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Lithic Resource Control and Economic Change in the Santa Barbara Channel Region

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THE distinctive geological structure of Santa Cruz Island, the largest land mass of the northern Channel Islands group (Fig. 1), includes major exploitable chert deposits along high ranges on the eastern part of the island. These chert resources are unique on the islands, and they were among the most important raw materials in Chumash territory. Their highly circumscribed distribution was important in establishing the potential for the emergence of resource control and legitimate craft specialization after ca. A.D. 1150-1300. During that time, island populations organized an intensive microblade manufacturing system that persisted until the historic era. These activities left deposits of millions of microlithic tools and associated production debris in sites on Santa Cruz Island. Microlithic manufacturing was linked technologically to intensive shell bead production activities at other sites on the northern islands (Arnold 1987). These two specialized crafts are among the most important and interesting dynamic features of complex Late Period (ca. post-A.D. 1300) hunter-gatherer society in the Channel Islands (Arnold 1987, In preparation).

The territory occupied by the Chumash and their prehistoric predecessors encompassed the northern Channel Islands and a large mainland area extending from modern San Luis Obispo to Malibu and inland to the western margin of the San Joaquin Valley. The region is characterized by significant physiographic, biotic, and geological diversity.

Each of these dimensions of variability has implications for the forms of human adaptation that developed during the course of several millennia of prehistory. A changing biotic milieu may require significant strategic responses from human populations (Arnold 1990a), but human response to stationary physiographic and geological features generally is assumed to reflect the relatively static nature of such features. Through time, then, changes in human exploitation of fixed geological resources, such as quarry outcrops, may be evaluated in terms of evolving cultural strategies regarding their use. In short, diachronic patterns of extraction of *undepleted* nonorganic resources in a given place are a consequence of human decision-making changes, rather than a function of change in the resources themselves. I consider here a case in the Channel Islands region, where important stone resources indeed were not depleted.

Patterns of use of lithic resources by prehistoric peoples in the densely populated coastal plains of Santa Barbara and Ventura counties and the adjacent northern Channel Islands are particularly interesting. Aboriginal use of these lithic materials can be understood in light of two factors. One is that exploitable, high quality, cryptocrystalline rock in this coastal region is relatively rare. The other is that the good conchoidally fracturing stone that does exist is extremely patchy in its distribution. During the last millennium, minimally, archaeological data indicate that there

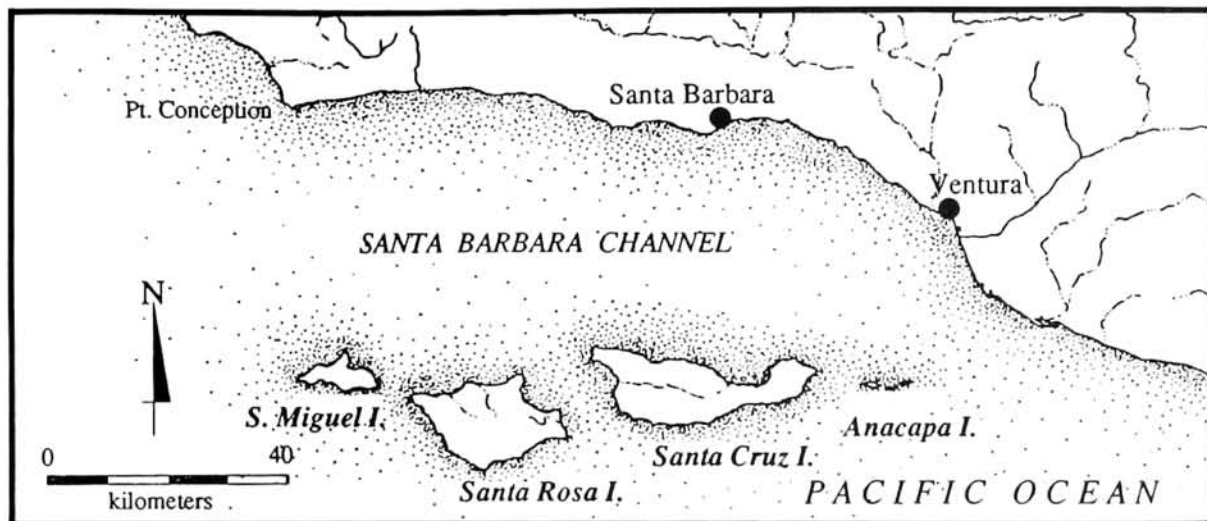


Fig. 1. The northern Channel Islands and adjacent mainland coastal region.

have been no radical cultural displacements in coastal and island Chumash territory. Had cultural substitutions occurred (such as was true of the Shoshonean incursion south of Chumash territory), they might have resulted in culturally different responses to the region's fixed, exploitable stone resources. This was not the case. However, it appears that the Santa Barbara Channel area populations did use limited, patchy lithic resources in significantly different ways through the latter part of the prehistoric sequence. In this paper, these changes in use of lithic materials will be linked to important sociopolitical changes.

