SANTA CATALINA'S SOAPSTONE VESSELS: PRODUCTION DYNAMICS

Virginia Howard

Archaeology Program, P.O. Box 951510, University of California, Los Angeles, CA 90095-1510
(310) 206-8934, FAX (310) 206-4723, Email: giahoward@juno.com

ABSTRACT

Soapstone vessels crafted by Santa Catalina Islands's prehistoric inhabitants were important exchange items in the Gabrielino (Tongva') and neighboring Chumash worlds. A review of mainland (and other island) artifact assemblages indicates an increasing demand for soapstone vessels in the Protohistoric and early Historic Periods. However, the effect of that demand on production activities is poorly understood. Current research on Santa Catalina incorporates the results from the recently completed survey of over 1,700 acres, detailed documentation of 76 source localities, and limited excavation of eight sites to investigate the full range of soapstone vessel production activities on the island. The regional approach of this research strategy facilitates contrasts between source localities exhibiting low intensity use to those that were markedly more intensively exploited. Analysis of these data demonstrate distinct variations in the production sequences, resource selection patterns, intensity of production, methods of production, success/failure rates, and associated tool assemblages. The data also emphasize the relative production importance of mining pits in comparison to the better documented quarried outcrops.

Keywords: Prehistory, craft specialization, Santa Catalina, Gabrielino, soapstone vessels, soapstone quarries, soapstone mines.

INTRODUCTION

Catalina's soapstone (commonly referred to as steatite) vessels have long been recovered in the archaeological assemblages of the Chumash and Gabrielino worlds. In particular, the large soapstone ollas are often found in contexts that suggest ceremonial and elite, conspicuous consumption in the Chumash world (Figure 1) and they were valued for cooking, storage and ceremonial purposes. Limited exchange of Catalina's soapstone vessels is documented as early as 800 AD (e.g., Malaga Cove). However, it is not until the very late Prehistoric/Proto-historic period (circa 1500 to 1800 AD) that the intensified demand for these vessels is evident in mainland and other island assemblages. How did changes in vessel demand affect production activities on Catalina Island?

The parent study from which this paper is drawn combines a regional analysis of the distribution and consumption patterns of soapstone vessels with an expanded survey

Figure 1. A soapstone olla, catalog number 30368, courtesy of the Smithsonian Museum, photograph by V. Howard.

of the soapstone quarry region, detailed site documentation, and test excavations to more fully comprehend the interaction between demand and production. Economic systems are composed of production, distribution, and consumption. Too often the mechanics and contexts of production are studied in relative isolation. This isolation of a specific component is a useful analytical convenience, but, we must not lose sight of the fact that the nature, level, and context of consumer demand coupled with the logistics of distribution provide the interpretational framework for understanding the context of production (Torrance 1982:49,75; Costin 1991:2-3; Schneider 1993:2). As such, while the data presented herein concentrate on production; the research was developed within that greater interpretive context.

Recent research on the Northern Channel Islands (Chumash territory) explores the relationship between resource stress, craft specialization, and the emergence of cultural complexity within the hunting, fishing, and gathering economy of the Chumash (Arnold 1987, 1991, 1992). The Chumash may have become a simple chiefdom by means of fundamental changes in the organization of labor, including the development of part-time specialization (King 1976, 1990; Hudson and Blackburn 1986; Arnold 1992, 1993). Catalina's socio-economic interaction with the Chumash in the Late Prehistoric and Historic periods is well documented

in the ethnohistoric, archaeological and mission records (cf. Wagner 1929; Bolton 1963; Johnson 1982, 1988; Hudson and Blackburn 1986; Gamble 1991). Did the intensification of Catalina's soapstone vessel-crafting follow a similar pattern to that of their Chumash neighbors to the north? The emergence of craft specialization can provide an opportunity for emerging elites to dominate certain facets of the economic sphere, and with that economic control, they may come to dominate the socio-political realm, as is evidenced in the Chumash case (Arnold 1987, 1995; Arnold and Munns 1994). However, it is also recognized that craft specialization can and does exist without social complexity (Clark and Perry 1990; Zeidler 1991; Arnold 1993). This paper addresses questions pertaining to the chronology, volume of production, and patterns of production of Catalina's principal industry.

The terms soapstone, steatite, chlorite schist, and talc schist, further described as "coarse" or "fine" grained, have been used by archaeologists to denote a relatively soft (Mohs hardness scale 1-4) silicate rock exhibiting a waxy or soapy feel and easily carved into a variety of shapes. *Steatite* and *soapstone* are probably the most often used terms for talcose rock in Californian archaeology. As used in the geological literature, the term *steatite* refers to the massive, relatively pure talcose rock, whereas *soapstone* is used to refer to the massive, impure talcose rock normally used for prehistoric crafting activities (Wells 1975; Wlodarski 1979; Williams and Rosenthal 1993). Soapstone, as found in the Gabrielino, Chumash and closely adjacent territories (i.e., Tataviam, Yokuts etc.), ranges from a fine-grained variant used to craft beads, effigies, small bowls, pipes and ornaments to the coarse-grained micaceous form of soapstone used to craft bowls, ollas, comals and boat-shaped vessels. While many sources for the fine-grained material exist on the mainland and on two of the Channel Islands, Catalina's relatively coarse-grained micaceous soapstone vessel quarries appear to be unique within the interaction sphere that included Gabrielino, Chumash, and peoples in closely adjacent territories and thus constitute the only known source for the massive micaceous soapstone vessels within that domain (cf. Romani 1982; Williams and Rosenthal 1993; Rosenthal and Williams 1992).

