupied over eight thousand years ago, yet it was probably always sparsely populated and seldom visited (Schwartz and Martz 1992:61-63). The island is low, windswept, and covered with shrubby vegetation. Its largest land animal is a small fox brought to the island by Native Americans (Collins 1993:351). In contrast to the sparse land mammal and plant resources, the rocky shoreline supports abundant shellfish, the coastal terraces

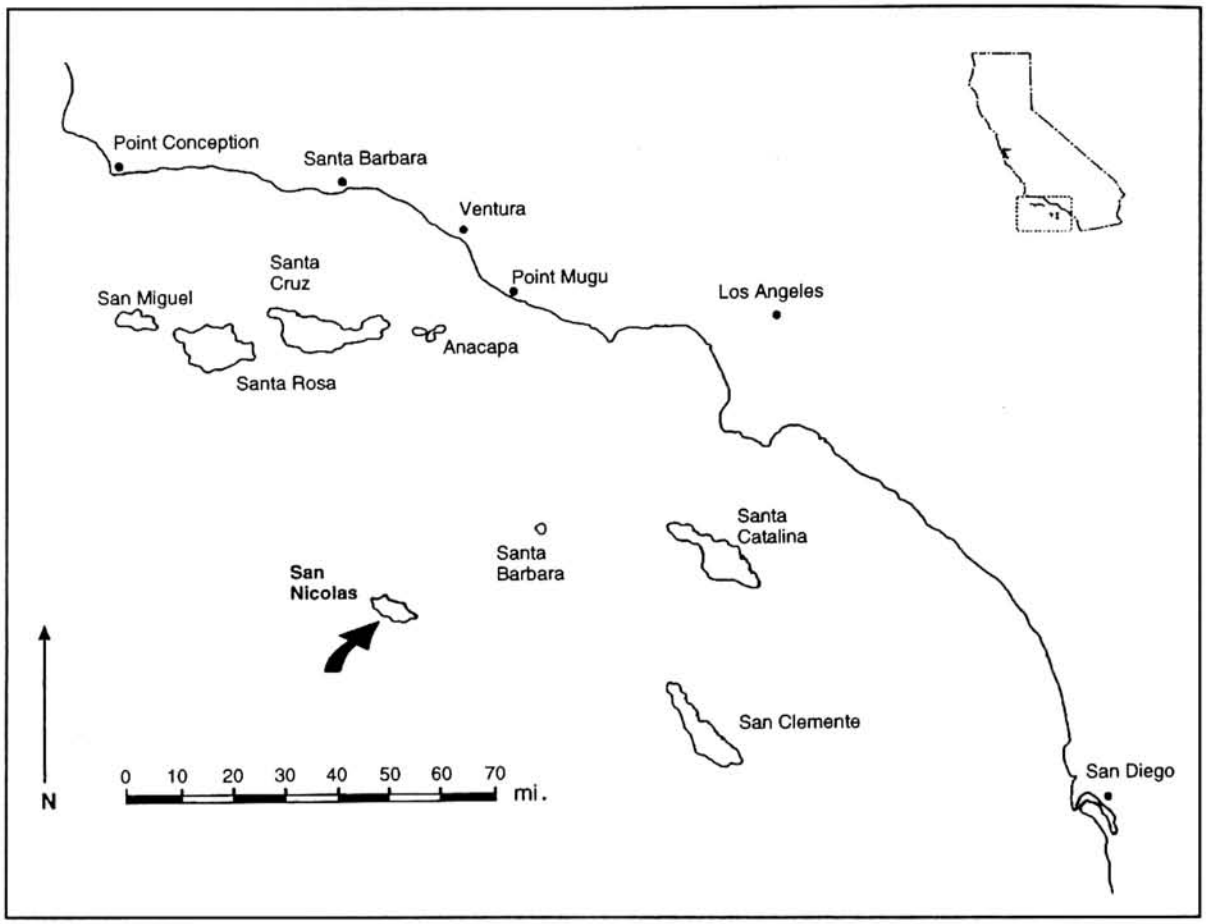

Fig. 1. Location of San Nicolas Island, among the California Channel Islands.

have large seabird colonies, and the sandy beaches maintain sizable sea mammal rookeries. Nearshore waters have extensive, fish-laden kelp forests. There is only one small, sheltered harbor on the island, barely large enough to moor a 30-ft. boat. It has no perennial streams, just springs and seeps. Throughout the year, the island is shrouded in fog; when the fog lifts, a steady breeze blows toward the mainland, resulting in high seas. As a result of these conditions, San Nicolas is somewhat isolated and inaccessible (Fig. 2).

