CHAPTER 5
SPECIAL STUDIES

PREVIOUSLY UNDOCUMENTED CHINESE ARTIFACTS

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INTRODUCTION

Chinese artifacts seem to fascinate the historical archaeologist. Whether the object in question is a ceramic sherd, an opium pipe-bowl, or a coin, all have distinctive designs and a sense of "otherness." The Sacramento HI56 collection contains a wide variety of Chinese ceramics, medicine vials, opium-related materials, coins, locks, gaming pieces, and decorative items. In this section, we examine artifacts that appear to be either unique to this site or previously undocumented in the Overseas Chinese archaeological literature.

CERAMICS

Approximately 15% of the ceramic assemblage consists of unique or unusual vessel forms or decorative types. At least six apparently new vessel forms have been identified: two are porcelain and the remainder have been classified as Chinese Brown Glazed Stoneware [CBGS]. The high ratio of new ceramic vessel forms from this site is noteworthy because the ceramic assemblages from Overseas Chinese sites tend to be comprised of examples of the same small number of patterns.

The artifacts in the present collection come from well-dated and defined archaeological contexts, where deposits were encapsulated between and below the historically documented 1861 flood and the 1855 fire layers, or within discrete features. Due to repeated flooding and fires, some of the ceramics are quite small and/or burnt. This sometimes made it difficult to identify particular vessel forms or decorations. On the other hand, well-stratified features yielded some interesting whole and reconstructible vessels. The early occupation date of this site may explain the presence of these unusual and previously undocumented Chinese ceramic vessels and patterns. While the majority of the ceramics appear to be either mass-produced tablewares or utilitarian stoneware foodstuff/liquor containers marketed for the Overseas Chinese community, there is also a notable presence of high-quality porcelain ceramics.

Porcelain

A large archaeological literature has been published over the past 20 years on Overseas Chinese archaeological sites and the materials unearthed by excavations and historical studies.[1] For this reason, little discussion is necessary regarding the well-documented Chinese tableware decorative types such as Double Happiness, Bamboo,

[1] For further information on Overseas Chinese archaeological investigations, see Praetzellis and Praetzellis 1990c:15.

Celadon, and Four Flowers, which dominate the Chinese porcelain collection from this site. This section, instead, focuses on the ceramic types that the authors were unable to locate in the archaeological literature. The three new Chinese porcelain artifact types identified from this study are defined by decoration, whereas the four new CBGS artifact types are defined by vessel form. The terminology used for the various forms of Chinese porcelain tableware is from Costello and Maniery (1988). Table 34 depicts Chinese marks on porcelain artifacts from the HI56 Block site.

Celadon

Celadon is a popular Chinese porcelain ceramic that is frequently found on Overseas Chinese archaeological sites (Chace 1976; Olsen 1978; Praetzellis and Praetzellis 1990c). A variety of forms are represented in this collection: plates, medium bowls, spoons, and tiny cups. Most noteworthy were two Celadon plates (720-2 & 737-1) and one medium-sized bowl (720-1) that were recovered from Pit 719, a deposit that postdates 1861. The same Chinese character, 永 (*yeung*, 'forever'), was found etched into the eating surfaces of each of these vessels (see Figures 33 and 34). [2] It has been proposed that the etched characters indicate personal ownership of a vessel at a time when ceramic wares were difficult to obtain. Similar etched characters have been found on Chinese porcelain tableware recovered from Weaverville, California (Brott 1982:129-130) and other archaeological sites.

Blue-on-White

Chinese porcelain classified as blue-on-white include Double Happiness, Bamboo (Figure 35), ginger jars, Chinese Export Porcelain, and Simple Flower designs (Felton, Lortie, and Schulz 1984:37). All of these patterns are represented in this collection, with Double Happiness and Bamboo medium rice bowls the most common. It should be noted that a variety of stylized designs of the Bamboo pattern are present. A complete medium dish with a highly stylized variation of Bamboo was found in the pre-1855 fire layer (954.1-4, Figure 36). In the past, archaeologists referred to this type as "Three Circles and a Dragonfly" (Chace 1976:523).

Other designs make up a small proportion of this collection. A minimum number of items [MNI] for these decorated types was determined for the ginger jar (1), Chinese Export Porcelain (2), and a Simple Flower teapot (1) along with several tiny cups of the latter design.

[2] The Chinese transliterations in this paper are in Mandarin Chinese using the Pinyin system, except where noted. Pinyin was chosen because it is the official system in China for romanizing documents.

Table 34. Chinese marks on porcelain artifacts

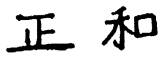
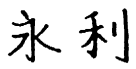
Catalog #	Embossment	Transliteration	Translation	Form
5-1			[Undefined]	Tiny Cup
5-3			[Undefined]	Medium Bowl
5-9		Jia//[Sign of Longevity]	Price//Sign of Longevity	Small Dish
18-6			[Undefined]	Tiny cup
18-7			[Undefined]	Dish or Plate
59-7		Xen Zhen	Sound Pillow	Hollowware
60-4		Zheng He	Proper Harmony	Undefined Vessel
60-6			[Undefined]	Plate
63-4		Yeung Li	Forever Profit	Plate

Table 34. Chinese marks on porcelain artifacts, continued

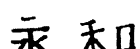
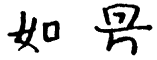
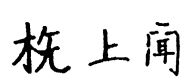
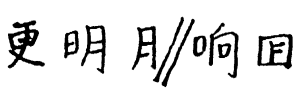
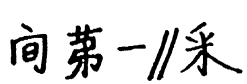
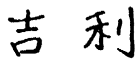
Catalog #	Embossment	Transliteration	Translation	Form
86-1			[Undefined]	Medium Bowl
96-3		Yeung He	Forever Harmony	Medium Bowl
105-2		Ru Xing	As Prosperity	Medium Bowl
107-2		…Pian Ching Xen//	…Piece Clear Sound//	Small Plate
		Zhen Xang Wen//	Heard Above the Pillow//	
		Geng Ming Yue//Xiang [Undefined]	Clear Moon Again//Sound [Undefined]	
107-3		Jian Di Yi//Cai	Space the First//Color	Small Cup
702.2-1			[Undefined]	Medium Bowl
702.4-1		Ji Li	Luck Profit	Medium Bowl

Table 34. Chinese marks on porcelain artifacts, continued

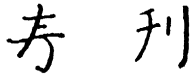
Catalog #	Embossment	Transliteration	Translation	Form
706.8-1			[Undefined]	Small Bowl
711-1			[Undefined]	Medium Bowl
			[Undefined] Spring	Medium Bowl
711-2			[Undefined]	Tiny Cup
			[Undefined]	Tiny Cup
711-4			Sign of Longevity	Small Dish
711-5		Ren Jia…Di…[Illegible] Xiang	Household…Grade…[Illegible] Fragrant	Tiny Cup
711-13		Shuo Li	Longevity Profit	Medium Bowl
		Sheng Yu	Life Jade	Medium Bowl

Table 34. Chinese marks on porcelain artifacts, continued

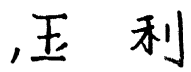
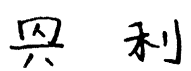
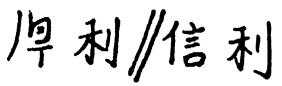
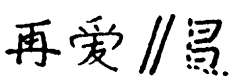
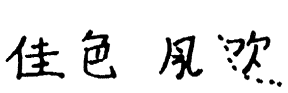
Catalog #	Embossment	Transliteration	Translation	Form
711-14		Yu Li	Jade Profit	Medium Bowl
		Xing Li	Prosperity Profit	Medium Bowl
720-3		De Li//Xin Li	Obtain Profit//Faith Profit	Medium Bowl
720-5			Sign of Longevity	Medium Bowl
720-6			Sign of Longevity	Large Bowl
720-8			Sign of Longevity	Plate
720-11		Zai Ai...//[Illegible]	To Love Again...//[Illegible]	Small Bowl/Cup
720-13		[Undefined]	[Undefined]	Spoon
900-1		Jia Se...Feng...	Beautiful Color...Wind...	Tiny Cup

Table 34. Chinese marks on porcelain artifacts, continued

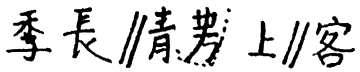
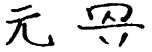
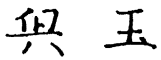
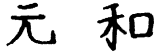
Catalog #	Embossment	Transliteration	Translation	Form
901-1		Ji Chang//Ching Wei Shang//Ke	Season Long//Green…/Guest//To Be//Above	Dish
902-1		[Undefined] He	[Undefined] Peace	Bowl
		…Xing	…Prosperity	Bowl
902-4		Yuan Xing	Beginning Prosperity	Medium Bowl
902-5		Xian Feng Nian Zhi	Made In The Reign Of Xian Feng	Bowl
903.06-1			[Undefined]	Sauce Pot
903.68-3		Xing Yu	Prosperity Jade	Medium Bowl
903.68-4			[Undefined]	Tiny Cup
903.68-6		Zhi Zai Ci Shan Zhong	Only In This Mountain	Spoon

Table 34. Chinese marks on porcelain artifacts, continued

Catalog #	Embossment	Transliteration	Translation	Form
913-3			Sign of Longevity	Bowl or Plate
954.2-1			[Undefined]	Medium Dish
963-1		Yuan He	Beginning Peace	Medium Bowl

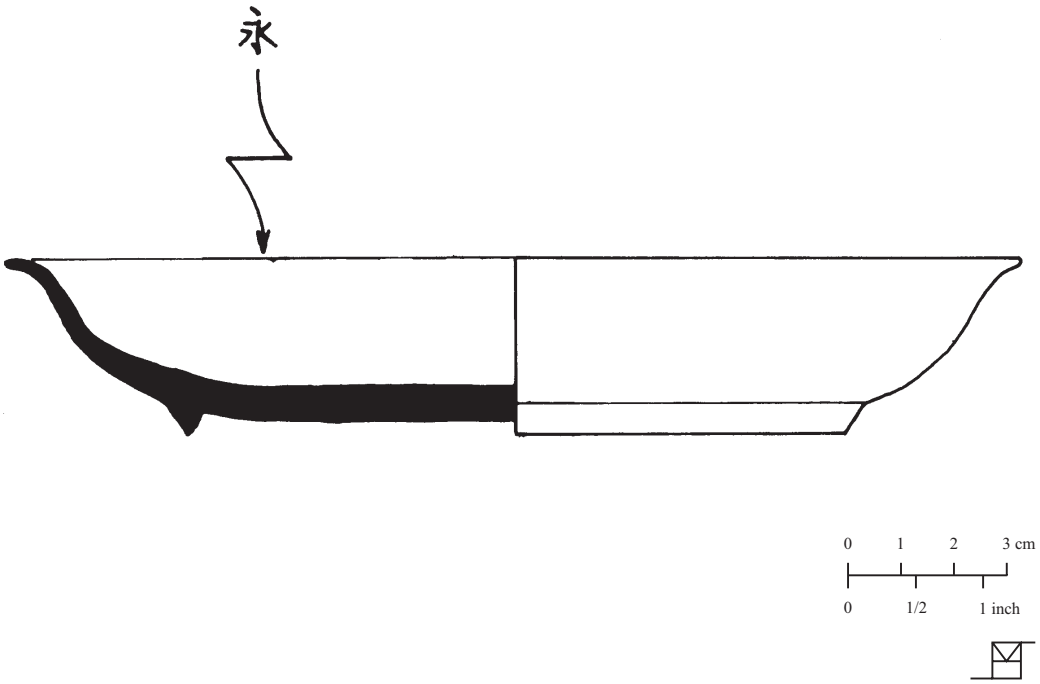


Figure 33. Chinese celadon plate. *Two identical celadon plates bear an etched Chinese character* yeung*, "forever," on the eating surfaces of each of the vessels. It has been proposed that the etched character indicates ownership of a vessel. See also Figure 34. Catalog 95-14-720-2 and 95-14-737-1. (Illustration by Mike Stoyka)*