Catalina's Soapstone Research

A review of previous soapstone research, including ethnographic and ethnohistoric accounts, the work of early antiquarians, and modern research efforts, reveals a consistent interest in soapstone vessels in general and Catalina's quarries specifically. Despite 45 years of modern research on Santa Catalina Island, many of the basic questions regarding the intensity and context of soapstone production and the socio-economic implications of soapstone vessel exchange still remain.

Ethnohistoric and ethnographic sources offer no direct references to the production of soapstone vessels. However, several observations attest to the utility and longevity of these vessels. Costanso's 1769 narrative notes that "(They roast their seeds) in large bowls, putting among the seeds the red-hot pebbles or small stones; then they stir and shake the bowl so as not to burn it" (Hemert-Engert and Teggart 1910:45, Hudson and Blackburn 1983:201). Longinos Martinez's account of the Chumash in 1792 states that: "Their instinct leads them to manufacture their pots and pans of a kind of mica stone, which is so resistant to heat that it never wears out or becomes unserviceable" (Simpson 1961:54; Hudson and Blackburn 1983:201). Accounts by Hugo Reid and Alexander Taylor document that soapstone vessels procured from Santa Catalina Island were still being used into the 1850s and 1860s (Taylor 1861:36; Heizer 1968:44; Hudson and Blackburn 1983:201). Were the vessels simply the valued vestiges of earlier exchange relationships, or were vessels being crafted at this relatively late date? It has been argued that the last native inhabitants were removed from Santa Catalina Island between 1789 and 1818 AD (Rosen 1980:54).

J. P. Harrington collected the following information from Fernando Librado, an elderly full-blooded Chumash consultant, who knew indirectly of the crafting of soapstone ollas (Hudson and Blackburn 1983:33):

> "In making an olla, they selected good steatite. They did not select rocks which had a bad grain. Once they found a rock which would make a good stone olla, they started to shape it out by pecking it into a ball-like shape, according to the form they desired. They pecked all around the outside. When this was done they hollowed it out by pecking, breaking off the pieces inside as they worked. When this was done they smoothed it. . . They worked the rock so that what was the bottom of the rock would become the vessel mouth, while what was the top of the rock became the vessel bottom where they were going to put the fire. Once at the Ventura Mission there were two or three cracked stone ollas, and an old Indian named Felipe said that this was because they had been cut out of the rock bottom up. . . Called an olla "sukuy". There was a V. Indian by this name; his Christian name was Francisco, and he was of "sis'a" rancheria. The "sukuy" olla came from the island of Catalina; that is the one place where they got soapstone. At Ventura during a fiesta there were between 30 and 40 fireplaces, each with 3 or 4 ollas. Gee, they must have had a big olla factory over there!" (Hudson and Blackburn 1983:203).

Dr. Yarrow's interview with Señora Welch at Dos Pueblos ranch notes that: " the principal articles of barter given in exchange for the ollas (were) grass-seeds, furs, skins, acorns, and roots of different kinds" (Schumacher 1879:118). These few ethnohistoric and ethnographic observations add interpretative texture to archaeologically observed production and consumption patterns but the obvious limitations of those data means that we must rely heavily on the

archaeological record to answer questions regarding the organization of soapstone vessel production.

The soapstone quarries on Santa Catalina Island have intrigued antiquarians and researchers since Schumacher first documented their existence in the 1870s. His investigations convinced him that he had found "the main factory of the ollas of the California aborigines" (Schumacher 1879:119). Although his investigations were not comprehensive in nature, Schumacher's detailed observations documented the presence of both mining pits and quarried outcrops, outlined the basic production techniques for bowls and tools, and recognized the presence of metal tool marks on some outcrops, making a substantial contribution to soapstone studies (Schumacher 1879). The latter part of the nineteenth and early part of the twentieth century witnessed considerable collecting at the more accessible and visible quarry areas by antiquarians collecting for eastern museums (e.g., the National Museum, the Peabody Museum, at Harvard, and the Heye Museum of the American Indian) and by private collectors often looting for resale. Due to the nature of the deposits, the quarry zone was not as heavily impacted as the coastal village communities, although anecdotal evidence speaks of private collectors who removed unfinished or partially broken vessels from the quarries, finishing and carbonizing the vessels prior to selling them to gullible mainland collectors. Whole bowls and comals apparently became scarce as fewer intact cemeteries were available for excavation, necessitating the crafting of believable frauds. An article on soapstone frauds was published in 1898 (Rust 1898:79; Hudson and Blackburn 1983:204).