The geology of San Nicolas consists primarily of sedimentary rocks, sandstones, and conglomerates, providing few materials suitable for flaked stone tool manufacture. Ongoing surveys of island stone material sources have revealed two primary local materials: metasedimentary (quartzite or argillite) and metavolcanic (often quite porphyritic) cobbles. Although they are abundant, these metamorphic rocks are not highly workable as they contain dense, dark minerals and have minimal quartz content, they often have large feldspar crystals (porphyritic), and they generally lack homogeneity. Flaked stone toolmakers could either employ these less desirable rocks, or they could import finer textured stone. As a result, Santa Cruz Island and mainland Monterey and Franciscan Formation cherts, Santa Catalina Island soapstone, and mainland obsidians all appear in San Nicolas Island artifact assemblages.

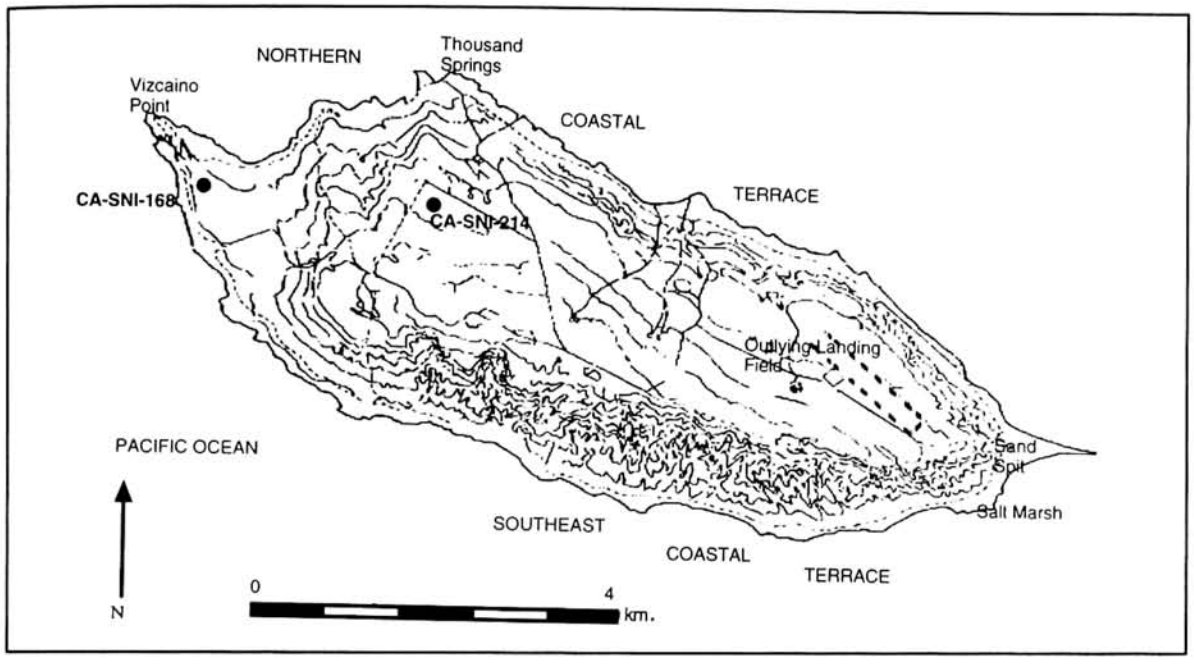

Fig. 2. San Nicolas Island, with approximate location of CA-SNI-214.

STONE TOOL TECHNOLOGY ON SAN NICOLAS ISLAND

In a study of the island's Middle Period occupation at CA-SNI-16, Lauter (1982) classified the tools discovered there on the basis of possible functions. However, in postulating a distinct stone technology, Clevenger (1985) described an extensive cobble reduction complex at CA-SNI-11, a large northwest coastal dune site that emphasized bipolar splitting and flake use which she termed the "split cobble reduction" technology. Although cobble choppers have been found on other Channel Islands and the mainland, Rondeau (1987:41) reported that bipolar techniques such as split cobble reduction occur primarily where materials are small in size or relatively scarce.