Archaeologists doing research in mainland Santa Barbara County are refining interpretations of prehistoric lithic resource exploitation along the coast, particularly at several primary Monterey chert source areas north of Point Conception (Rudolph 1984; Arnold In press). I have examined more than 100 lithic collections from the Vandenberg Air Force Base, Lompoc, Gaviota, Santa Barbara, and Ventura areas in order to understand the production and distribution of chert tools in the region. An important Monterey chert biface production system centered in the

Vandenberg area, which appears to have had considerable longevity, is of special interest for the prehistory of the mainland coast (Arnold In press).

On the other hand, the northern Channel Islands witnessed a rapid and important change in patterns of stone resource use in later prehistory (Arnold 1985a, 1985b, 1987). Since 1981, my fieldwork has involved recovery and analysis of a number of major lithic collections from both eastern and western Santa Cruz Island sites. These sites include quarries, microlith production sites, bead-making sites, and specialized knapping locales. Test excavations at two sites, a quarry and a microblade production village, have yielded dense, substantial collections of chipped lithic materials (Arnold 1983). The previously unrecognized size and complexity of the lithic assemblages suggests considerable intensity of microblade production activities for sustained periods.

During the course of this fieldwork, more than 25 sites with significant microlith production debitage were recorded. These, plus two sites recorded in 1974 by the University of California, Santa Barbara,

constitute the primary data base for an examination of changes in islanders' control over their lithic resources. Previously, Swartz (1959, 1960), McKusick et al. (1961), Heizer and Kelley (1962), Curtis (1964), King (1976), Rozaire (1978), and others also noted distributions of microlithic artifacts at sites in the Santa Barbara Channel area, although the nature of the microlithic industry was just beginning to be understood. In these early years, this assemblage briefly suffered misinterpretation as a burin industry, and until about 1980, its full distribution, magnitude, and chronological placement were more or less unrecognized.

O'Neil (1984) presented outdated and misinformed interpretations of the Channel Islands microlithic assemblages. At the time that he wrote, substantial data on microliths and their chronological context were available (King 1976, 1981; Arnold 1983) but he did not cite them. Indeed, his statement, ". . . none of the southern California microblade data demonstrate a highly developed, intensive tradition comparable to Upper Paleolithic Europe" (O'Neil 1984:222) certainly is refutable and demonstrates his lack of familiarity with the collections from the channel region. The present paper should help to clear some of these misconceptions (Arnold 1987).

GEOLOGICAL INVESTIGATIONS

Geological literature on the northern Channel Islands (Rand 1930; Meyer 1967; Weaver 1969; Weaver and Meyer 1969) was employed to identify all potential chert-bearing areas on these four islands, since all microliths from island sites are manufactured from Monterey cherts. Field investigations and consultations with geologists then verified chert outcrop localities. Moderately high quality cherts are present in specific parts of the basal Monterey formation sequences on

Santa Cruz Island, and these represent the usable, conchoidally fracturing materials that were exploited prehistorically. However, "siliceous shales," "platy cherts," and other related types discussed in the geological documents describe materials that were not exploited prehistorically and were not usable for knapping activities. Many sections of the geological formations labeled this way were located in the field, and the low-grade "cherts" were tested for their knapping qualities and found to be lacking. In short, the geological term "chert" as used by local geologists (Weaver and Meyer 1969) includes a much broader range of materials than does the archaeological term.

Another problem in interpreting source areas for cherts on these islands stems from the fact that archaeologists with limited geological and lithic expertise have sometimes used the terms "chert" or "chalcedony" to describe materials that are actually derived from crevices in igneous formations on the islands. These materials in fact have a very different geological history than the cherts, they do not fracture predictably, and they must be evaluated separately. Importantly, while bifaces occasionally were made from these materials, microliths were not. Several unfounded claims for "chert" source loci beyond Santa Cruz Island can be dismissed because of this particular misuse of the term. Clearly, there has been a history of minor misunderstandings regarding chert sources on the islands.

The only significant source of high quality cryptocrystalline chert on these four islands is in the vicinity of the El Montañon mountain range on eastern Santa Cruz Island. In this area, several grades of usable Monterey formation cherts occur at a zone of geological contact between basal strata of Monterey shales and Miocene age volcanic rocks. One line of nearly continuous association of these

two formations is located on the western flank of El Montañón and has been labeled the "Contact Zone." There, prehistoric exploitation of 11 quarries is indicated by abundant microblade cores, rejected microblades, and associated byproducts. Within a radius of several kilometers, an additional 13 microblade production sites dating to two periods similarly exhibit significant concentrations of chert microlithic materials (Arnold 1987).

ARCHAEOLOGICAL INVESTIGATIONS

Systematic investigations of prehistoric uses of chert deposits on the northern Channel Islands began with these areas of major microlithic production on eastern Santa Cruz Island. The first sizable collections of chert artifacts from the islands came from the quarries and were collected in the late nineteenth century (Heizer and Kelley 1962). We now know that more than two dozen significant sites involved in microlith production are located in this vicinity.