By the late 1950s modern research strategies had been employed to identify and record 41 quarry/mining sites, to investigate production techniques at the quarries, and to excavate a small camp site (Miners Camp, CA-SCAI-118) associated with vessel crafting activities (Reiss 1955; Meighan and Johnson 1957; Meighan and Rootenberg 1957). Meighan's excavation produced the first controlled sampling of a site in the quarry zone and posited a date of post-1000 AD for quarrying activities (Meighan and Rootenberg 1957:182). Subsequent excavation at the site using 1/8th inch screen recovered several shell beads and two glass beads dating to the Mission Period, firmly dating the upper levels of the site to the Historic Period (Rosen 1980:48). Meighan and Johnson's work in the quarry region noted two processes of vessel removal: 1) a natural projection would be rounded, undercut and pried off, 2) the vessel would be shaped by excavating, creating a spherical form which was then undercut and pried off (Meighan and Johnson 1957:26).

After a hiatus of more than ten years, the 1970s and early 1980s witnessed a resurgence of research interest in the quarries and associated camp sites. Site relocation surveys performed by crews from the Archaeological Research Unit of the University of California at Riverside in 1976 concentrated on the relocation of previously recorded quarry sites, providing detailed site record updates. Extensive excavations at CA-SCAI-26, a broad shallow midden associated with a soapstone quarry at Ripper's Cove were undertaken in 1977. In contrast to the excavations of CA-SCAI-118, CA-SCAI-26 yielded the array of bone, lithic and shell artifacts, and features (four burials) expected from a longer term settlement (Reinman and Eberhart 1980:98). The assemblage clearly reflects the importance of soapstone vessel-crafting to the site's inhabitants (Reinman and Eberhart 1980:98). Four radiocarbon dates indicate a potential occupation date from 1340 to 1730 AD, but, the absence of historic artifacts suggests a Late Prehistoric/Proto-Historic Period use or perhaps a very limited historic use of the site (Reinman and Eberhart 1980:68). Three additional excavations were undertaken in campsites associated with quarrying activities ("BC-572," "BC-429A," and CA-SCAI-50) but none have been fully analyzed or published (Wlodarski 1979:340).

The excavation at CA-SCAI-72 by Wlodarski et al. (1984) constitutes the only excavation undertaken specifically at a quarry, and two results of that research are particularly significant for understanding production activities on the island. First, metal tools were used at the quarry. Second, there was substantial subsurface quarrying activity present at the site. Where only 10 bowl scars had been visible above ground, excavation revealed a concave surface where several layers of vessels had been removed. Conservative estimates derived from the mass of rock removed argues that 180, 30-cm-by-30 cm vessels could have been removed from the outcrop (Wlodarski et al. 1984:58). In the early 1980s, Williams and Rosenthal (1993) undertook a geologic survey of some Catalina Island quarries (no mining activities are mentioned) and a detailed surface documentation of a production and quarry site at the Buffalo Springs reservoirs in order to evaluate the evidence for craft specialization in soapstone vessel production. On the basis of this rather limited research, they concluded that it was unlikely that specialized production of soapstone vessels had occurred on Santa Catalina Island (Williams and Rosenthal 1993:42-44). My own research demonstrates that this conclusion was premature, based as it was on evidence from a very limited part of the large array of quarries and mining pits on this island.

METHODS

My phase I field efforts involved extensive survey of central portions of Santa Catalina Island and mapping of sites to document the number and regional extent of the steatite sources and vessel production sites. Project members surveyed over 1,700 acres within the Ollas 1 geologic zone (OMS1, chlorite, actinolite, talc melange [Bailey 1940]), adjacent landslide areas, and shear zones (Figure 2). I produced detailed site maps, and notes regarding the range of variation present in steatite vessel production sequences, resource selection patterns, intensity of production, methods of production, and associated tool assemblages. I made petrological observations about the quarried outcrops and associated failed vessels, promoting a more accurate measurement of the success/failure rate for vessel production.

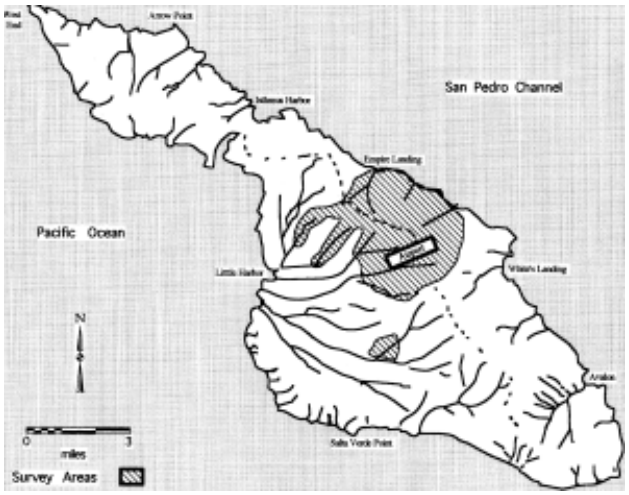

Figure 2. Areas surveyed for soapstone quarries and mines.

Finally, I documented (at the quarried outcrops) patterns and types of tool marks, numbers and sizes of vessel scars, sizes of removal stubs, and the techniques utilized to retouch surfaces in preparation for the removal of additional bowls. This data demonstrated variations in intensity, production sequences, resource selection and standardization at the quarries.