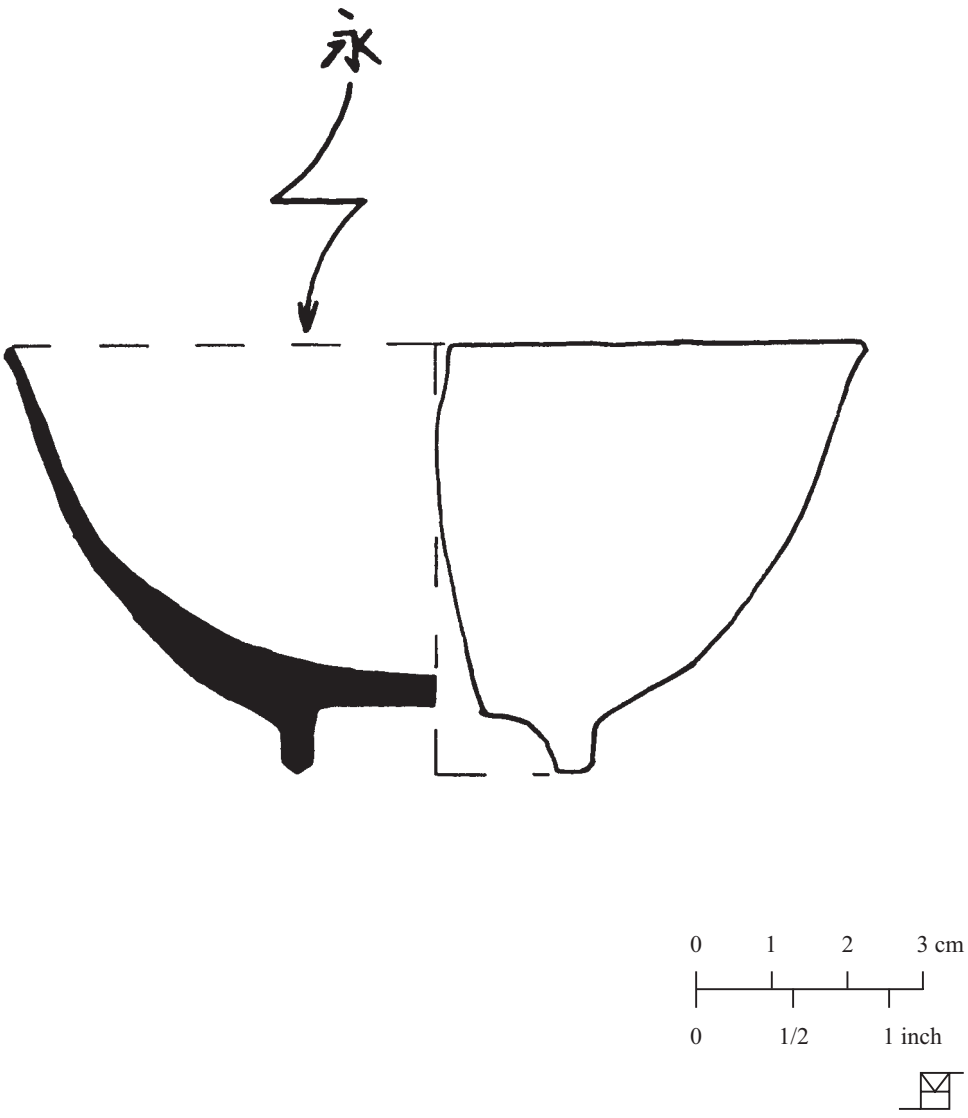


Figure 34. Chinese celadon bowl. *This celadon bowl has the Chinese character* yeung, *"forever," etched on the interior. See also Figure 33. Catalog 95-14-720-1. (Illustration by Mike Stoyka)*

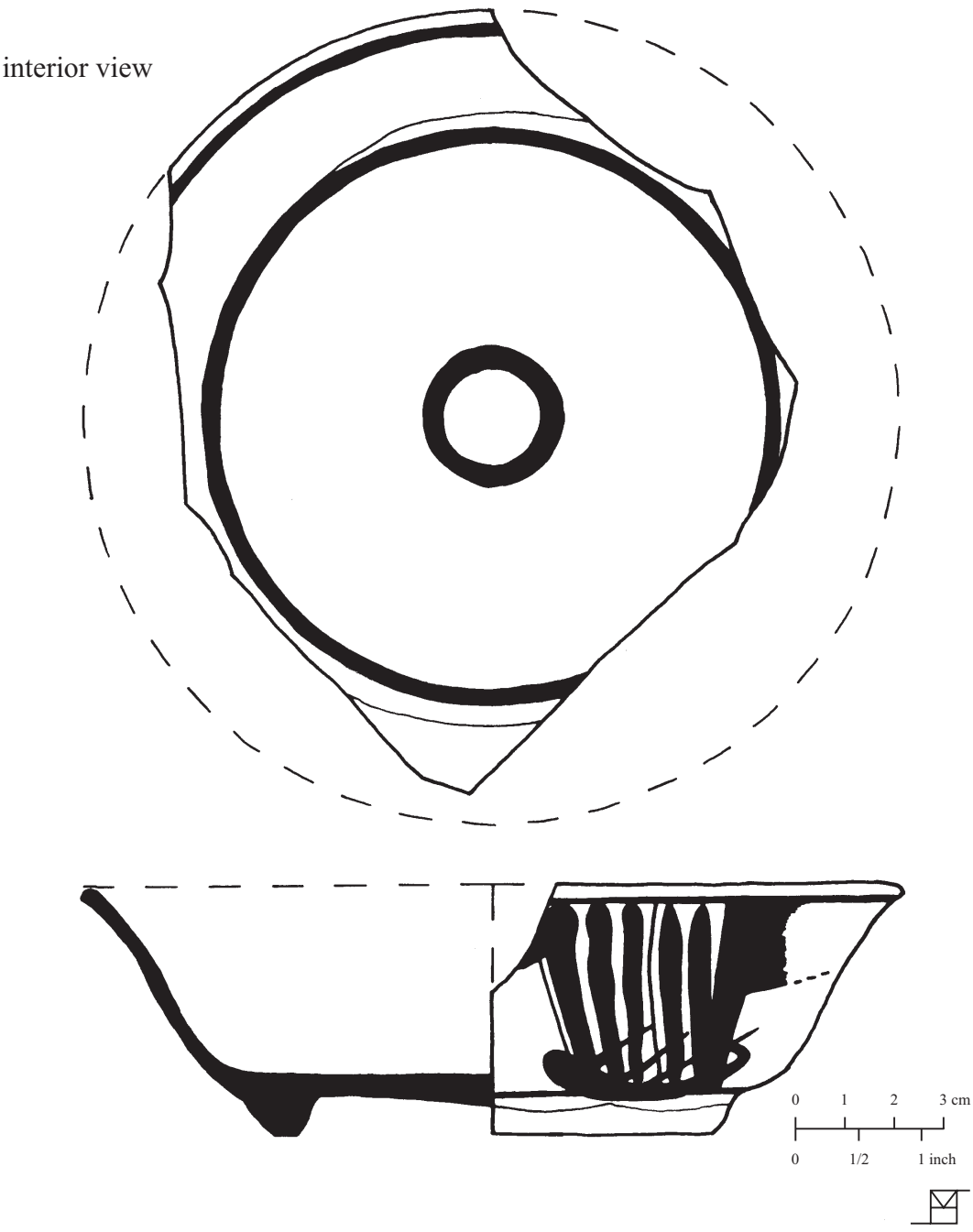


Figure 35. Bamboo design bowl. *This large, gray-bodied, blue-on-white porcelain bowl bears a variation of the Bamboo design and has a large interior stacking ring. Catalog 95-14-958-4. (Illustration by Mike Stoyka)*

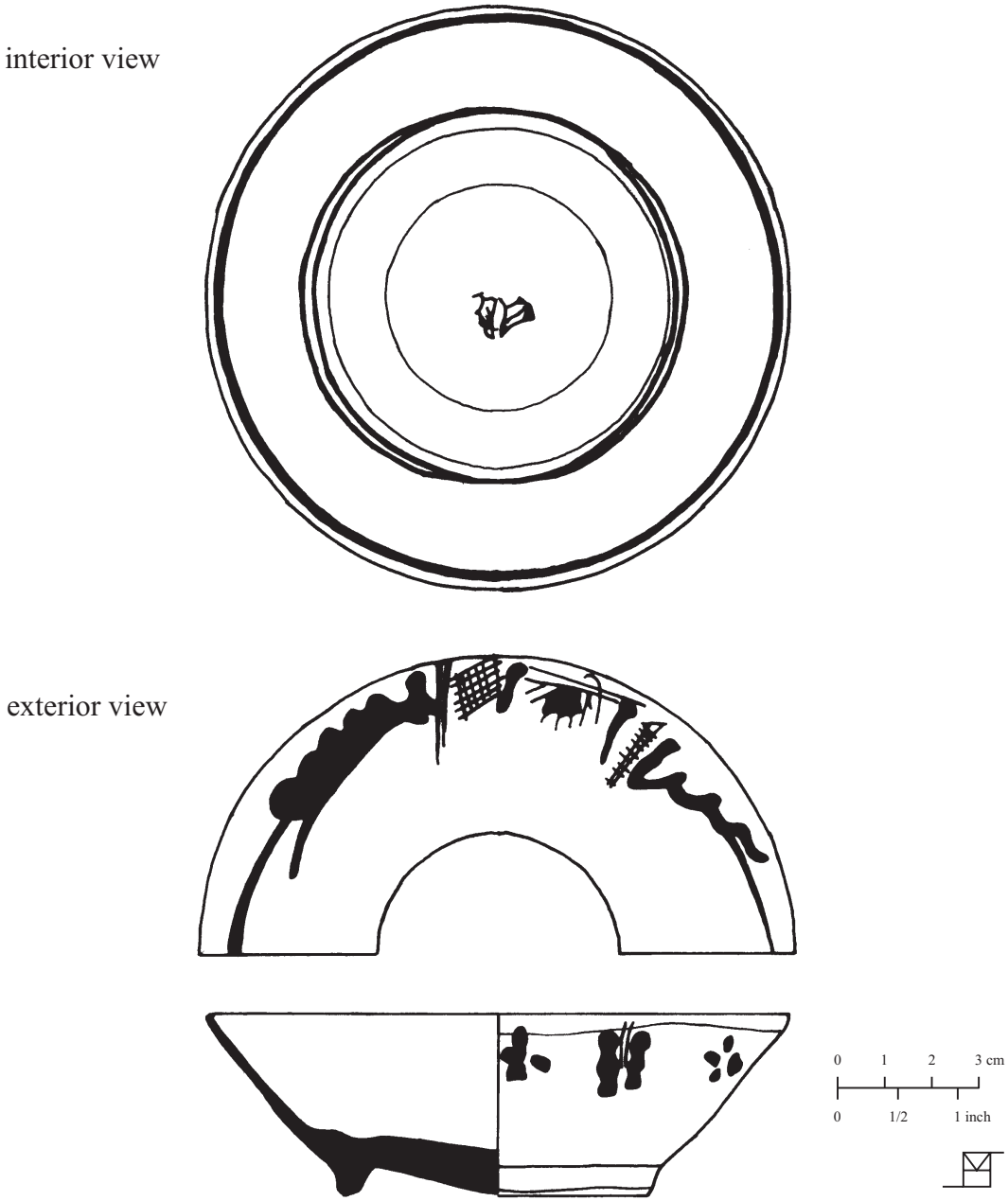


Figure 36. Bamboo design medium dish. *This Chinese porcelain vessel is decorated on the exterior with a highly stylized variation of the Bamboo design, which has been referred to elsewhere as "Three Circles and a Dragonfly." Catalog 95-14-954.01-4. (Illustration by Mike Stoyka)*

Peach and Fungus. A variation of the Peach and Fungus design, represented by two small bowls, was recovered from Context 903, the 1855 fire layer. Each of these small bowls has a continuous linear design on the exterior that is reminiscent of the vines on the Simple Flower pattern. Within the center of these vessels are different blue underglaze designs: one is highly stylized (706.8-1, Figure 39), while the second is an "X."