The split cobble reduction described by Clevenger (1985) is not a traditional bipolar technique (Hayden 1980:2-5). Typically, metavolcanic and metasedimentary cobbles were placed on an anvil and struck to initiate flake removal, then the anvil was abandoned. Subsequently, the stoneworker employed direct, freehand percussion to produce additional flakes. My own research and informal replication studies have indicated that the San Nicolas Island split cobble technique was used when larger, flatter flakes were desired. This technique produced straighter flakes with much less pronounced bulbs of force. Split cobble technology is a flake-producing technique that compensates for the dense and heterogeneous character of the metamorphic cobbles found on San Nicolas Island.

The split cobble technique is a specialized toolmaking system that was much more common on San Nicolas Island than elsewhere. However, a second percussion technique was also employed to manufacture San Nicolas stone tools. This technique utilized mid-size cobbles and resulted in a unidirectional core which could produce numerous 3-cm. to 5-cm. long, noncortical flakes. This second core reduction technology appears quite methodical when compared to the expedient core technologies typical of Los Angeles Basin assemblages (Rosenthal and Padon 1994:22). Despite these systematic ap-

proaches to core shaping and flake production, complex stone tool percussion techniques, such as Santa Cruz bladelet manufacture (Arnold 1985, 1987), have not been identified among San Nicolas artifacts. Microblade drills occur infrequently and are always made from imported chert. It is doubtful they were manufactured on the island. The artifact assemblages from sites such as CA-SNI-351 contain less than 3% imported stone, and almost no nonisland material is debitage (Rosenthal 1992:2). Islanders apparently preferred to use locally available, but not highly workable, metavolcanic and metasedimentary rock for manufacturing flaked tools.

Island artifacts are similar to the expediently made, utilized flake tools found throughout the Chumash Interaction Sphere (Hudson and Blackburn 1981, 1982, 1987). The main differences between mainland and island tools lie in the materials and manufacturing techniques. At CA-SNI-214, a specialized manufacturing technique was identified among a small number of stone artifacts. These artifacts, a set of variably sized, hafted bifaces, are the focus of the following discussion.

SITE DESCRIPTION

CA-SNI-214 is a large site that lies near the western portion of the central plateau of San Nicolas, and is essentially a longitudinal dune overlying dipping Pleistocene terraces. There are extensive cultural deposits and a blowout from the prevailing wind on the west side. This western face has considerable abalone refuse, sea mammal bone, and whalebone, as well as numerous stone artifacts, but no obvious midden. In contrast, the eastern (leeward) third of the site has an intact, stratified, charcoal-stained midden.

In 1989, Steven Schwartz, Pt. Mugu Naval Air Weapons Station archaeologist, learned that a burial was being exposed by dune deflation at CA-SNI-214. The burial was a male in his mid-thirties who was in a flexed position on his left side, with his head oriented southeast. A dog skeleton, also flexed, lay in front of his arms. Schwartz (personal communication 1994) suggested that the burial had once been bundled in a woven mat or cloak that disintegrated. Preliminary analysis suggested that the individual had arthritis, spina bifida, and generally poor muscular development (S. Schwartz, personal communication 1994).

Island interments often have no accompanying grave goods. However, this burial contained numerous grave goods, including stone, bone, and shell artifacts. Stone pestles, whalebone abalone pries, steatite ornaments, two sandstone palettes, shell fishhooks and blanks, two water bottle fragments, and portions of 14 bifaces were also found (S. Schwartz, personal communication 1994). The burial and the artifacts appeared to be contemporaneous, although deflation had disturbed the relative associations of the artifacts.

ANALYSIS OF THE CA-SNI-214 BIFACES

The bifaces from CA-SNI-214 are a tool association that has not been previously reported by San Nicolas researchers. Not only are bifaces infrequently encountered within island domestic refuse, but the commingling of large and small forms has also not been observed. The biface set consists of 14 bifacially worked artifacts produced from silicified shales (often called cherty shale). The only known source of this material is the coastal California Middle Miocene Monterey Formation, which has interbedded porcelinites, diatomites, siltstones, and shales with thin layers of microcrystalline quartz and opaline cherts. The microcrystalline quartz chert, known as Monterey chert, is the preferred local biface material throughout coastal southern California.