While the data collected from the regional survey added much to our understanding of source areas, these results were not conclusive on several levels. Comparison of data from early accounts and site records illustrates the extent of unauthorized surface collecting that has occurred on the island. It is entirely possible that some of the patterns observed from surface assemblages are a consequence of past disturbances to the sites. Also, the nature of production activities associated with mining pits makes them difficult to assess from surface assemblages. Moreover, twenty one quarries exhibited signs of subsurface quarrying activities, and therefore could not be assessed solely on surface evidence. The excavation of CA-SCAI-72 was the only previous excavation at a quarry site (as opposed to associated camp and settlement areas). Therefore, I began a program of limited subsurface testing to better understand the range of production activities at these types of sites. Eight quarry/mining sites were selected using a stratified random sampling method. The strata are site types derived from the survey phase of investigation. Site types identified by surface examination included:

1) Isolated, intensively-quarried outcrops (with 10 to 80+ visible bowl scars from the last stage of quarrying; often exhibit evidence of subsurface quarrying; may exhibit evidence of slab removal for the crafting of comals; lack evidence of mining; and, can be either a single outcrop or cluster of outcrops);

2) Intensively-quarried outcrops associated with one or more mining pits;

3) Isolated, moderately-quarried outcrops (5 to 9 bowl scars, may exhibit evidence of subsurface quarrying activity);

4) Moderately-quarried outcrops associated with one or more mining pits;

5) Isolated outcrops exhibiting low-intensity quarrying efforts (1 to 4 bowl scars, few exhibit evidence of subsurface quarrying);

6) Low-intensity quarried outcrops associated with one or more mining pits;

7) Isolated mining pits (no quarry present); and

8) Isolated outcrops exhibiting only a few random tool marks (no evidence of vessel removal from the outcrop, no evidence of mining present).

No sites from site Type 8 were selected for excavation due to the minimal nature of the activity. Site Type 1 includes one of the few identified quarries for the crafting of the large ollas. Therefore, two sites from this category were selected for subsurface testing. Between two and four excavation units were placed at each site, dependent on the intensity of production activities and number of features. A total of 26 units was placed at the eight sites. Units were placed adjacent to quarried outcrops, in the debris rim and or backfilled portions of mining pits, and in production/refuse loci. Manual excavation proceeded in 10 cm levels with matrix processed over 1/8th inch mesh screens. Column samples were collected and subjected to small screen (1/16th inch) analysis to recover fine fraction data.

RESULTS

Seventy-six vessel mining and/or quarrying sites are documented in the vicinity of Catalina Island airport, Potts Valley (also known as the Valley of the Ollas), Empire Landing, Eagle's Nest, and Little Springs Drainage. The term "quarry" is used here to denote a steatite outcrop from which vessel blanks have been shaped and removed including workings that extend below the surface (Figure 3). The removal of bowls from the outcrop results in depressions or "bowl scars," within which the "bowl stub" (a circular neck from undercutting the vessel prior to removal) is often visible. Many outcrops exhibit a concave surface from the removal of more than one layer of vessels. In contrast, the term "mining pit" is used to denote an excavated pit feature created by mining for steatite float (disconnected boulders and cobbles) (Figure 4). Float materials accessed by mining excavations lie within two meters of the ground surface. Mining pits, especially when intensively utilized, are associated with a rim of debris composed of failed vessels, the debitage from crafting bowls, and raw material unsuitable for the crafting process. Quarries and mining pits may occur as separate entities or may be associated in more complex sites.

Figure 3. A soapstone quarry.

Figure 4. A soapstone mining pit.

The 76 sites encompass 79 quarried outcrops and 70 mining pits. When assessing prehistoric production activities, these site totals are conservative on several levels. Ongoing removal of the goats and feral pigs, and the limitation of bison and deer populations have together resulted in a vegetation rebound which have undoubtedly obscured some small outcrops and mines. Catalina's significant topographic relief promotes an active erosional and depositional environment. Also, many mining pits are in the process of silting-in and others have undoubtedly done so. Continuing deposition has probably buried a number of small, ground-level outcrops, an ongoing process observable at many sites. In three cases, quarried outcrops originally located on the terrace above a drainage have been undercut and are presently found in the drainage, resulting in water erosion of bowl scars and tool marks located below the high water line. Erosion and lichen growth combine to obscure tool marks on some outcrops. Historic impacts to the quarry/mining zones have also occurred, including: historic quarrying and mining operations in the Valley of the Ollas; road construction and maintenance; the construction of the Catalina's airport; and the excavation and maintenance of game ponds (i.e., at the Buffalo Springs Reservoirs).

Survey and excavation efforts documented distinct differences between sites displaying low intensity use and those sites that were markedly more intensively exploited. Thirty-nine sites are classified as low-intensity, containing either low intensity quarries from which less than four vessels have been removed and no evidence of subsurface quarrying and/or small shallow mining pits with no development of a debitage rim. Twenty-four sites are classified as intensively-utilized based on the number of bowl scars present on the quarry(s), the size and number of mining pits, the development of a debitage rim surrounding the mining pit, and the surface assemblage. Eleven of these sites contain intensively utilized quarries, ten sites contain intensive mining activity, and three sites consist of both intensively-utilized quarries and intensive mining activities. Where an outcrop reflecting low intensity of exploitation occurs adjacent to mining pits, it is not unusual for there to be evidence of only tool marks or one bowl extraction, perhaps to test the quality of the outcrop. The outcrop was then abandoned but an extensive mining effort occurred, as is clear from the multiple failed vessels and the development of the debitage rim surrounding the pit. Twelve sites are classified as moderate-intensity, These sites demonstrate use patterns that are intermediate between the low-intensity and high-intensity sites. Seven of these sites exhibit evidence of subsurface quarrying and of production patterns more closely aligned to patterns documented for intensively-utilized sites. Further investigation may require the reclassification of these sites. One quarry could not be classified because the terrace upon which it originally sat has collapsed into the Cottonwood drainage. Subsequent erosion of all vessel scars below the high water line and the washing away of associated artifacts renders classification of this quarry, difficult.