Early investigations revealed that finished chert microlithic tools were used in the production of shell beads at a number of coastal villages, principally along southern and western Santa Cruz Island and on eastern Santa Rosa Island. It is now clear that virtually no microliths were retained to manufacture beads at the *eastern* Santa Cruz Island sites where the microliths were made; this is particularly true during the Late Period. Indeed, Late Period islanders became highly specialized regionally, with a clear separation between the east-end microlith-making villages and more westerly bead-making villages (Arnold 1987). Several types of shell beads were important to channel area people, as adornments and in ritual and domestic contexts. In addition, during the Late Period, an *Olivella* shell bead type reportedly served as a standard of value in exchange (King 1976; Hudson and Blackburn

1987).

Once detached from microblade cores (Arnold 1985b, 1987), microblades required minor modification at one end to become functional microdrills. The shaft was hafted into a slender dowel-like piece of wood and used by hand to drill *Olivella biplicata*, *Mytilus californianus* (mussel), *Haliotis rufescens* or *H. cracherodii* (abalone), *Tivela stultorum* (Pismo clam), serpentine, or other materials for beads (Hudson and Blackburn 1987).

What I will argue here is that island chert resources were widely available to many users during the terminal Middle Period (ca. A.D. 900-1150), when earlier phases of microlithic production began (Arnold 1987). I will show that, later, Santa Cruz Islanders began to restrict access to these resources. East-end residents started to manufacture large quantities of microblades at the same time that more westerly islanders began to manufacture substantial numbers of shell beads (ca. A.D. 1200-1300). Concurrent with this change in the use of chert resources, legitimate craft specialization in stone tool and bead production apparently developed. Elsewhere, it has been proposed that an important archaeological indicator of craft specialization is evidence of some degree of control over key resources (Arnold 1985a). A discussion of the relevant evidence is presented below.

Methods

Field methods employed to recover data pertinent to lithic resource control on Santa Cruz Island included intensive survey over the length of the Contact Zone and El Montañón area, in the deeply dissected canyons immediately to the west, and in portions of the adjacent north coast shore. Reconnaissance teams used 3-5 m. intervals between surveyors and systematic surface collection techniques. These activities were followed by test

excavations at a Middle Period quarry site (SCRI-93) and a Late Period microlith production village (SCRI-306). In addition, large zones of the central and western portions of the island have been surveyed, including all loci where chert-bearing sequences possibly are exposed. The eastern tip of the island, just beyond El Montañon to the east, has been inaccessible to scientific research for decades (due to landowner policy). We were therefore unable to investigate that area for either geological or archaeological resources during the 1980s.

However, in mid-1990, as the National Park Service began partial stewardship of the eastern one-ninth of the island, a brief visit was made to the east end (Arnold 1990b). This preliminary examination revealed that Middle Period microlithic production debris is present at several sites; these can now be added to the growing list of dispersed localities involved in microlithic manufacture during the late Middle Period. Survey shows that there are distributions of lower-grade but usable chert deposits in a few spots on this part of the island; however, most of the microliths in east-end sites appear to have come from the higher quality outcrops near El Montañon. Interestingly, one of these villages appears also to contain small amounts of Late Period microlith production debris, so one or more sites may be added to the considerably smaller roster of Late Period production sites once there is further opportunity for research. Limited collections from other east-end sites (such as those acquired by Ronald Olson in the late 1920s) have been useful in making preliminary assessments of the nature of archaeological sites in this sector of the island. This information thus far has supported propositions about the pattern of lithic resource control practiced by the prehistoric inhabitants.

In addition, large areas of the north

coastline between China Harbor and Prisoners Harbor were surveyed between 1981 and 1989 to locate chert outcrops and microblade production sites. Extensive areas of the interior of the isthmus of the island (where Monterey formation shales are abundant) have also been examined, and a number of localities elsewhere on the island that had some potential to contain conchoidally fracturing materials were visited. Areas selected for examination were those identified in geological reports as basal Monterey formation contiguous with Santa Cruz volcanic formation (the same pair of formations that produced the Contact Zone), or those where Monterey shales were reported to bear highly siliceous strata.

Attention was also focused on analysis of quarry use and the distribution of microblade production debris across all island sites with any such artifacts. Systematic surface collections at a number of quarries and microblade production sites and excavations at two key sites produced abundant data with which to address our research questions.

RESULTS

Chert Resources

Field investigations thus far confirm expectations that major, higher-grade chert beds are confined to the Contact Zone which lies just on the *west* side of El Montañon. As noted above, this must be qualified because there remain a few areas of Santa Cruz Island that have not yet been examined, including parts of the long-inaccessible eastern tip of the island. However, the chert sources observed on the east end during 1990 were expansive, eroded cobble scatters and fractured bedrock exposures. These appear to have been exploited sporadically for microlith manufacture during the Middle Period, and not at all for microlith production during the Late Period. It is not yet clear whether a few

high-grade outcrop areas may be present in the highlands east of El Montañon. In any case, if the quality chert-bearing zone is eventually extended eastward, it will have a minor effect on arguments regarding lithic resource control because any such sources would be so close to the Contact Zone that they could be treated as part of the same geographical unit.

Monterey strata dip westward at a steep 50° angle from El Montañon; consequently, the chert-bearing basal stratum is deeply buried west of the Contact Zone, with the exception of unreachable exposures in vertical cliff faces 2-3 km. east of Prisoners Harbor. Volcanic rocks, sandstones, shales, conglomerates, and other rock types dominate much of the central and westerly parts of the island; none of these are chert-bearing formations. There is, then, only this Contact Zone area in which quality chert resources could be obtained by aboriginal tool makers. Chert deposits of any size or quality are absent on Santa Rosa, San Miguel, and Anacapa islands.