In *Nonya Ware and Kitchen Ch'ing*, Willetts and Poh (1981:68) illustrate this design on two bowls. The peach and "fungus of immortality" are set in continuous panels. Lydon (1996) recovered a fragmented specimen of the type from the Rocks, an Overseas Chinese archaeological site in Australia. She depicts a complete example from an Idaho collection in that report (Lydon 1996:Color Plate 4, Appendix 1). It should be noted that the two small bowls found in the HI56 collection are different from those described above, in that the small bowls from HI56 are only decorated on the exterior, and the design is a highly stylized variation. The HI56 bowls are closer in design to the Idaho example.

Top Side. A second design (107-6 and 711-15) was designated "Top Side." This name refers to the pattern on a small dish, which is a continuous band of blue underglaze around the rim of the vessel and is broken by a band of unglazed circular stacking rings. In the center of the dish there is a blue underglaze Chinese character 上 (*shàng,* 'top' or 'above') against a white glazed background. The exterior of this vessel has two blue underglaze stylized bats on opposing sides of the rim (Figure 40).

Two base and rim sherds (702.7-1 and 702-153) that mended to reveal half of a small dish were also found within the 1855 fire layer. This vessel is quite similar to the 'Top Side' pattern in terms of vessel form, glaze, and general design. In this case, however, the Chinese character in the center of the dish, although incomplete, is clearly different from the one mentioned previously. No name has been assigned because the vessel is not fully reconstructible. The reverse of the vessel contains at least three stylized bat motifs (Figure 41).

Cauldron and Bat. A final new vessel pattern within the blue-on-white category is present on a medium plate (107-4, Figure 42). This artifact has a distinct bluish green underglaze *dǐng* (鼎 , a three- or four-legged cauldron) surmounted by a stylized bat in the center of the vessel. Eight blue underglaze wheel motifs appear around the inside rim of this vessel. The exterior bears a blue underglaze endless knot, a common symbol for longevity. Although the temptation to designate this new pattern as "Ding Bat" was great, the authors opted for the name "Cauldron and Bat."

In addition to these reconstructible patterns of blue-on-white porcelain, fragments of six vessels were found that had insufficient design elements to determine the complete pattern. As with the Top Side and Cauldron and Bat patterns, a literature search was conducted to identify the names of these types, but without success. The designs on these sherds range from geometrical to floral. Several contained five-petaled lotus flowers (e.g., 958-5).

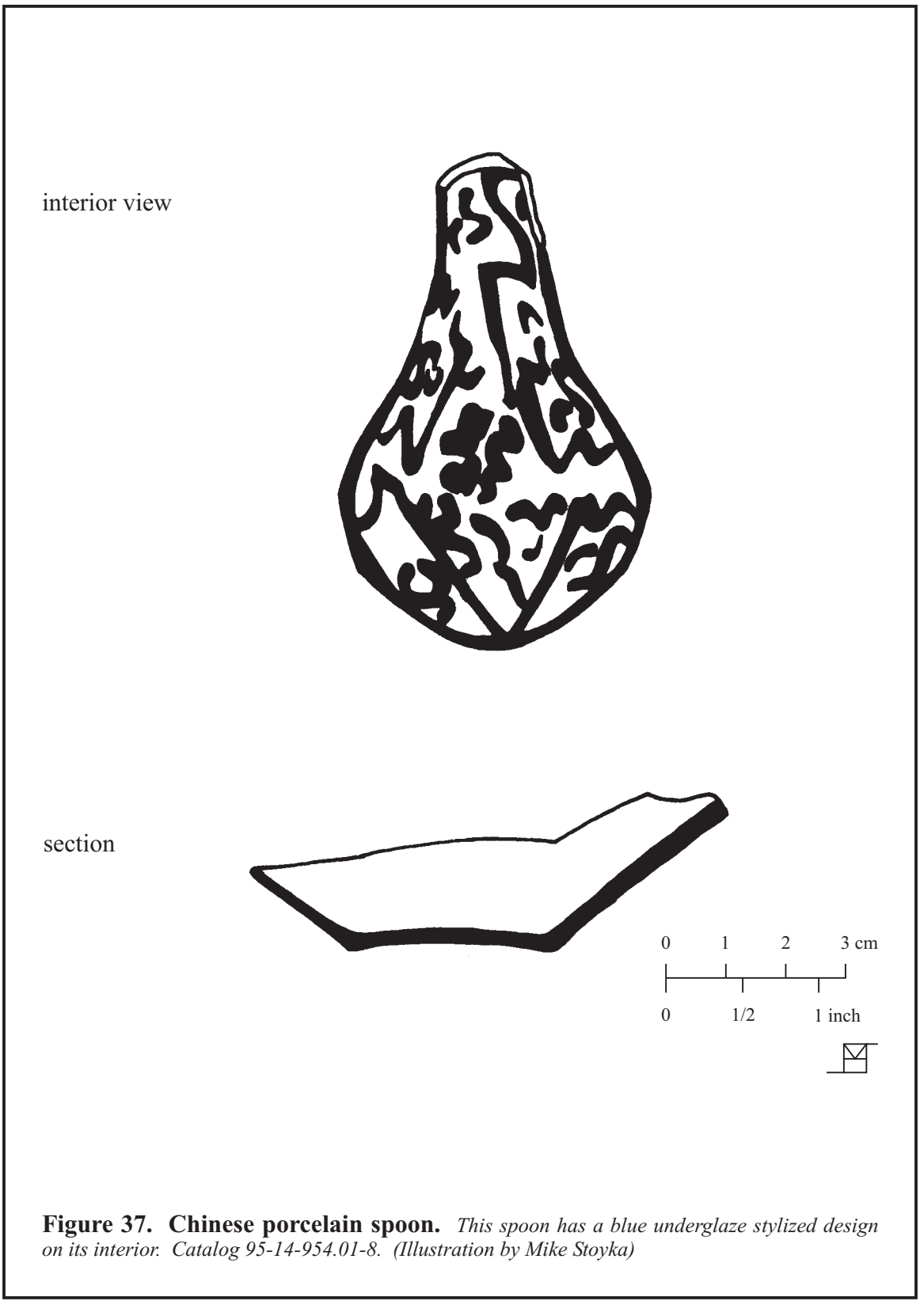


Figure 37. Chinese porcelain spoon. *This spoon has a blue underglaze stylized design on its interior. Catalog 95-14-954.01-8. (Illustration by Mike Stoyka)*

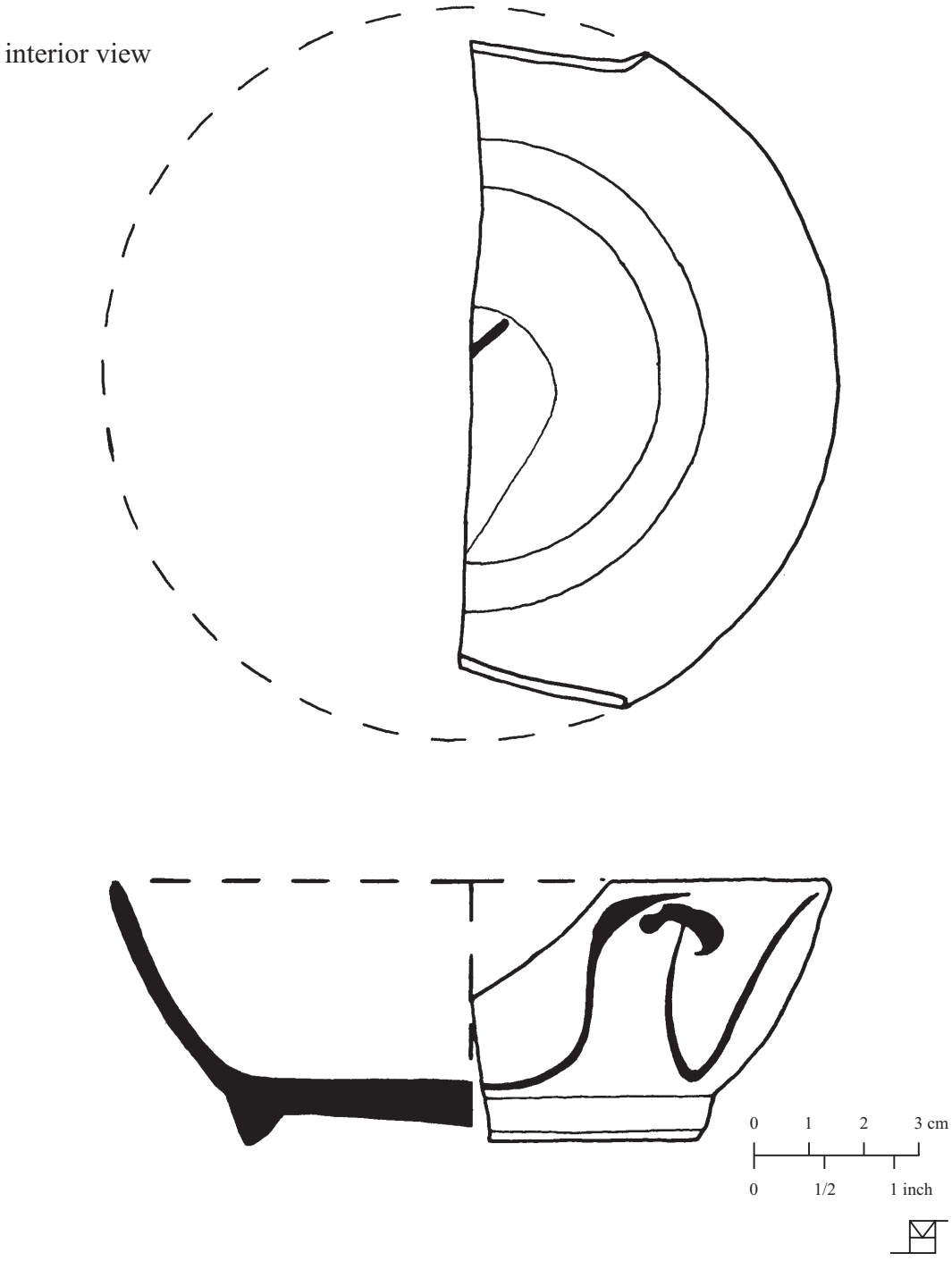


Figure 38. Chinese porcelain medium bowl. *This vessel has stacking rings in its interior and a gray, underglazed, handpainted, stylized linear design on its exterior. Catalog 95-14-108-4. (Illustration by Mike Stoyka)*