Monterey Formation outcrops appear along the coast of California from San Francisco Bay to central Orange County (Newport Bay) and on

Santa Cruz, Santa Catalina, and San Clemente islands (see Fig. 1). Santa Cruz has highly workable quartz cherts that facilitated the development of a sophisticated microblade industry on Santa Cruz Island (Arnold 1983, 1987, 1992), and on Anacapa and San Miguel islands (Rozaire 1993). In contrast, Santa Catalina and San Clemente (southern Channel Islands) cherts are opaline. They are brittle, have a planar fracture, and are seldom used for tool production.

In terms of workability, silicified, or cherty, shale lies midway between opaline and quartz chert. Stone workers occasionally used cherty shale for small tools. Cherty shale has been infrequently recovered from regional sites, particularly on Palos Verdes Peninsula in Los Angeles County (Cooley 1982). Cherty shale exists within the northern Channel Island Monterey Formation materials, but not on the southern Channel Islands. The cherty shale biface material is therefore probably derived from either mainland or northern Channel Island deposits.

Cherty shale is an unusual stone to select for biface manufacture. It does not fracture conchoidally and its natural bedding inhibits stone fracture, except along parallel planes. Percussion and pressure forces follow homogeneous layers, terminating abruptly at the softer shale layers and continuing to fracture where layers are more silicified. Nevertheless, the 14 bifaces found associated with the burial were produced from this material. Five of the bifaces that best represent the manufacturing technique and size range are detailed below. Attribute data for all 14 specimens are outlined in Table 1.

The first biface (Cat. No. 4, Fig. 3a) is a complete stemmed projectile point measuring 32.2 mm. in maximum length, 8.9 mm. in width at its midsection, and 3.0 mm. in thickness. The point is unbroken and has one weathered (oxidized) face. The manufacturing process appears to consist of serial percussion or possibly pressure flake scars, indicating bifacial removal from tip to base along the edges. Only one series of flake scars is apparent.

Figure 3b (Cat. No. 17) illustrates the tip and midsection of a biface that is 23.8 mm. in length, has a maximum width of 11.7 mm. at the midsection break, and is 2.0 mm. thick. Several important manufacturing attributes can be seen on this specimen. First, one face has been systematically abraded, exhibiting a pattern of parallel striae (visible at 10X magnification) that occurs both perpendicularly (from tip to base) and obliquely (angled from one edge to the other) across the face. Additionally, the entire edge has a single series of bifacial flakes. This retouching consists of deep, slightly ovoid scars, suggesting that percussion methods shaped the biface edge. Figure 3c (Cat. No. 44) clearly illustrates the retouching technique. This specimen is 35.3 mm. long, 13.2 mm. wide, and 2.6 mm. in thickness. Figure 3d (Cat. No. 27) is a slightly larger biface showing similar manufacturing attributes, and measures 41.7 mm. long, 18.8 mm. wide, and 2.9 mm. in thickness.

The base, midsection, and partial tip of a large biface is illustrated in Figure 3e (Cat. Nos. 36 and 43). This specimen is broken in three pieces, but it measures 97.6 mm. long, 29.5 mm. wide, and is 6.1 mm. thick. Both faces have multidirectional striae and the edges are bifacially retouched. Asphaltum is present on the base. Figure 3f (Cat. No. 77) is an identically manufactured biface that measures 103.7 mm. long, 38.1 mm. wide, and 8.7 mm. thick.

Figure 4a (Cat. No. 46) is a biface base and midsection fragment that has broken parallel to the bedding plane of the stone. The two faces appear identically worked. A weathered surface indicates that the biface may have been deliberately fractured along the bedding plane before being deposited in the burial. The artifact measures 37.3 mm. in length and 38.4 mm. in width, and is 8.1 mm. thick. The fragment has bifacially retouched edges, and multidirectional striae indicate that it was also abraded. Asphaltum adheres to its base.

Table 1
ATTRIBUTES OF THE BIFACES FROM CA-SNI-214

Cat. No.	Cortex	Abrasion	Length (mm.)	Width (mm.)	Thickness (mm.)	Comments	Fig.
4	unifacial	unknown	32.2	8.9	3.0	stemmed point	3a
17	none	yes	23.8[a]	11.7[a]	2.0	tip and midsection	3b
27	none	yes	41.7[a]	18.8	2.9	–	3d
32	unifacial	yes	30.2[a]	39.1[a]	5.9[a]	base	
39	none	yes	21.3[a]	21.8[a]	2.8	–	
41	none	yes	28.8[a]	31.5[a]	6.2	–	
42	bifacial	yes	38.9[a]	39.4[a]	8.3[a]	–	
43/36	none	yes	97.6[a]	29.5	6.1	base, midsection, partial tip (3 pcs.); asphaltum	3e
44	bifacial	yes	35.3[a]	13.2	2.6	–	3c
45	none	yes	44.8[a]	39.4[a]	8.2[a]	asphaltum	
46	none	yes	37.3[a]	38.4[a]	8.1[a]	base and midsection; asphaltum	4a
75	both	yes	59.0	41.9	6.6	asphaltum	
77	none	yes	103.7[a]	38.1	8.7	asphaltum	3f
81	none	yes	42.7[a]	40.2	5.0	base; asphaltum	4b

[a] Partial measurement.