Chronology

An ongoing difficulty with quarry studies in general and Catalina's soapstone quarries specifically, is the relative dearth of datable materials directly associated with quarry/mining sites. Previously reported assemblages from CA-SCAI-26 (directly associated with at least one intensively utilized quarry) and CA-SCAI-118 demonstrate the presence of intensive soapstone vessel production from 1350 AD and into the historic era. Dated assemblages including finished vessels in mainland and island domestic contexts place the intensive crafting of soapstone vessels after 1500 AD, and the crafting of the large, small-mouthed ollas well into the historic era. The quarry at CA-SCAI-104 represents one of the few identified quarries for the crafting of the large ollas, and can be cautiously dated into the Historic Period based on assemblage distribution patterns. One goal of the present research program was to further address this key issue. Our excavations recovered one radiocarbon sample from the debitage rim surrounding the intensively-utilized mining pit at "SCAI-95-19" (temporary number). Beta Analytic processed the sample and returned a date of 230 $\pm$60 years BP (marine calibrations using 225 $\pm$35 for local reservoir effect).

Evidence of metal tool marks has also proven useful in the relative dating of the intensively worked outcrops. Where evidence for use of metal tools is present at the intensive quarries, it offers a means to date these in the historic era. Seven of the fourteen sites containing intensively worked quarries exhibit marks from the use of metal tools. Debitage from the upper levels of three units placed in the debris rim surrounding an intensively-utilized mining pit also exhibited evidence of metal tool use. Santa Catalina's native inhabitants may have had earlier access to a broader array of European goods than those living on the mainland and other Channel Islands. In 1598, a Manila galleon, the *San Pedro* was shipwrecked in shallow waters off the coast of Santa Catalina, with its crew and passengers spending several months on the island prior to rescue (Muche 1977, 1978, 1981). Vizcaino's diary of his 1602 voyage notes that "an Indian woman brought him two pieces of figured China silk, telling him that they had got them from people like ourselves, who had negroes; that had come on the ship which was driven by a strong wind to the coast and wreaked" (Bolton 1963:85). The combination of long-term interaction with the shipwrecked Europeans, and the potential for drift material from the ship as it broke up in shallow waters may have resulted in unusual numbers of European goods (including metal) becoming available to Santa Catalina's native population. In sum, nine of the fourteen sites containing intensively-quarried outcrops and one of the intensively-utilized mining pits can be dated to the Protohistoric and Historic periods. At least the end of the use-lives of these sources are Historic. Unfortunately, the relatively low activity levels present at the low intensity sites hinder attempts at dating.

Volume of Production

Estimating the volume of production from Santa Catalina's soapstone sources is a difficult research question. Though early researchers waxed poetic regarding the number of sites and extent of the quarrying activity on the island, later researchers questioned those levels of production (Schumacher 1879; Meighan 1957:176; Williams and Rosenthal 1993:43). The number of soapstone vessels identified in assemblages from the mainland and other Channel Islands illustrate that vessel production had intensified far beyond the utilitarian requirements of Santa Catalina inhabitants, but the extent of that intensification is poorly understood. Past attempts at production estimates have concentrated on the excavation of one site and the detailed surface documentation of another (Wlodarski et al. 1984; Williams and Rosenthal 1993). Therefore, integral in our survey and excavation goals was the gathering of data to better address questions of the volume of production.

My survey and excavation results serve to underscore the importance of including mining activities in estimates of the volume of production. Recent research has virtually ignored mining pits in favor of the more obvious quarried outcrops. In some cases, the occurrence of mining activities was not recognized, while in others, the term mining pit is used to refer to the depression at the base of a quarried outcrop caused by subsurface quarrying. As used here, the term "mining pit" explicitly refers to the depressions caused by the excavation for and removal of soapstone cobbles for the crafting of vessels. Our survey crews located seventy mining pits ranging in size from just under a meter in diameter to those measuring approximately seven meters in diameter. My petrological examination of quarried outcrops and associated failed vessels documented a material difference between the petrology of the outcrop and some of the failed vessels at nine sites. These sites contained vessels that could not have been removed from the quarried outcrop on site (perhaps indicating the presence of shallow mining pits, now silted in). As noted above, mining pits may be isolated; associated with low, moderate or intensively utilized quarries; or grouped as a series of associated pits. At four sites (CA-SCAI-77, CA-SCAI-82, CA-SCAI-54 and "SCAI-95-19"), excavation units were placed in the debitage rim surrounding a mining pit. Discussion of the results from one of these sites is enlightening.