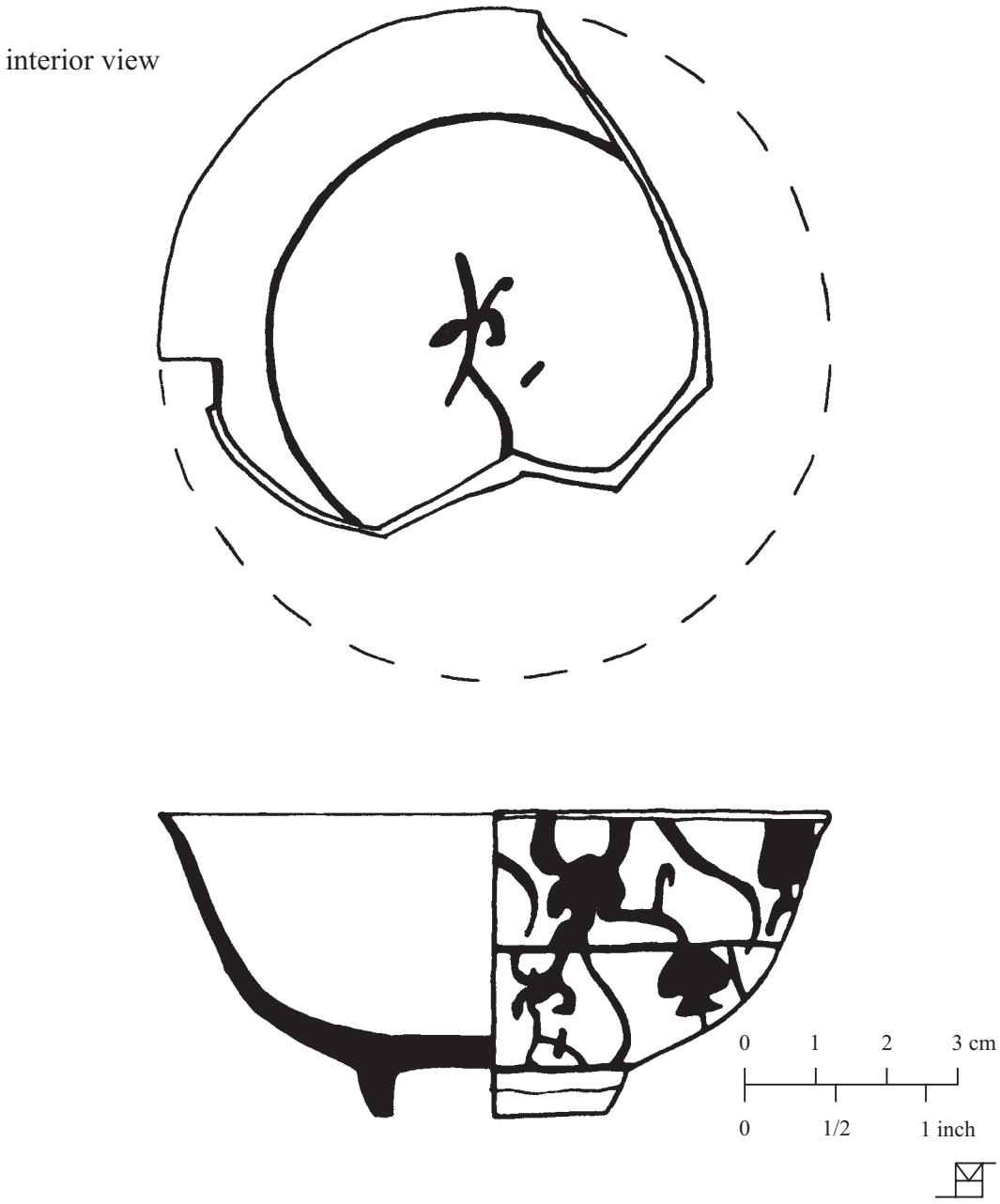


Figure 39. Peach and Fungus design bowl, a variation. *This Chinese blue-on-white porcelain bowl has continuous linear designs on the exterior that are reminiscent of the vines from the Simple Flower pattern. The interior of the bowl bears a stylized design. Catalog 95-14-706.8-1. (Illustration by Mike Stoyka)*

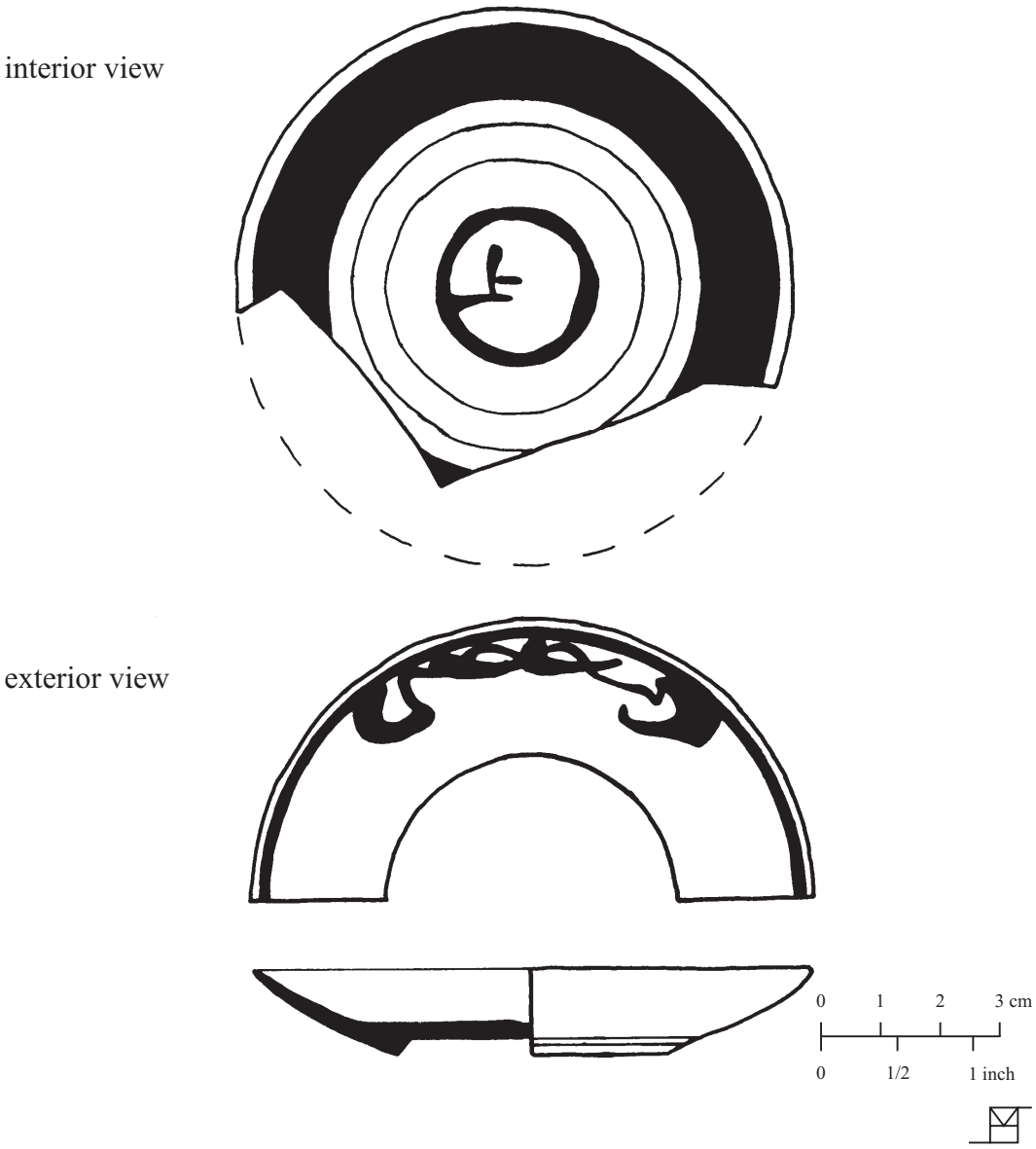


Figure 40. "Top Side" design small dish. *This newly recognized type of Chinese, blue-on-white porcelain has a continuous band of blue underglaze around the rim of the vessel and a blue underglaze Chinese character* (shàng) *in the center, which reads "top." Catalog 95-14-704-6 and 95-14-711-15. (Illustration by Mike Stoyka)*

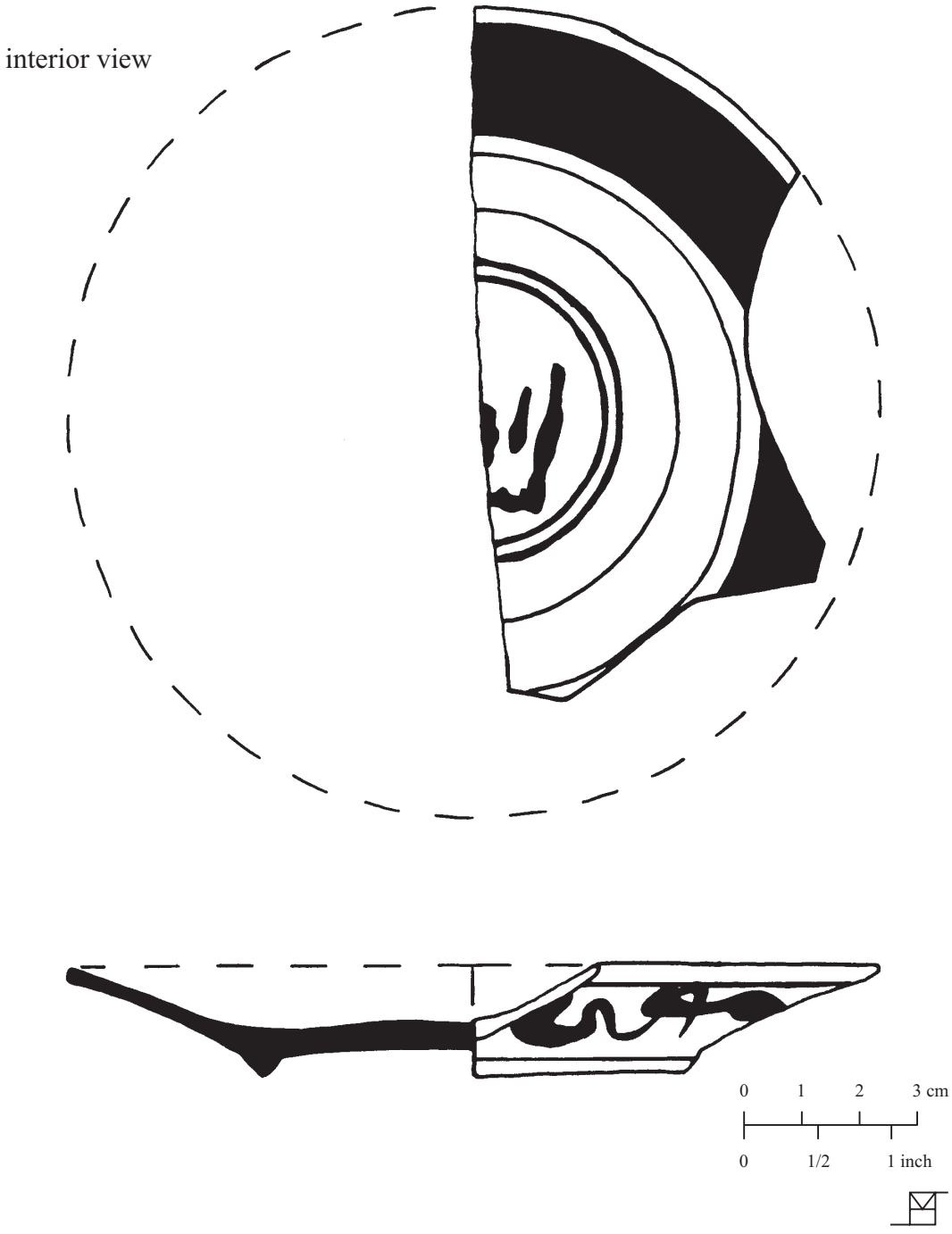


Figure 41. Blue-on-white porcelain dish. *This small Chinese dish has a design similar to the Top Side pattern. No name has been assigned, however, because the Chinese character in the interior of the dish is different from that in Top Side, and the vessel is not fully reconstructible. Catalog 95-14-702.15-3 and 95-14-702.7-1. (Illustration by Mike Stoyka)*