The basal fragment of a large biface (Cat. No. 81, Fig. 4b) measures 42.7 mm. in length, 40.2 in width, and is 5.0 mm. thick. The base is concave and both faces are flat, with multidirectional striations and deep scarring from edge retouching. There is also a considerable amount of asphaltum adhering to the base.

The bifaces described above could all be functionally categorized as hunting or butchering equipment (points or knives). The biface assemblage also contained a possible drill (Cat. No. 75). This artifact is complete and measures 59.0 mm. long, 41.9 mm. wide, and 6.6 mm. thick. It has been bifacially percussion flaked along its edges, and as a result has very deep scarring. Multidirectional, linear abrasion striations are apparent on both faces under low magnification. A thick cortical rind is present on part of the artifact and a small amount of asphaltum adheres to the base.

DISCUSSION

These bifaces have several common attributes. All were primarily shaped by abrasion by rubbing with a coarse material, leaving parallel striae on their surfaces. This type of abrasion could be called grinding; however, a terminological distinction has been made because the abrading appears to be solely for shaping. The term "grinding" has been confined to the heavy alteration shown in Figure 4b (Cat. No. 81), where the stone was thinned by removing considerable amounts of the soft shale, producing a concave hafting area.

All of the bifaces were finished by percussion flaking along their edges, where silicified layers were exposed by the abrading activity. Bifaces were apparently hafted to wooden or bone handles. Six bases have asphaltum adhering to their surfaces (Figs. 3e-f and 4a-b, Table 1). Flat