Archaeological Sites

Local igneous, quartzite, crystalline, and quartz materials were utilized prehistorically for chipped stone manufacture throughout the northern islands. These materials were not, however, suitable for – or used for – microlith manufacture. Of perhaps 75,000 microliths and cores examined from many northern Channel Islands sites, none are made of materials other than various grades of Santa Cruz Island chert. At Goleta on the mainland, there is one site (SBA-60) with microcores and microblades made from local chert nodules (McKusick et al. 1961). All remaining examples of formalized Chumash microlith technology (see Arnold 1987) of which I am aware, from islands or mainland, are made from the distinctive, blocky island cherts. A few other kinds of small drilling or perforating

implements are known archaeologically in the region. These were, in contrast, fashioned from flakes (not microblades) of local materials and are not part of the widely recognizable formal Middle Period or Late Period microlith reduction technology. These unstandardized flake drills may have been used for drilling shell ornaments, fishhooks, or possibly beads. They would have been awkward for bead-drilling, however, and more effective for artifacts with larger holes.

Twenty-three quarries, small microblade production sites, and village sites involved to a significant degree in microblade production activities were identified between 1981 and 1985 in the El Montañon to China Harbor vicinity (Table 1), including two sites that had been recorded previously (SCRI-93 and -306). In addition, four village sites and two small inland microblade production loci (principally of Middle Period age) were recorded in 1990 on the east end of the island. The multi-component village at Prisoners Harbor (SCRI-240) has been identified with microlith manufacture for decades.

Study of surface and/or subsurface characteristics of these 30 sites reveals that they can be separated chronologically into two groups, one representing the terminal Middle Period (ca. A.D. 900-1150; chronology largely follows King 1981) and the other, the transitional Middle-to-Late and Late Period (ca. A.D. 1150-1785); only SCRI-240 at Prisoners Harbor spans the two periods. Assignments of dates are based on more than 30 radiocarbon dates in close association with microlithic assemblages. While it is not within the purview of this paper to outline all of the supporting data for the arguments to follow (see Arnold 1985a, 1985b, 1987), several points merit mention.

During terminal Middle Period times, tool producers made a distinctive microblade type that was broad, thin, and trapezoidal in cross-

Table 1
SANTA CRUZ ISLAND SITES WITH MICROLITHIC PRODUCTION ARTIFACTS

Site No.	Site Type	Period		Location ^a
		Middle	Late	
SCRI-93	Quarry; major microlith production	X		CZ
SCRI-394	Quarry; major microlith production	X		CZ
SCRI-395	Quarry; major microlith production	X		CZ
SCRI-396	Village; major microlith production	X		CZ
SCRI-397	Small El Montañon production locus	X		EM
SCRI-400	Small El Montañon production locus	X		EM
SCRI-401	Small El Montañon production locus	X		EM
SCRI-403	Small El Montañon production locus	X		EM
SCRI-410	Small El Montañon production locus	X		EM
SCRI-413	Small El Montañon production locus	X		EM
SCRI-408	Quarry; major microlith production	X		CZ
SCRI-409	Quarry; minor microlith production	X		CZ
SCRI-412	Quarry; minor microlith production	X		CZ
SCRI-414	Quarry; minor microlith production	X		CZ
SCRI-415	Quarry; major microlith production	X		CZ
SCRI-417	Quarry; major microlith production	X		CZ
SCRI-419	Quarry; moderate microlith production	X		CZ
SCRI-504	Village; moderate microlith production	X		EE
SCRI-505	Village; minor microlith production	X	rare	EE
SCRI-506	Village; minor microlith production	X		EE
SCRI-507	Village; major microlith production	X	few	EE
SCRI-508	Small inland east end production locus	X		EI
SCRI-509	Small inland east end production locus	X		EI
SCRI-240	Village; major microlith production	X	X	PH
SCRI-306	Village; major microlith production		X	CH
SCRI-392	Village/quarry; major microlith production		X	CH
SCRI-416	Village; moderate to major microlith production		X	CH
SCRI-420	Village; moderate to major microlith production		X	CH
SCRI-421	Village; moderate to major microlith production		X	CH
SCRI-422	Village; moderate to major microlith production		X	CH

^a Key to site locations: CH (China Harbor), CZ (Contact Zone), EE (east end of the island), EI (east end, interior highlands), EM (El Montañon), PH (Prisoners Harbor).

section (Fig. 2, top row). Thousands of these have been observed and recovered at quarry and microlith production sites directly along the Contact Zone, at very small production sites along El Montañon and at inland east-end loci, and at four east-end villages. The lithic assemblage associated with this type of microblade consists of exhausted microblade cores exhibiting reuse of platform areas (Fig. 2, N-U), rejected microblades (Fig. 2, J-M), rejected test cores, and waste flakes. The deeper radiocarbon-dated strata at Prisoners Harbor, which is the most westerly village where many microblades of this type were

made, provided the first chronological basis for dating this series of sites (Arnold 1987).