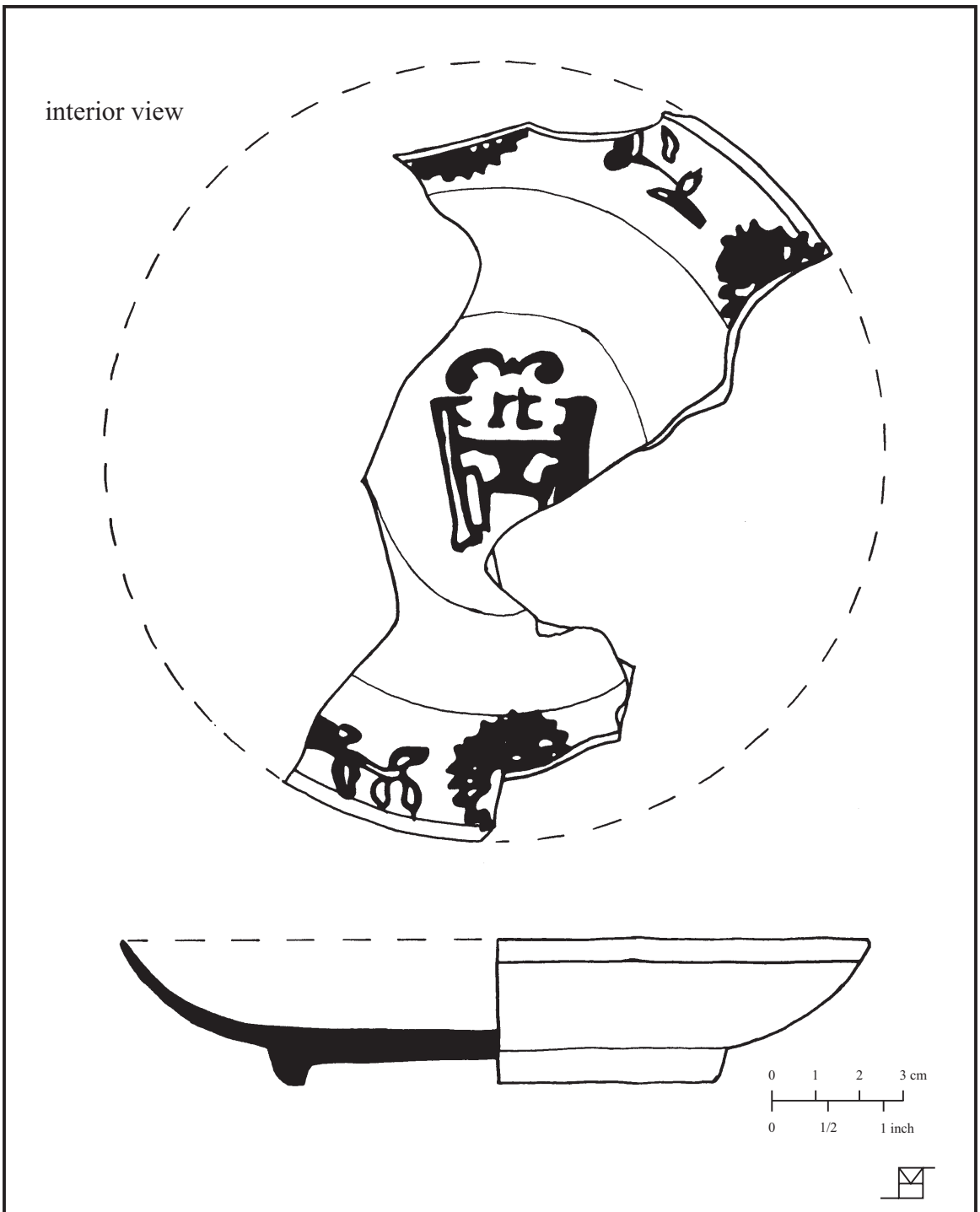


Figure 42. Cauldron and Bat design plate. *This Chinese, blue-on-white porcelain, medium plate depicts a stylized bat and what appears to be a three-legged cooking vessel* (ding). *There is a blue underglaze endless knot on the base. Catalog 95-14-107-4. (Illustration by Mike Stoyka)*

Polychrome

The most common polychrome pattern was Four Flowers, a popular Chinese utilitarian tableware not intended for European export (Praetzellis and Praetzellis 1990c:29). Four Flowers tableware appears in the broadest variety of forms and includes plates, large serving bowls, medium rice bowls, spoons, medium dishes, and tiny cups. Four Flowers vessels are often decorated with a stylized red overglaze sign of longevity (the endless knot) on the base, as well as the bat motif, representing happiness, on the exterior. One small Four Flowers bowl (902-5) from the 1861 flood layer has the reign mark 咸豐年製 (*xíanfeng nían zhì*, 'made in the reign of Xíanfeng') on its base indicating that the bowl was made between 1851 and 1861, during the reign of Emperor Xíanfeng.

Southern Chinese Export Porcelain. There appear to be two grades of polychrome wares in the collection. We have distinguished these types based on the presence or absence of delicate, handpainted designs with elegant Chinese characters on the vessel, which we call "calligraphic." The distinction between the two lies in the decoration of the vessel rather than any relative difference in refinement of the clay fabric. Chinese porcelain wares with calligraphic designs would have been produced by literate artisans who were also skilled in the craft of the decorative arts.

While the presence of Chinese characters on ceramic wares is not uncommon, most characters, as well as popular Chinese symbols such as the bat or the endless knot, seem to take on a highly stylized free-hand appearance. This may be related to the fact that many Chinese ceramics were mass-produced, and such stylized marks reflect the conditions of production and aesthetics of the various potters who produced them. In addition to the well-formed Chinese characters found on the calligraphic ceramic type, stylized red overglaze chop marks are present on four of five different vessel designs identified within this collection. The term "chop mark" refers to the stamped mark used by artisans to designate the design as their own work. It is highly likely that the handpainted Chinese characters on these calligraphic vessels are sections of poems. In this context, a chop mark would indicate authorship of the poem.

Among the polychrome porcelain sherds, the authors were able to identify several distinct vessels decorated with calligraphic and thinner, more delicate and precise, designs. Some representative forms of these higher grade vessels include plate, medium dish, lid/dish, small octagonal cup, and spoon. Based on the variety of forms, we infer that an entire set of such Southern Chinese Export Porcelain with the same pattern could have been available.

Three reconstructible or nearly complete vessels with these designs are worth describing in more detail. A medium dish (107-2) has a peach, another symbol of long life, in the center, fine handpainted yellowish/white bamboo leaves and stalk on two opposing sides, and fragmentary poem inscriptions on the remaining sides. The Chinese characters are followed by a red, stylized chop mark (Figure 43). A small octagonal cup (107-3) is decorated with fine handpainted yellowish/white flower and leaves (Figure 44). The Chinese characters are set off to the side, followed by a red, stylized chop mark. Lastly, the "poem spoon" (903.68-6, Figure 45) has a fine yellowish/white bamboo leaves and stalk design with Chinese characters 只在此山中 (*zhǐ zài cǐ shan zhong*,

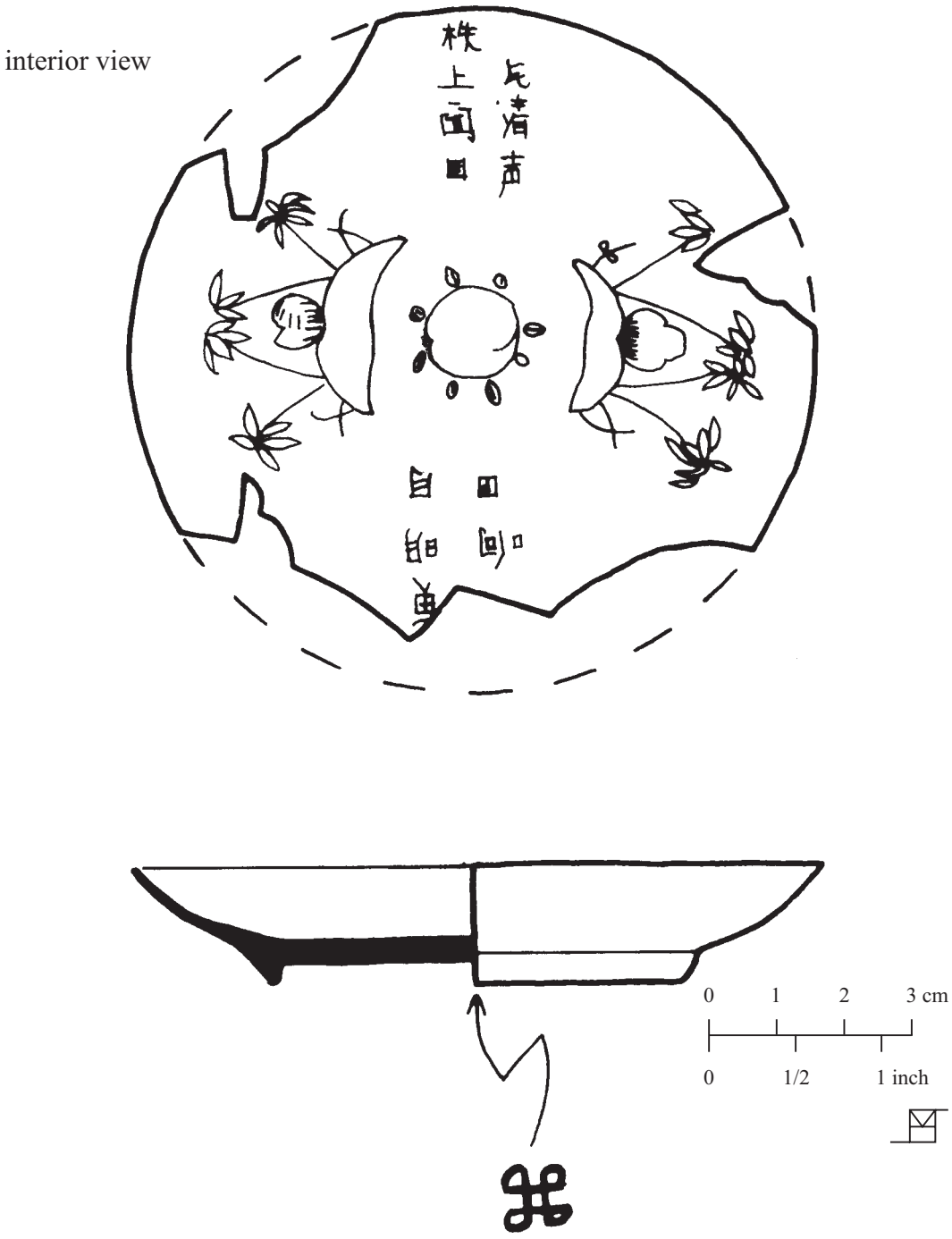


Figure 43. Polychrome dish. *This Chinese porcelain medium dish depicts a peach, yellowish/white bamboo groves, and fragmentary poem inscription. The Chinese characters read "A clear sound is heard above the pillow/A clear moon... sound." There is an endless knot, a sign of longevity, in red on the base of the dish. Catalog 95-14-107-2. (Illustration by Mike Stoyka)*