"SCAI-95-19" consists of an isolated mining pit, surrounded on the downslope side by a well developed debris rim, associated tools and failed vessels. The site is located outside the area traditionally regarded as the quarry zone, and its surface assemblage is characterized by vessels broken in every stage of production, rather than the more limited assemblage evident at well-collected sites. The presence of a single mining pit at the site offers an opportunity to assess the range of production activities associated with a specific pit. Four units were placed to assess the depth and composition of the debris rim, and to determine whether the debris on the western side of the pit was a backfilled extension of the pit or a simple extension of the debris rim surrounding the pit. All soapstone debitage exhibiting tool marks was recovered and quantified. Table 1 contains corrected totals for the weight of soapstone debitage exhibiting tool marks, and reflects the removal of any large debitage fragments that may have resulted from the excavation of the mining pit rather than from the crafting of vessels. Approximately 46,133.6 grams of soapstone debitage (corrected total) was recovered from the four units.

Replicative experiments, crafting bowls of similar size to those failed vessels found on site provides a means for interpreting these numbers. The crafting of one bowl 27 to 30 cm in diameter (the size of failed bowls on the site) resulted in the generation of approximately 1,550 grams of debitage recoverable in 1/8th inch screen and roughly twice that weight in steatite dust and debris smaller than 1/8th inch. Conservative extrapolation from the corrected weight of debitage from these four units suggests that a minimum of 29 vessels, 27 to 30 cm in diameter, could have been crafted from the recovered soapstone debitage. This number must be balanced by evidence of vessel failure. A total of nine vessel fragments was recovered from the excavation. Six of these are from the same unit and level (Unit 4, 30 to 40 cm) and appear to be from the same vessel. Even when we factor

Table 1. Soapstone debitage exhibiting tool marks recovered from the excavation of four units in SCAI-95-19, corrected totals are presented in the first column and raw totals are in parenthesis.

1 m x 0.5 m units	UNIT 1	UNIT 2	UNIT 3	UNIT 4
00-10 CM	401.4	201.4 (547)	326.6 (1124)	203 (531)
10-20 CM	2275.7 (5715)	703.3 (1121)	622.4 (2266)	3502.8 (8202)
20-30 CM	7081.5 (14731)	808.3 (867)	3449.8 (7609)	5037.8 (9908)
30-40 CM	7288.4 (14348)	592.4 (740)	1488.8 (4698)	2255.3 (4544)
40-50 CM	789.2 (2832)	2866.2 (6920)	1326.7 (2014)	
50-60 CM		2130.6 (4970)		
60-70 CM		2782.0 (6483)		
TOTAL	17,836.2	2,305.4	13,666.4	12,325.6

in the total surface assemblage of eleven vessel blanks, preforms, bowls, and fragments, the relative success rate appears to be quite high. Survey efforts have documented thirteen sites that contain intensive mining activities. At least nine of these sites appear (from surface assessment) to equal or surpass the intensity demonstrated here. Clearly vessels crafted from material excavated from mining pits made a substantial contribution to the volume of production on the island.

Understanding the production activities at intensively-quarried outcrops involves more than simply counting the number of vessel scars present on the outcrop and using the surrounding failed vessels to estimate error ratios. My survey efforts documented 21 sites containing quarries with evidence of subsurface quarrying activities. Excavation units were placed adjacent to three of these quarried outcrops. At two of these sites, CA-SCAI-77 (a large, intensively-worked quarry) and CA-SCAI-59 (a quarry initially classified as moderately-worked), the excavation units revealed substantial subsurface quarrying activities. Prior to excavation, just six vessel scars were visible at CA-SCAI-59 and the quarry was designated as of moderate-intensity, even though the placement of vessel scars and pattern of tool marks more closely resembled intensively utilized quarries. When completely exposed, the quarry face extended 95 cm below ground surface and between 50 and 60 cm outward in a concave fashion from the main body of the quarry. Clearly, at least two layers of vessels had been removed from the quarry's face. The quarry was then reclassified as intensively-worked. The quarry at CA-SCAI-77 followed a similar pattern. Over thirty vessel scars were initially documented on the outcrop, and excavation revealed evidence of subsurface quarrying extending over 1.5 m outward and 50 cm below ground surface. This new information substantially increased the vessel production estimates at a site already identified as intensively-utilized, based on both the heavily quarried outcrop and the presence of two large mining pits. In distinct contrast, excavation units placed at low-intensity quarries yielded no evidence of subsurface quarrying activity and no artifacts below 15 cm in depth.

Production Patterns

Several production patterns exhibited by high-intensity quarries are relevant to questions about standardization of production procedures and possible control over use of the source areas. My study of the placement of vessel scars on the intensively-worked outcrops exhibits patterns not seen at low-intensity quarries. I see the labor investment required to carve out a vessel as the effort required to excavate each of four sides around the vessel. Therefore, excavation of the first vessel entails the greatest labor investment. If a second vessel excavation is placed directly adjacent to the first, then this vessel requires less labor to excavate as one side is already excavated, when the first bowl was removed. The third vessel could be placed to take advantage of the two earlier bowl removals, and thus even less labor is required for the removal of the bowl. However, at many intensive quarries, this pattern is modified. The third and fourth vessels are removed to set up the excavation of a fifth one in the center of the four. In this pattern, the removal of the fifth vessel requires little additional labor as the majority of the excavation has occurred during the excavation of the other four vessels. This is not the pattern of labor investment expected if bowl removal were occasional, haphazard or if there was no reason for the individual craftsperson to benefit from the pattern of initial labor investment. This pattern argues for some level of restricted use of the intensive quarries.