Among the most important characteristics of this phase of the industry are: (1) most microblade production sites are found across eastern Santa Cruz Island, but many others are found on Anacapa Island, elsewhere on Santa Cruz, on the other islands, and on the mainland coast; and (2) although a total of hundreds of thousands of tools were made at these sites over a period of several hundred years, insufficient numbers were made, and they were of inadequate degree of standardization, to argue that producers were craft

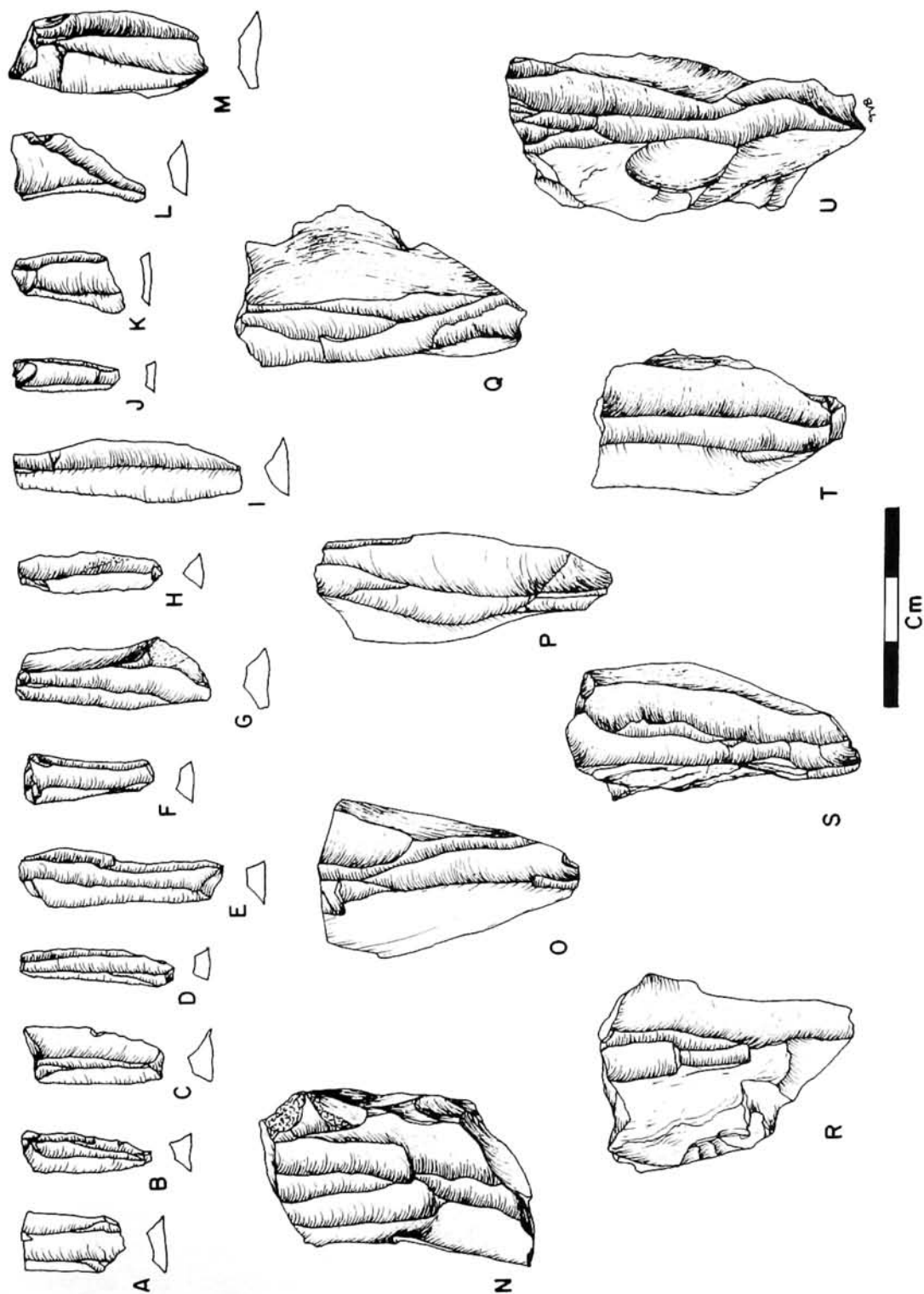


Fig. 2. Middle Period microlithic artifacts, ca. A.D. 900-1150 (from SCRI-93). A-G: trapezoidal microblades; H-I: triangular, unretouched microblades; J-M: rejected microblades; N-U: microblade cores.

specialists. Importantly, there are no data to suggest that either microblade manufacturing activity or access to chert resources was controlled during this era, and production followed formal reduction techniques but remained relatively unstandardized, with only modest success rates.

On the other hand, during the Late Period, sites concentrated in the north shore area west of the quarries (China Harbor), including the later phase of occupation of the multicomponent Prisoners Harbor village, exhibit microblades of a different type. Associated with these are exhausted cores, core rejects, core rejuvenation flakes, and other debitage. A now extensive series of radiocarbon dates from one China Harbor site, from Prisoners Harbor, and from several other sites where completed microliths of this type have been recovered consistently verify Late Period chronological contexts. These microblades are triangular in cross-section, are relatively narrow and thick, and most have a retouched dorsal ridge (Fig. 3, top row). Detached from small chert cores that display retouch along ridges below prepared platforms, just one or two microblades were removed from each core (Fig. 3, M-U). These cores rarely exhibit reuse of a specific platform locus. Also common in the Late Period assemblages are triangular microblades without dorsal retouch (typically about 15-20% of the total number of microliths).