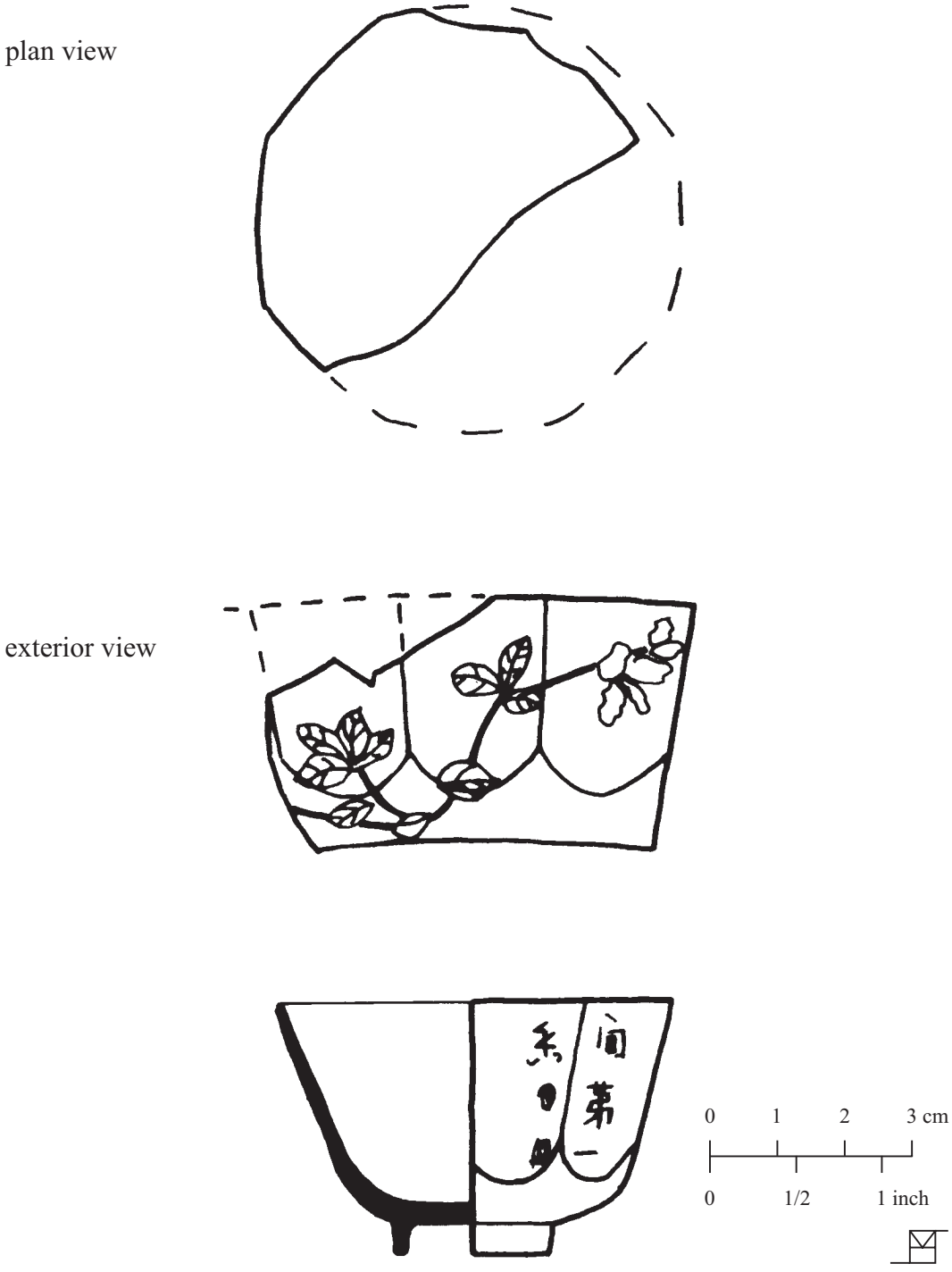


Figure 44. Polychrome cup. *This small octagonal porcelain cup is decorated with yellowish/white flower and leaves. The Chinese characters read "The first color in..." followed by a red, stylized chop mark. Catalog 95-14-107-3. (Illustration by Mike Stoyka)*

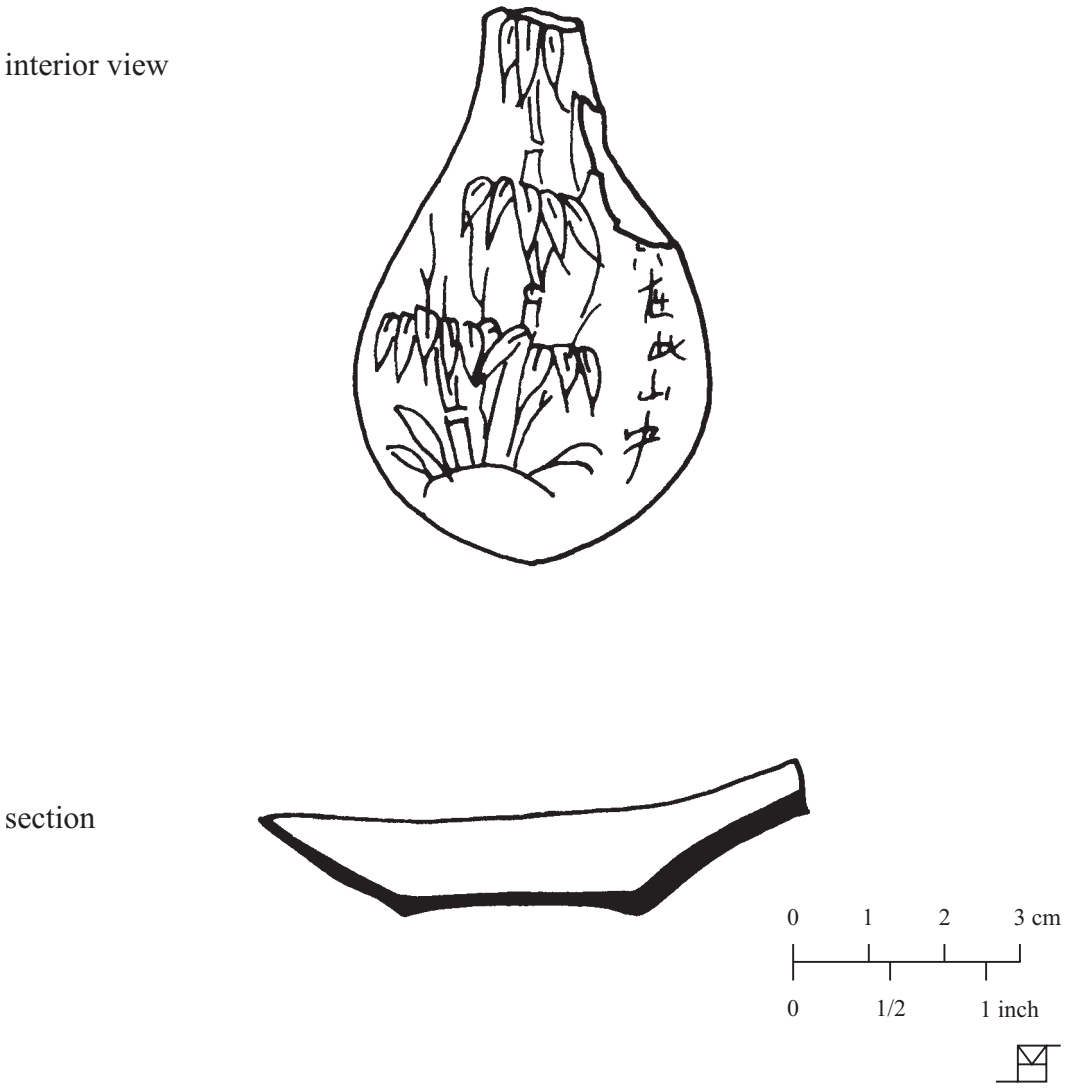
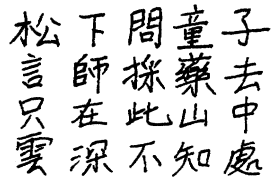


Figure 45. Polychrome porcelain spoon. *This Chinese artifact has been dubbed the "poem spoon" because it bears the third verse from a famous Tang Dynasty (618-906 A.D.) Chinese poem, accompanied by the yellowish/white bamboo grove. The Chinese characters read "Only in this mountain." Catalog 95-14-903.68-6. (Illustration by Mike Stoyka)*

"only in this mountain"). The five characters make up the third verse in a famous Tang Dynasty (A.D. 618-906) poem written by Jia Dao, in which the poet writes about his unfruitful search for a hermit in a mountain:



I asked a boy underneath the pine tree,
He said his teacher had gone to pick herbs for medicine.
"He's only in this mountain,
But the clouds are so dense that I don't know where he is."

The bamboo pattern encompasses nearly all of the spoon's eating surface; the poem takes up the remainder. The authors speculate that this may have been one of a set of four spoons, each bearing one verse from the four-line poem.

Lotus-like. Within the Southern Chinese Export Porcelain category, some polychrome sherds have lotus-like designs. The items that bear these patterns are incomplete vessels and come in the form of medium bowls and plates. Two plates (913-3, 960-24) each have a stylized red endless knot on the base. These sherds have designs in thick, dense handpainted enamel. The base sherds from the plates have a peach in the center, which is encircled by pinkish white, flowing lotus-like plants that blend into a green background. The bowl fragments are rim sherds with handpainted overglaze on the exterior of the vessels. The effect of grass is created by the two shades of green enamel with fine black lines running throughout. Close to the midsection of the vessels, pinkish white, lotus-like stalks rise up towards and into the green area.

The most important element of this design is the lotus. The lotus flower is associated with the Buddha and other revered figures in the Buddhist and Toaist traditions, who are often pictured sitting on a seat made up of lotus flowers. As the lotus flower rises above the muddy pond water in which it grows, in traditional Chinese culture, this flower has come to represent the superior person's ability to separate oneself from the corruption of the world.