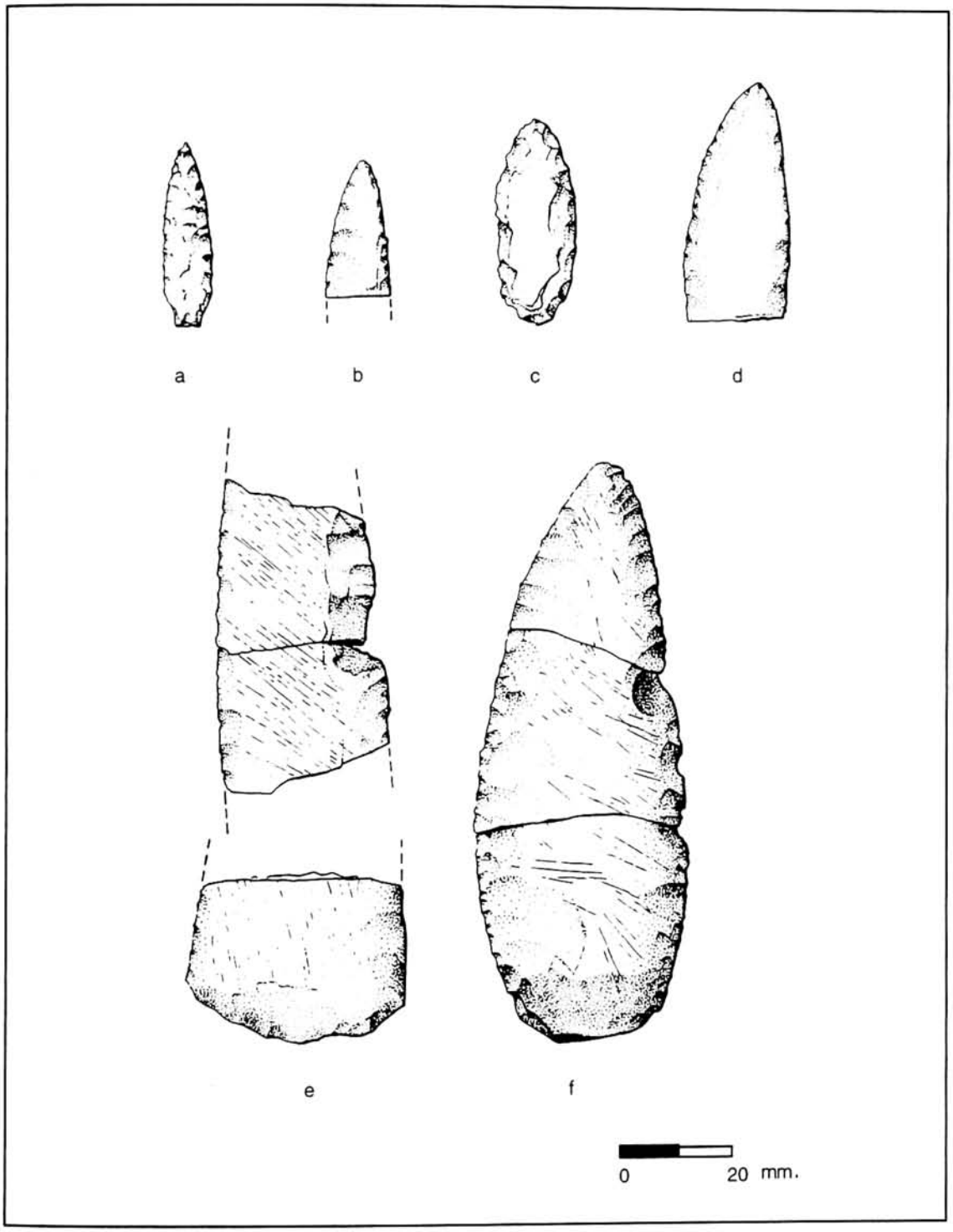

Fig. 3. Bifaces from CA-SNI-214: (a) small abraded biface (Cat. No. 4); (b) small abraded biface (Cat. No. 17); (c) medium-size ground biface (Cat. No. 44); (d) large biface (Cat. No. 27); (e) large biface (Cat. Nos. 36 and 43); (f) large biface (Cat. No. 77).