The standardization of the pattern of tool marks at several of the intensively- worked quarries also reinforces this interpretation of the presence of craftsmen. First it must be understood that both stone and metal tools have often been used on the same outcrop, and therefore it is necessary to separate the tool patterns into separate categories. Where stone picks are being used on an outcrop (e.g., CA-SCAI-26, -58, -63, -77 etc.), they are consistently used in a downward motion from the upper portion of the scar down to the base of the scar. Where metal tool marks are evident, they have been used in a circular pattern around the scar. At intensively quarried outcrops, like CA-SCAI-35, this translates into a very interesting pattern of tool use. The outcrop is measured 7.32 m in length, 4.5 m in height, and between

4 and 5 m in width. The quarry has been worked extensively on its north/northeast face and exhibits at least 27 measurable bowl scars, the remnants of four to six scars too incomplete to measure, and exhibits evidence of subsurface quarrying activities. While both stone and metal tool marks are evident, the majority of the scars have been made using metal tools. Tool marks on scars at the northern side of the quarry all run in a counter-clockwise direction, while for the eleven relatively complete scars at the southern end of the quarry, all the blade marks run in a clockwise direction. These highly structured patterns of tool use may suggest just two or a few specialized craftsmen.

DISCUSSION

Although limited space precludes the full presentation of all data I have gathered to evaluate the existence of part-time craft specialization, the evidence presented does illustrate the range of variation across the archaeological landscape of soapstone vessel production. Sites range from low-intensity sites to sites that were markedly more intensively utilized. The majority of the vessels exchanged to the mainland in the Protohistoric and Historic periods came from these high intensity-quarries and mines, underscoring their importance to any evaluation of soapstone production activities. While historic activities have certainly impacted the quarry/mining zone, our surveys were able to document the existence of twenty four intensively-utilized sites, and several of the sites now categorized as moderately-used may be categorized as high-intensity sites with additional research. Evidence of metal tool use at seven of the intensive quarries and at one of the intensively-utilized mining pits, coupled with the radiocarbon dates from CA-SCAI-26, argues for a Protohistoric/Historic date for a number of these sites.

ACKNOWLEDGMENTS

The field work on Santa Catalina Island was supported by the Santa Catalina Island Conservancy; University of California, Los Angeles, Friends of Archaeology Grant; and a National Science Foundation Dissertation Improvement Grant awarded to Jeanne Arnold and Virginia Howard. Numerous volunteers from the University of California, Los Angeles, Friends of Archaeology, and the Santa Catalina Island Conservancy Volunteer Program provided good natured and much appreciated field help. I am also very grateful to the Staff of the Santa Catalina Island Conservancy for their generous support, and constant enthusiasm. Patricia Moore and Stacy Otte of the Santa Catalina Island Museum facilitated access to existing collections, and provided invaluable knowledge of the historic background of Santa Catalina Island.

LITERATURE CITED

Arnold, J. E. 1987. Craft specialization in the Prehistoric Channel Islands, California, University of California Press. Berkeley, CA.

Arnold J. E. 1991. Transformation of a regional economy: sociopolitical evolution and the production of valuables in Southern California. Antiquity 65:953-962.

Arnold J. E. 1992. Complex hunter-gatherer-fishers of prehistoric California: chiefs, specialists, and maritime adaptations of the Channel Islands. American Antiquity 57:60-84.

Arnold J. E. 1993. Labor and the rise of complex hunter-gatherers. Journal of Anthropological Archaeology 12:75-119.

Arnold J. E. 1995. Transportation innovation and social complexity among maritime hunter-gatherer societies. American Anthropologist 97:733-747.

Arnold J. E. and A. Munns. 1994. Independent or attached specialization: the organization of shell bead production in California. Journal of Field Archaeology 24:473-489.

Bailey, E. H. 1940. Generalized geologic map of Santa Catalina Island, California.

Bolton, H. E. 1963. Spanish explorations in the southwest, 1542-1706. Barnes and Noble. New York, NY.

Clark, J. E. and W. J. Parry. 1990. Craft specialization and cultural complexity. Research in Economic Anthropology 12:289-346.

Costin, C. L. 1991. Craft specialization: issues in defining, documenting, and explaining the organization of production. Pages 1-56 *in* Schiffer, M. (ed.), Archaeological Method and Theory, Volume 3. University of Arizona Press.

Gamble, L. 1991. Organization of activities at the historic settlement of Helo': a Chumash political, economic and religious center. Unpublished Dissertation, Anthropology Department, University of California, Santa Barbara, CA.

Hemert-Engert, A. and F. Teggart (eds). 1910. The narrative of the Portola' expedition of 1769-1770 by Michael Costanso. Publications of the Academy of Pacific Coast History 1 (3). Berkeley, CA.

Heizer R. F. 1968. The Indians of Los Angeles County: Hugo Reid's letters of 1852. Southwest Museum Paper 21. Highland Park, CA.

Hudson, T. and T. C. Blackburn. 1983. The material culture of the Chumash interaction sphere: volume II: food preparation and shelter. Ballena Press/Santa Barbara Museum of Natural History Cooperative Publication. Santa Barbara, CA.