Several sherds were recovered that could not be reconstructed or located in the Overseas Chinese literature. A base sherd (731-1) recovered beneath the 1855 burn layer has an overglaze green, handpainted, high foot rim with fine, gilded double horizontal lines above and below the green band. In the interior of the vessel is a fine handpainted black bird in flight. The second item is represented by a medium bowl rim and body sherds (720-12). These sherds all mend and are decorated with a red, brown, green, and black stylized four-petaled flower. A double-line band around the rim of the interior and exterior of this vessel type is similar to that found on Double Happiness bowls.

Chinese Brown Glazed Stoneware

Seven of the 13 archive boxes of ceramic artifacts contained Chinese brown glazed stoneware (CBGS), one of the most frequently encountered artifact types on Overseas Chinese archaeological sites. In addition to eight previously documented forms, the Sacramento HI56 collection revealed four apparently undocumented forms (Table 35).

Previous research indicated that the CBGS vessels are all containers of food. Most were produced in Canton, a province in southern China, with the potteries of Shek Wan being the most famous (Chace 1976; Laird 1918; Olsen 1978; Yang and Hellmann 1996).

The minute differences in the pots of a given form can be explained by the fact that CBGS was made by hundreds of small potters (Morrow 1995). Some of the pots have incised marks on the side or base (Table 36); because many pottery workers were illiterate, however, the characters are often illegible. CBGS is not a good dating tool because the forms of the pots have remained the same for the past 200 years or more. Various sizes and shapes were produced, with similar attributes of body fabric and glaze. Most notable are the glazes. The color of the exterior glaze varies from iridescent brown to almost black, while the interior glaze is typically a thin, light brown. After the food in the containers was consumed, the vessels were often re-used by their owners for other purposes (Yang and Hellmann 1996).

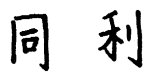
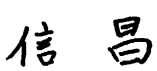
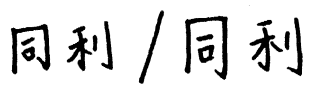
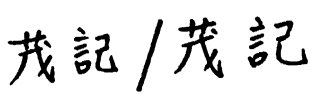
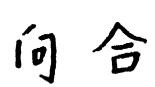
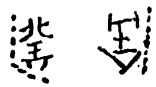
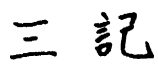
Table 35. Chinese Brown Glazed Stoneware (Total from HI56 Block, Sacramento)

Form	MNI
Wide-Mouthed Jar	42
Liquor Bottle	31
Globular Jar	27
Straight-Sided Jar	16
Barrel Jar	12
Spouted Jar	10
Pan	4
Stew Pot	1
Previously Undocumented	
Rectangular Vessel	1
Recessed-Rim Jar	1
Lug-Handled Jar	1
Straight-Sided Jar	1

In this section we discuss all the forms of CBGS recovered from the HI56 site. For the previously undocumented forms, only physical descriptions will be provided because no information on their functions is available. Please note that the Chinese characters within this section are transliterated in Cantonese because the oral interviews were conducted in that dialect.[3]

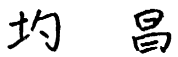
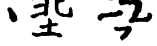
[3] Because the majority of the 19th-century Chinese immigrants came from Canton, Cantonese would have been the dialect these sojourners were using.

Table 36. Makers' marks on Chinese Brown Glazed Stoneware

Catalog #	Embossment	Transliteration	Translation	Form
5-27			[Undefined]	Wide-Mouthed Jar
99-13		Feng	Full; Harvest	Barrel Jar Lid
704-17		Tong Li//Li	Together Profit//Li	Liquor Bottle
		Xin Chang	Faithful Prosperity	Liquor Bottle
902-48		Tong Li/Tong Li	Together Profit/Together Profit	Liquor Bottle
		Mao Ji/Mao Ji	Prosperity Mark/Prosperity Mark	Liquor Bottle
903.12-3		Xian He	To Peace; To Cooperation	Wide-Mouthed Jar
903.57-1		[Illegible]	[Undefined]	Globular Jar
903.68-17		San Ji[1]	Three Mark	Square Straight-Sided Jar

[1] These two characters were stamped as mirror images of their actual forms; in other words, they were printed right-side left. No explanation is available for the mirror imaging.

Table 36. Makers' marks on Chinese Brown Glazed Stoneware, continued

Catalog #	Embossment	Transliteration	Translation	Form
954.2-22		Jun Chang	Balanced Prosperous	Liquor Bottle
954.4-42		[Illegible] Chang Tu Ji	The Mark of…Chang	Liquor Bottle
954.5-43		Sheng He	Life Peace	Wide-Mouthed Jar
954.4-50		Xuan [Illegible]	Picked…	Large Storage Vessel

Spouted Jar

The Spouted Jar, or *ngǎ hú* (瓦壺 , 'pottery pot'), has a round, squat body with a small, lipped opening in the center and a spout to the side. It has been called a soy pot, but research indicates this term is too restrictive, as other food items such as liquor, black vinegar, and peanut oil came in these jars. In rural areas they have been used as teapots as well (Yang and Hellmann 1996).

Liquor Bottle

The tear-drop-shaped liquor bottle, or *tsáo tsun* (酒磳 , 'liquor bottle'), has also been called a wine bottle in the past. Sprague (1987) pointed out these are more likely liquor than wine bottles. He noted that while Chinese *wine* could have been easily reproduced in California by the early immigrants, Chinese *liquor* is very distinctive in its flavor and would have been very difficult to make in the United States. It is therefore not likely that Chinese *wine* was imported to California when there was a much greater market for Chinese liquor. Two common types of Chinese liquor, *Ng Ga Py* (五加皮) and *Mui Guai Lo* (玫瑰露), were sold in these bottles and can still be found in Chinese grocery stores. Both types of liquor are around 100 proof, and are used in cooking as well as for drinking.

Wide-Mouthed Jar

A variety of shapes and sizes make up the category of wide-mouthed jars (Figures 46, 47, 48, 49), or *fùt hów ngá pěng* (濶口瓦瓶 , 'wide-mouthed pottery bottle'). Generally speaking, the wide-mouthed jar has a round and squat body with a wide, lipped opening in the center. Some researchers have called this form the shouldered jar.

John Olsen has compared wide-mouthed jars to Mason jars in Western culture, because both are mass-produced to hold products for storage, and yet may be re-used for other purposes after they have been emptied and cleaned (Olsen 1978:32). The wide-mouthed jars contained preserved tofu; sweet bean paste; black, brown, and white beans; pickled turnips; cabbage; and shrimp paste. In homes they have been used to store sugar, as well as various condiments (Yang and Hellmann 1996).

Globular Jar

As its name implies, the globular jar, or *chǐng* (缸罌 , 'jar'), is globular in body, has a rolled lip on its opening, and may or may not have lug handles. The original content of many globular jars was hard liquor, but oil was also sold in them. Stores and taverns used the larger ones for shipping; while the medium-sized and small ones were used in homes. They have been used to store soy sauce, pickled carrots, scallions, salted cabbage, melons, cucumbers, ginger, and salty duck eggs, also known as "thousand-year-old eggs" in North America (Yang and Hellmann 1996).

Straight-Sided Jar

The straight-sided jars, or *jiung* (盅 , 'covered cup'), are round in cross section, have roughly parallel sides, are usually thinner in body than the forms mentioned above, and possess a glazed lid. Typically, the seat for the lid is unglazed. Like the wide-mouthed jars, they came in several sizes. Some Chinese doctors used the smaller vessels to store

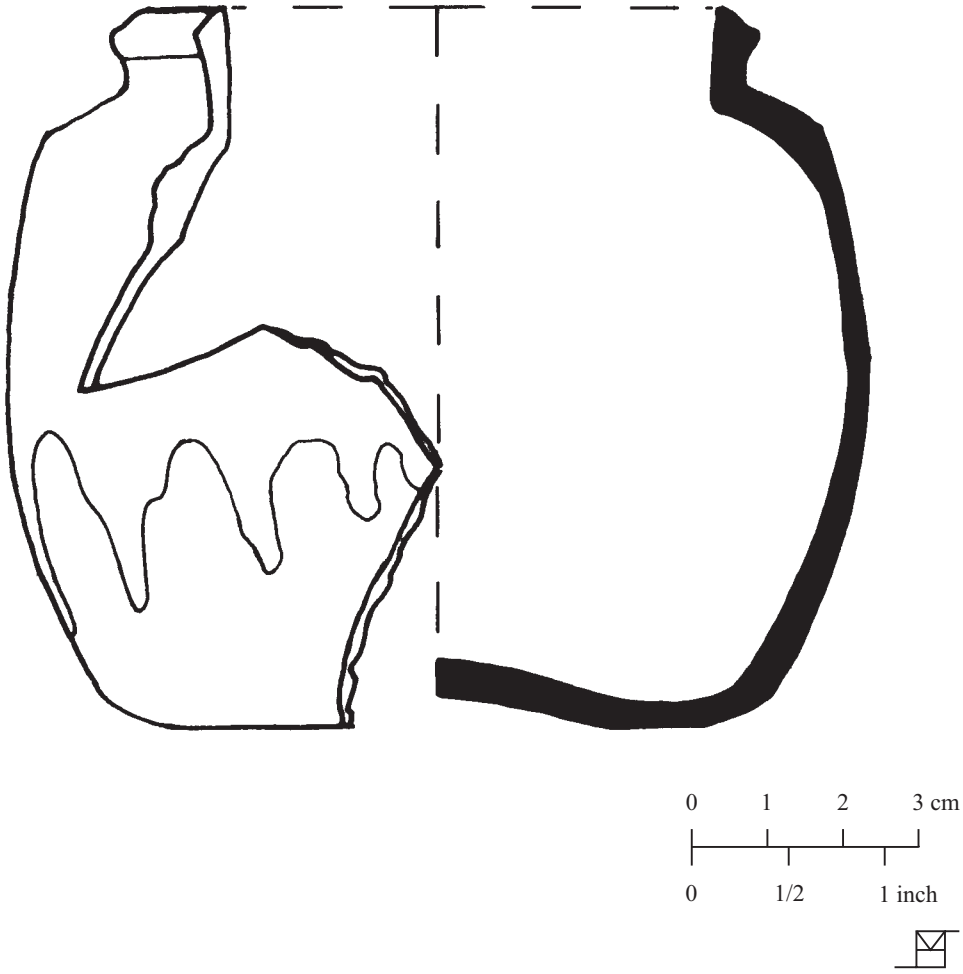


Figure 46. Chinese brown glazed stoneware wide-mouthed jar. *This type of vessel comes in many varieties, from short and squat to tall and narrow. Some have wider openings. See also Figures 47, 48, and 49. Catalog 95-14-954.4-43. (Illustration by Mike Stoyka)*