Research on the microlithic industries of the northern Channel Islands now supports the following conclusions: (1) all Late Period microblades for the region were produced *only* within a small, spatially delimited district on the northeastern shore of Santa Cruz Island; (2) microliths of Late Period age were produced in significantly greater quantities than their Middle Period counterparts, even while production activities were increasingly centralized at a much smaller number of

villages; local labor directed to these ends was greatly intensified; (3) production methods became notably more standardized and success rates increased, so there are measurable improvements in the quality of microlithic products at the start of the Late Period, even while production quantity rose sharply; and (4) information from recent excavations at bead-making sites on western Santa Cruz Island (Arnold In preparation) indicates that intensification in microlithic production activities was closely coordinated with the intensity of standardized bead production on the west end. These several lines of evidence suggest that Late Period bead and microlith producers were regionally organized, legitimate craft specialists; thus, criteria of intensification, production for export, standardization, increasing success rates, and regional coordination of production activities are all met (Arnold 1987).

An estimated several million discarded microblades and more than one million microblade cores occur in a small group of five Late Period China Harbor sites, based on extraordinary artifact densities ranging up to 22,000 chert microblades and 5,000 microblade cores *per cubic meter*. Annual production of exported microliths far exceeded local needs and indicates organized manufacture of notable quantities (several thousand per year for four to five centuries) for export to bead-making localities. Channel Islands sites appear to represent a microlithic production industry even more intensive than those of the complex Mississippian societies (Yerkes 1983) in eastern North America. It is increasingly recognized that intensive practices of craft specialization are not the exclusive province of complex agricultural societies; complex hunter-gatherers such as the Chumash were specialized to a remarkable degree as well.