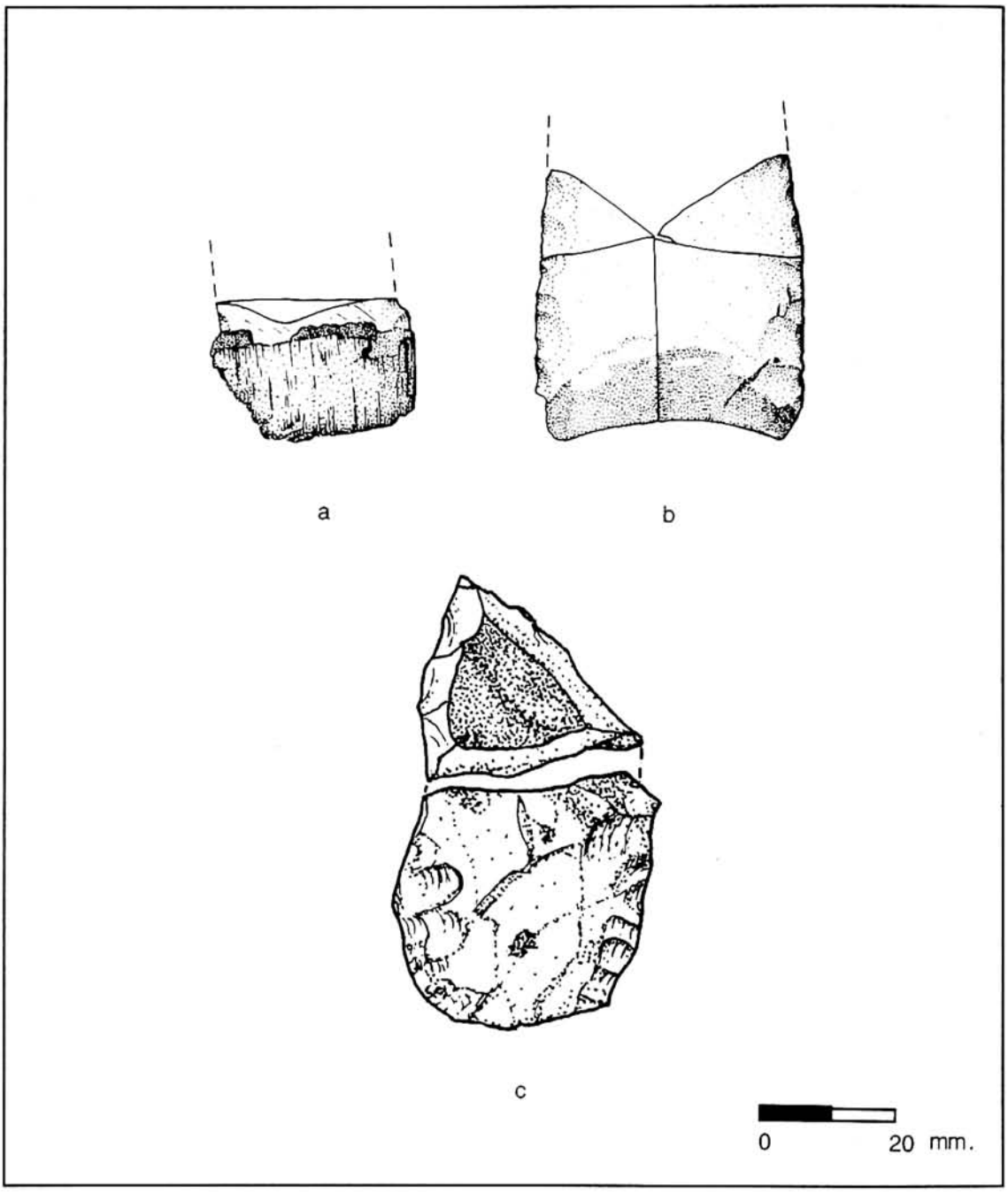

Fig. 4. Bifaces from CA-SNI-214: (a) large biface (Cat. No. 46); (b) large biface (Cat. No. 81). Figure 4c is a percussion flaked chert biface from CA-SNI-168 (Cat. No. 15).

pads of soft asphaltum are found on the northern beaches of San Nicolas, and after melting could have been used to haft tools (Williams 1994:G8-G9). One biface (Fig. 4a) has asphaltum with parallel lines imprinted on its surface, and under 30 power magnification these lines look like a

wooden handle impression. Additionally, all of the larger specimens were broken into several pieces, as if they had been deliberately snapped off.

There appear to be three size ranges among the bifaces, including a small biface approximately 30 mm. long, medium bifaces about 40 to 60 mm. long, and large bifaces about 80 to 100 mm. long. This size distribution might be significant. In a review of historic records, Hudson and Blackburn (1987:75) noted Spanish comments that the Chumash had three distinct knife sizes.

The abraded bifaces have not as yet been replicated, as an appropriate, accessible, cherty shale source has not been located. In an analysis of artifact attributes, however, some very distinct patterns were discerned (Table 1). Regardless of their overall size, the bifaces share a common manufacture style. Tabular pieces of cherty shale appear to have been abraded to a thin, lenticular form. The abrasion striations are often oblique or multidirectional, and were probably produced with a sandstone rubbing tool rather than a softer sharkskin abrader (Hudson and Blackburn 1987:74), because they are readily apparent at low magnification, or even with the unaided eye. After the bifaces were roughed out, a soft hammerstone may have been used to shape the edge. Percussion techniques were probably used because the resulting flake scars are deep and rounded; elongated, thin, and shallow scars would indicate a pressure technique. The bases were probably made by either pressure flaking, particularly on the smaller specimens, or by heavy grinding on the larger specimens. The final manufacturing step was to haft the biface onto wooden or bone shafts or handles using asphaltum as a cement.

The bifaces from CA-SNI-214 are atypical of bifaces and projectile points found among San Nicolas Island artifact assemblages. Although a complete review of all of the San Nicolas collections (particularly those collected during the last century and now housed in European museums) has not been performed, it is apparent that mainland arrow and dart point styles are uncommon in assemblages recovered during the last 20 years at sites such as CA-SNI-11, -16, -38, -168, and -351. These sites produced very few bifaces, fewer projectile points, and no biface production debitage. The larger bifaces that have been recovered are mostly made of finer textured metavolcanic or metasedimentary rock, while smaller ones are either chert or quartz. They are often preforms with undamaged edges, and their bases seldom display asphaltum. Smaller bifaces are fairly thick, and some appear to be harpoon points rather than arrow tips. The large and medium size bifaces are percussion flaked using a stone hammer, while the small points are often just flakes that are shaped by pressure techniques. A chert specimen from CA-SNI-168 (Cat. No. 15, Fig. 4c), which was recently recovered during an environmental assessment (Rosenthal and Padon 1995), exhibits deep, unpatterned, negative scars over much of the surface, the typical manufacture attributes of the larger percussion flaked bifaces. The CA-SNI-168 artifact is thicker and more ovoid in shape than the cherty shale bifaces, and is obviously a much sturdier instrument (Rosenthal and Padon 1995:16). Among the site assemblage, biface manufacture appears to be nonpatterned; no obvious parallel, converging, or overlapping reduction or thinning flake scars are present.