Hudson, T. and T. C. Blackburn. 1986. The material culture of the Chumash interaction sphere: volume IV: manufacturing processes, metrology and trade. Ballena Press/ Santa Barbara Museum of Natural History Cooperative Publication. Santa Barbara, CA.

Johnson, J. 1982. An ethnohistoric study of the Island Chumash. Unpublished Masters Thesis. Department of Anthropology, University of California, Santa Barbara, CA.

Johnson, J. 1988. The people of Quinquiana: San Clemente Island's original inhabitants as described in ethnohistoric documents. Unpublished manuscript prepared for the Natural Resources Office, Naval Air Station, North Island. San Diego, CA.

King, C. 1976. Chumash inter-village economic exchange. Pages 76-91 *in* Bean, L. J. and T. C. Blackburn (eds.), Native Californians: A Theoretical Retrospective. Ballena Press, Ramona, CA.

King, C. 1990. The evolution of Chumash society: a comparative study of artifacts used in social systems maintenance in the Santa Barbara Channel region before A. D. 1704. Garland Publications. New York, NY.

Meighan, C. W. and S. Rootenburg. 1957. A prehistoric miner's camp on Catalina Island, The Masterkey, Volume XXXI, No. 6:176-184.

Meighan, C. W. and K. L. Johnson. 1957. Isle of mines: Catalina's ancient indian quarries. Pacific Discovery 10 (1):24-29.

Muche, J. E. 1977. Initial survey—Manila galleon San Pedro. Search: The Journal of Undersea Archaeology, Maritime History, and Related Fields of Study 1(2):13-33.

Muche, J. E. 1978. Manila galleon San Pedro: second survey. Search: The Journal of Undersea Archaeology, Maritime History, and Related Fields of Study 3(2):5-14.

Muche, J. E. 1982. The Manila galleon San Pedro: subsequent surveys. Pages 45-66 *in* Cockrell, W. A. (ed.), The Realms of Gold: The Proceedings of the Tenth Conference on Underwater Archaeology. Fathom Eight Special Publication.

Reinman, F. and H. Eberharhart. 1980. Test excavations at the Ripper's Cove site (SCAI-26). Pacific Coast Archaeological Society Quarterly 16(1):61-105.

Reiss, F. 1955. Indian quarry sites, Catalina Island airport area. Unpublished Manuscript on File at the Santa Catalina Island Museum, and Santa Catalina Island Company, CA.

Romani, G. R. 1982. In search of soapstone. Unpublished Masters Thesis. Anthropology Department, California State University, Northridge, CA.

Rosen, M. D. 1980. Archaeological investigations at two Santa Catalina sites: rosski (SCAI-45) and miner's camp (SCAI-118). Pacific Coast Archaeological Society Quarterly 16(1):22-60.

Rust, H. N. 1898. Archaeological frauds. American Archaeologist 2(3):79.

Rosenthal, J. and S. L. Williams. 1992. Some southern California soapstone sources. Pages 219-227 *in* Rosen, M. D., L. E. Christenson and D. Laylander (eds.), Proceedings of the Society for California Archaeology. Society for California Archaeology. San Diego, California.

Schneider, J. S. 1993. Aboriginal milling-implement quarries in eastern California and western Arizona: a behavioral perspective. Unpublished dissertation. Anthropology Department, University of California, Riverside, CA.

Schumacher, P. 1879. The method and manufacture of soapstone pots. Pages 117-121 in Report Upon United States Geographical Survey West of the 100th Meridian Volume VII. Government Printing Press.

Simpson, L. (ed). 1961. Journal of Jose' Longinos Martinez. John Howell Books. San Francisco, California.

Taylor, A. 1861. The indianology of California, The California Farmer and Journal of Useful Sciences, October 18, 1961, Column 59.

Torrance, R. 1982. Monopoly or direct access? industrial organization at the Melos obsidian quarries. Pages 49-64 *in* Ericson, J. E. and B. A. Purdy (eds.), Prehistoric Quarries and Lithic Production. Cambridge University Press. Cambridge, England.

Wagner, H. R. 1929. Spanish voyages to the northwest coast in the sixteenth century. California Historical Society. San Francisco, CA.

Wells, R. J. 1975. Talc, soapstone, and pyrophyllite. California Bureau of Mines, Mineral Facts and Problems Bulletin Number 667.

Williams, S. L. and E. J. Rosenthal 1993. Soapstone craft specialization at the upper buffalo springs quarry, Santa Catalina Island. Pacific Coast Archaeological Society Quarterly, Volume 29 (3):22-50.

Wlodarski, R. J. 1979. Catalina Island soapstone manufacture. Journal of California and Great Basin Anthropology Volume 1 (2):331-355.

Wlodarsk, R. J, J. F. Romani, G. R. Romani and D. A. Larson. 1984. Preliminary evidence of metal tool use in soapstone quarry-mining on Catalina Island: Jane Russell Quarry. Pacific Coast Archaeological Quarterly, 20(3):35-66.

Zeidler, J. A. 1991. Maritime exchange in the formative period of coastal Ecuador: geopolitical origins of uneven development. Pages 247-268 *in* Research in Economic Anthropology, Volume 13. JAI Press Inc., Greenwich, CT.