The cultural context in which these important technological and organizational

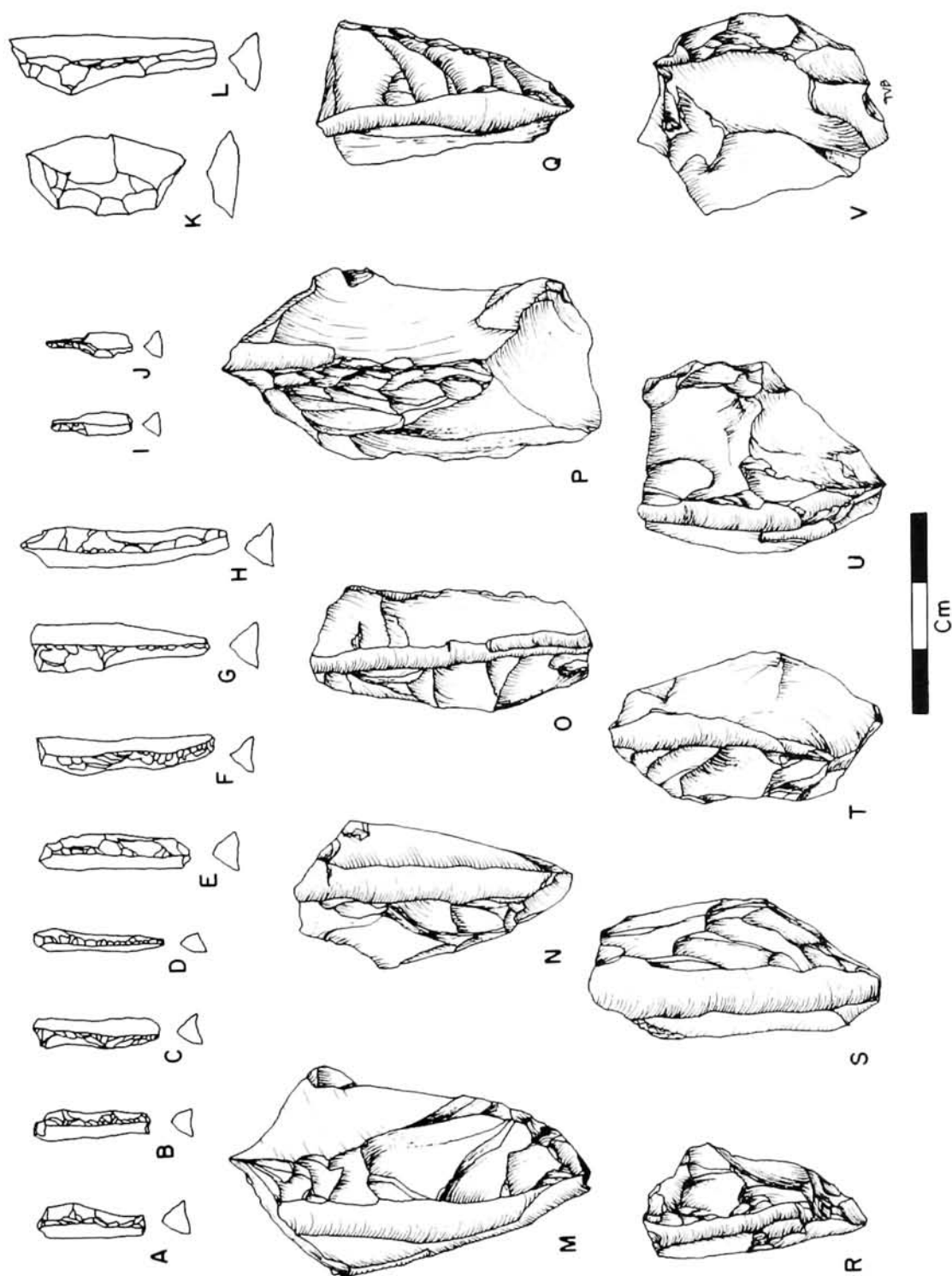


Fig. 3. Late Period microlithic artifacts, ca. A.D. 1300-1785 (from SCRI-306). A-H: triangular, retouched microblades; I-J: microdrills; K-L: rejected microblades; M-U: microblade cores; V: core with retouched ridge but no microblade detachment.

transformations occurred was highlighted by the development of beads that reportedly served as a currency for cross-channel exchange during the Late Period (King 1976). It is argued that as beads filled this new role, their production was increasingly restricted. Theory on the origins of "primitive" money systems indicates that the manufacture of money forms must be strictly controlled to be economically effective (Codere 1968). In the channel area, as beads became more important economically, so too did the tools used to create them, the microliths. Thus, it appears that microlith production evolved from a Middle Period activity which supported modest decorative bead-making operations scattered throughout the channel area (but principally on the islands) into a Late Period specialization that was an essential first stage of organized, intensive bead-making operations. By the Late Period, microlith production villages were located exclusively on northeastern Santa Cruz Island.

DISCUSSION

It is proposed that Late Period populations on Santa Cruz Island established control over their unique, valuable chert resource; this can be inferred from several lines of geological and archaeological evidence from throughout the region. Looking first at the adjacent mainland, while there are exploitable chert deposits along the coast in the areas north of Point Conception (Arnold In press), in inland areas north of the Santa Ynez Mountains (Franciscan chert formations), and well to the south on the Palos Verdes Peninsula, the 150-km. section of heavily populated coastal zone from south of Ventura to Point Conception has yielded only sparse, fairly small, cobble chert resources for aboriginal use.

During Early Period and Middle Period times, inhabitants of this important mainland coastal zone apparently imported many of

their raw materials or tools from inland, Franciscan chert-bearing localities and from rich sources of laminar Monterey chert north of Point Conception (Arnold In press). They also made use of low-quality local cobble sources and employed several nonchert resources. For example, the fused shale of Grimes Canyon in inland Ventura County was used to make projectile points. Some of the distinctive Santa Cruz Island cherts were also traded or directly acquired from the island during these times, including small amounts of chert for making microblade cores and microblades in the later Middle Period. Use of lithic resources was generally unrestricted, flexible, and largely uncontrolled by local interests prior to the onset of the Late Period.

Turning attention to the islands, a moderate tradition of Early Period and Middle Period bead-making occurred on Santa Cruz Island, undoubtedly because the blocky Monterey cherts ideal for drill production were most easily accessible there. Species of shellfish used in decorative bead-making also were abundant along the shores of the island. Importantly, however, as mentioned previously, some drill and bead manufacturing during the Middle Period also occurred on the mainland (McKusick et al. 1961) and at a number of localities on Anacapa, Santa Rosa, and San Miguel islands (Arnold 1987), usually using Santa Cruz Island cherts. So although it was relatively more cost effective to make microliths quite near the island sources of chert, a moderate amount of chert both unmodified and in core form left Santa Cruz Island for reduction at the other northern islands and the Ventura and Santa Barbara coasts. Clearly, pre-Late Period islanders did not restrict access to the Contact Zone chert outcrops.

But as *Olivella* bead production exploded in importance in the regional economy, and as one type of bead—made from the callus

portion of the *Olivella* shell—reportedly began to function as a currency in economic interactions (King 1981) sometime after ca. A.D. 1200-1300, there were concurrent repercussions in the supporting microblade production industry. It has been argued elsewhere (Walker 1986; Arnold 1987, In preparation) that a sustained marine water temperature fluctuation around this time (Pisias 1978) reduced shellfish and fish resources on which islanders were heavily reliant. Island populations responded to subsistence stress by turning to an increased emphasis on cross-channel trade, through which they could obtain some mainland terrestrial food supplies. Large quantities of beads were needed under such circumstances to fuel the exchange system, and the relatively greater emphasis on bead production on the islands was intensified. How would a rising group of organizers and managers of an intensified production and exchange system ensure demand for their product? They could exercise control over access to the most limited and circumscribed resource in the production system: the Santa Cruz Island cherts.