Several large, elongated bifaces are on display at the Santa Barbara Museum of Natural History. These bifaces appear to be manufactured predominantly by percussion reduction, with their edges being shaped by pressure techniques. They are also made from Monterey Formation quartz cherts rather than the cherty shale. The only other similar bifaces of which I am aware are those that were photographed by Robert Heizer among island collections at the Musee d'Homme in Paris (Hudson and Blackburn 1981). Although only CA-SNI-214 has pro-

duced such items in recent times, Heizer's photographs of the specimens of the nineteenth century collector De Cessac imply that abraded bifaces were found during the late nineteenth and early twentieth centuries by national and international museum expeditions to the California Islands.

There are at least three possible explanations for the occurrence of these atypical bifaces: (1) the bifaces may be a common but previously unrecognized aspect of island assemblages; (2) the bifaces could represent a special use tool kit; and/or (3) the bifaces could represent a ritual tool kit. Each of these explanations is discussed below.

Since island archaeological research began, several archaeologists familiar with toolmaking techniques, notably Meighan and Eberhart (1953) and Rogers (1993), have described stone assemblages from San Nicolas. No mention has ever been made, either by these researchers or any others, of cherty shale bifaces. Abraded bifaces were not recovered during excavation at sites such as CA-SNI-11, -16, -38, -168 or -351. Although cherty shale breaks easily, it is doubtful that broken biface sections would have gone unrecognized at these sites.

These bifaces could also represent a specialized, hafted tool that was used on an occasional basis for specific tasks. If this were the case, they would occur infrequently, and because few sites have been excavated, they may not have been previously encountered. Careful description and analysis of artifacts discovered during survey and/or excavation, as well as a review of existing collections, may eventually support this idea.

A third explanation is the possibility that abraded bifaces had a ritual, rather than a secular, function. Because these bifaces are presumed to have been deliberately broken before being placed in the burial, they may have been part of the ritual paraphernalia of the deceased. Access to highly workable chert was restricted on San Nicolas Island. Chert was imported and appears to have been used almost exclusively for smaller tools (e.g., drills and harpoon points) or occasionally for larger bifaces (e.g., knives). The alternative use of cherty shale, as well as the toolmaking technique described herein, appears to argue for a ritual function for the bifaces. The abrading, grinding, and edge retouch technique permitted bifaces to be made from a substitute material without wasting valuable imported chert pieces.

Material that is easily broken is not practical for sustained use as a hunting, butchering, or processing tool. If the bifaces had a solely ritual function, however, then the lack of sturdiness of the cherty shale may not have been a concern. It could be easily shaped, and its similarity in appearance to chert may have made it an attractive alternative. For ceremonial use, size or shape may have been more important than material. The tools may then have been buried with the deceased instead of being distributed to kinsmen or reworked into new tools. The use of substitute materials for objects that function in religious or curing activities is not an uncommon practice among Native Americans.

It is difficult to link an atypical manufacturing process to a tool user, particularly when the products of production (debitage) are tiny flakes or small, dusty piles of sediment. Further, the tool user may not necessarily have been the manufacturer, and it is possible that all cherty shale bifaces were produced at one location, such as the Palos Verdes Peninsula, and distributed throughout the southern Channel Islands. People living on the southern Channel Islands had limited access to highly workable siliceous stone. In contrast to northern Channel Islanders, they had an incentive to obtain and work alternative materials.

CONCLUSIONS

As opportunities to study San Nicolas Island collections at various museums become avail-

able, I am convinced that more evidence for ground or abraded bifaces will be found. What is more intriguing, however, is that other examples of specialized technologies may also be recognized. The discovery of these bifaces has provided insight into the choices made by people with limited access to desired resources. Isolation and distance from material sources are often incentives for technological innovation, sometimes creating distinctive artifacts. When these factors are combined with the maritime setting of San Nicolas Island, many opportunities to study peoples' imaginative answers to technological questions may appear.

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