The most direct evidence for lithic resource control comes from a dramatic change in the distribution of island chert production debitage across the region through this critical period. There is a well-documented virtual disappearance of microlith production debitage outside the China Harbor-Prisoners Harbor area after ca. A.D. 1200-1300 (Arnold 1987). *Finished* chert microliths (microdrills) appear in significant numbers in bead-making sites to the west after this time, but the cores and other microlithic production debitage are absent at sites except within the northeastern coastal sector. The total number of participating microlith production sites drops from 40 or more, regionwide, to fewer than ten between the Middle and Late periods. Yet the total number of microliths

produced rises sharply in the Late Period.

Furthermore, recent augering and test excavations at various sites across the island have confirmed that a measurable drop in the availability of any kind of flaked Santa Cruz chert outside this northeastern production area occurred after ca. A.D. 1200. Flakes and cores of island chert across western Santa Cruz Island sites, for example, decline by more than 80% (by weight) from Middle to Late period strata. Other local lithic materials such as fine-grained igneous rocks increasingly were substituted as basic materials for chipped stone tools (Arnold 1990a). It appears that control over access to the chert outcrops on the island began to be asserted by eastern Santa Cruz Islanders at this time. Other social and economic data which indicate that Chumash society became increasingly hierarchically organized during this era (Arnold 1990a) suggest that aspiring leaders may have seized the opportunity to organize microlith production into a specialized activity. If so, this essentially led to control over most bead-making in the channel area (Arnold In preparation).

A key to this argument lies in the nature of the island chert itself: such developments were possible because these cherts are situated in a circumscribed area and are unique within the channel coastal region for their unlaminated, block-like structural qualities, making them alone suitable for efficient, standardized microblade production. Most of the production activity began to be centered on the China Harbor shoreline, where there was easy access to a small quarry (SCRI-392) that yielded high quality chert along the east margin of the harbor.

Current research is addressing a related issue: was a newly developing elite group on both sides of the channel becoming involved in control over intensified construction and operation of the renowned Chumash plank

canoes (perhaps invented ca. A.D. 500-700)? This technology would have made frequent and relatively safe cross-channel exchange more possible (Hudson et al. 1978). This is relevant because a rising leadership would have manipulated those parts of the economic system that were the most crucial and the easiest to control, i.e., exploitation of the cherts and transportation of the finished beads across the channel via the plank canoe.

Research on the emergence of new forms of social and political control requires assessment of many variables. I have developed a model of emergent cultural complexity for the prehistoric Chumash based on research into environmental stress, population-resource imbalances, political opportunism, and labor control (Arnold In preparation). Challenges presented by environmental events and food resource overexploitation, which would have upset the equilibrium between human populations and their rich marine resource base, may have been stimuli to cultural evolution in the northern Channel Islands region. The present discussion of lithic resource control is valuable insofar as it illustrates the potential importance of changes in access to, and the manipulation of, key resources, and the role of the rise of specialists. These developments were crucial to the evolution of Santa Barbara Channel society.

CONCLUSIONS

Lithic resource control in the Santa Barbara channel area is archaeologically identifiable, and the changing regional distribution of Santa Cruz Island chert tool production debitage is significant. Prior to A.D. 1150-1200, the distinctive Santa Cruz Island cherts were used for artifact production relatively broadly around the islands and to a lesser degree on the mainland coast. But after this time, island chert production

debitage, representing intensified microlith production, is found only within a small zone centered at fewer than ten sites on the northeastern shore of Santa Cruz Island. It appears to be the case that not only was no *microblade* production occurring outside this small area, but also extremely little unmodified or flaked island chert was circulating outside this zone after the onset of the Late Period. Recent excavations at a number of Middle Period and Late Period sites continue to confirm this observation, as do collections from numerous sites beyond this island.

At most Santa Cruz Island sites exhibiting moderate to major concentrations of island chert cores, tools, and debitage in Middle Period strata, chert density drops sharply in the Late Period. Yet at the same time overall demand for many products—including knappable stone—was rising. This alone is an important sign of change in the availability of island chert in the system. At this time, and until the historic era, chert use for microblade production increased measurably at the Late Period production villages clustering around China Harbor. Obviously, then, during these several centuries, the microlith production villages acquired and used a very sizable share of the chert (probably 99% by weight) available on the island.

It is important to note that Late Period microlith production techniques improved the durability of these tools; made straighter, thicker, and stronger by predetachment dorsal retouch and a roughly equilateral triangular cross section, they could drill tough, costly *Olivella* callus beads. Also, important advances in rates of production success from Middle Period to Late Period times, along with noted improvements in quality control and standardization (Arnold 1985a), indicate that production was increasingly managed and organized on a regional scale. Effort expended to organize production processes of

a valuable/money bead form would have included measures to ensure an uninterrupted supply of the critical chert resource and to prevent others from obtaining that resource. Lithic resource control thus may be inferred in part from independent correlates of organization of production of valuables (Codere 1968). These data appear to substantiate the presence of organized and controlled use of lithic resources at the onset of the Late Period (Arnold 1987).

There is considerable potential for further research into craft specialization and issues related to the rise of cultural complexity in the Channel Islands region. Identification of new organizational structures that play a role in the rise of simple "chiefdom" culture is important in the context of emerging theory on the origins of complexity among maritime hunters and gatherers. Future archaeological investigations on the Channel Islands should contribute significantly to theory building on the issues of specialization, organizational change, and governance of crucial resources in prehistory.

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