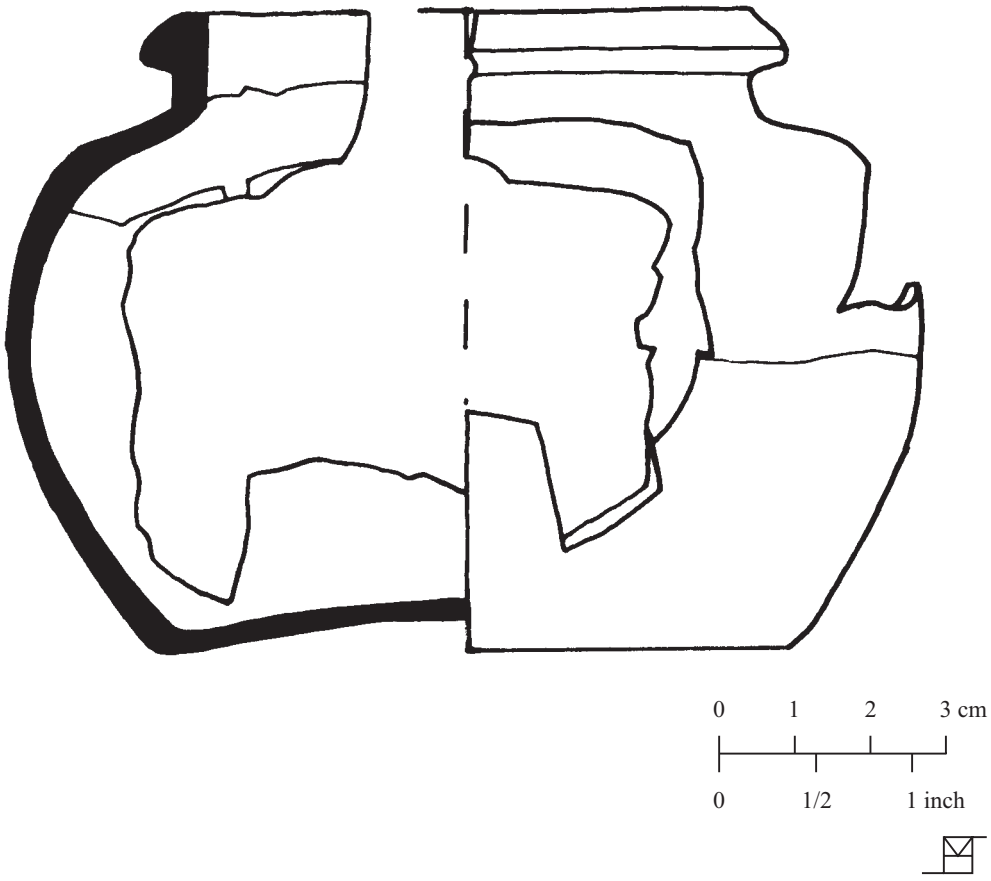


Figure 47. Chinese brown glazed stoneware wide-mouthed jar. *This is an example of a squat wide-mouthed jar. See also Figures 46, 48, and 49. Catalog 95-14-5-27. (Illustration by Mike Stoyka)*

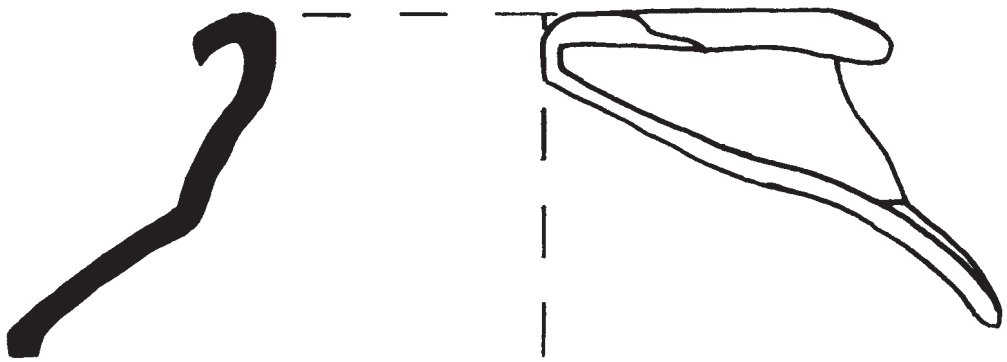


Figure 48(a). Chinese brown glazed stoneware wide-mouthed jar rim. *This rim has a pronounced rolled rim when compared to other wide-mouthed jar vessels. See also Figures 46, 47, and 49. Catalog 95-14-903.51-7.*

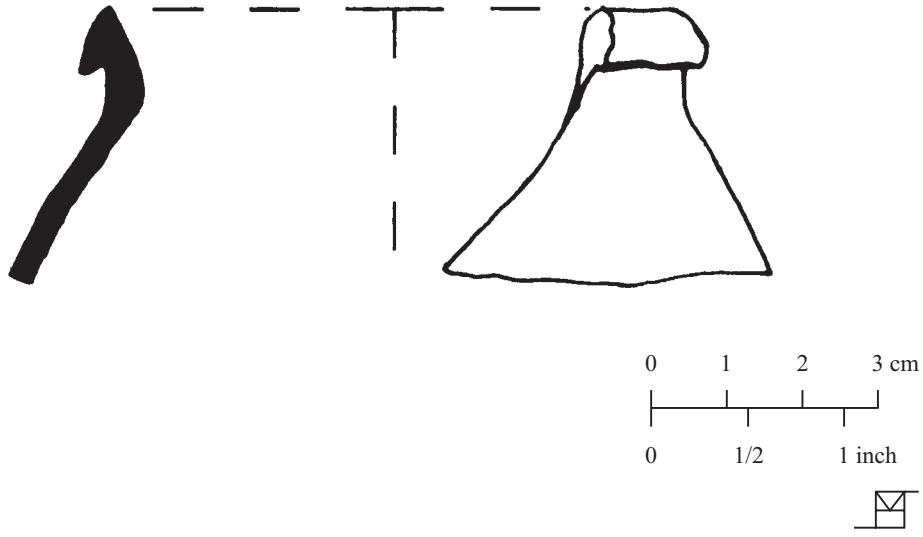


Figure 48(b). Chinese brown glazed stoneware wide-mouthed jar rim. *This rolled rim is less pronounced than the example shown above. Catalog 95-14-903.51-7. (Illustration by Mike Stoyka)*

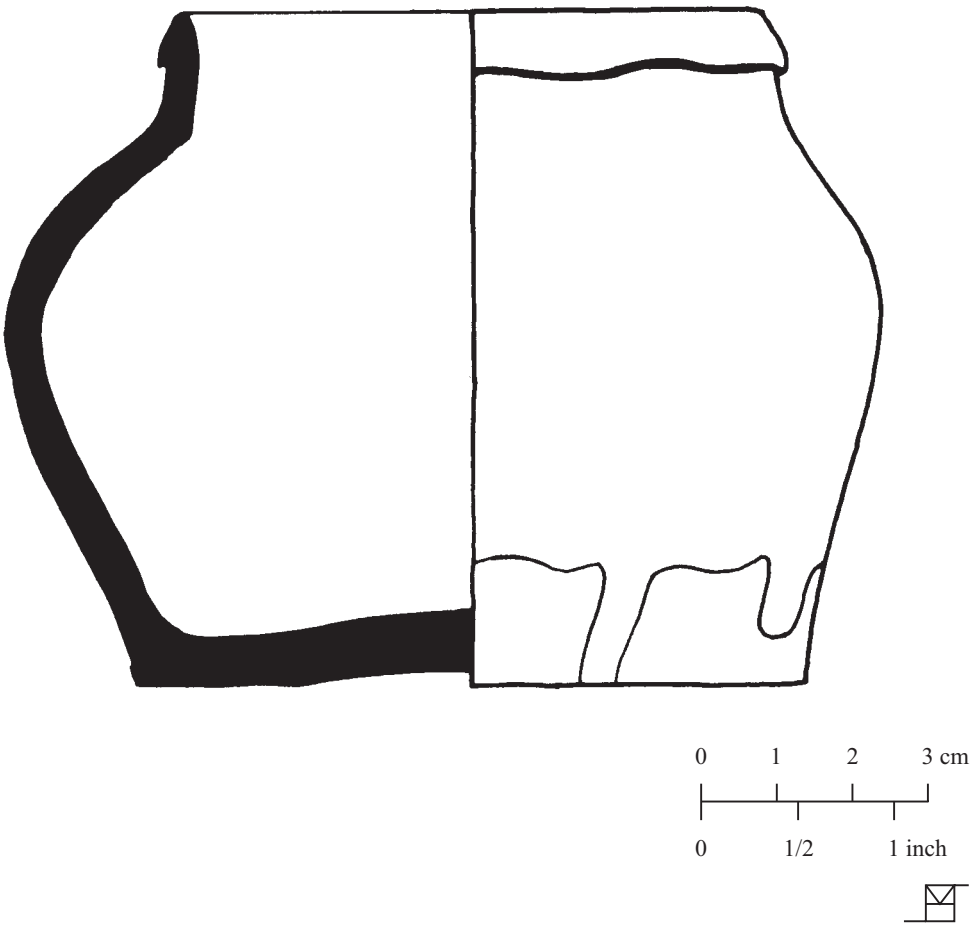


Figure 49. Chinese brown glazed stoneware wide-mouthed jar. *Another subtle form variation of the wide-mouthed jar type. See also Figures 46, 47, and 48. Catalog 95-14-88-4. (Illustration by Mike Stoyka)*

medicinal ointment; the preserved tofu mentioned previously was available in the medium- and large-sized jars. In homes they might have contained maltose—a sweet, sticky substance used in Cantonese cuisine—or medicinal herbs. They also were used to steam vegetables (Yang and Hellmann 1996).

Barrel Jar

The barrel jar, or *ngá gong* (瓦缸 , 'pottery barrel'), is essentially a huge straight-sided jar (Figures 50a and 50b). Many of these jars were originally used to pack *pintong* (片糖 , 'sheet sugar') for transport. The jars were re-used to store rice, other grains, sticky rice powder, and whole soy beans. In the days before tap water, these jars were also left outside the house to catch rain. The larger vessels could also have been used to ship the bones of the dead back to China. According to Cantonese custom, the relatives of the deceased would exhume the body after 10 years. After arranging the bones in a ritually specified way in the barrel jar, it would be reburied in the family cemetery plot (Yang and Hellmann 1996).

Pan

Fragments representing at least four pans, or *tsǒi but* (菜钵 , 'vegetable basin'), were recovered from the site. Pans are usually glazed on the inside, with the exterior glazed only as far as the sides' horizontal ridge at the midsection. The rest of the vessel is unglazed (Praetzellis and Praetzellis 1979:155). Unlike the six CGBS forms discussed above, which could be found in the kitchens of both the farmer and the merchant classes, the pan was used only by the poorest rural families in China. It is not used as a cooking utensil, but rather as a serving dish. A Chinese elder interviewed for this study indicated that the pan was the least expensive CBGS vessel form available. In China, the pan was also used by beggars or Buddhist monks to beg for food or money. At the Chew Kee Store in Fiddletown, California, a Chinese herb shop that dates to late 19th century, the authors observed pans that were used as lids for wide-mouthed jars. Recent research suggests the pan probably could have been used that way in mid-19th-century Sacramento too; the Chinese are not *that* particular about the functions of these ceramics (Yang and Hellmann 1996).

Stew Pot

Only one representative vessel of the stew pot, or *sha bo* (沙煲 , 'sand pot'), was recovered. The fabric of the stew pot is usually thinner and more refined when compared to other CBGS vessels, and the interior is glazed while the exterior is not. There is always a handle, and the lid can be flipped over to be used as a dish. They are used on stove tops to cook Chinese beef or tofu stew, hence the name "stew pot." Stew pots are still used today in Chinese restaurants.

Rectangular Vessel

This vessel has a rectangular shape with a circular opening on top (906-30, Figure 51). The height is unknown because it is incomplete. The body is very thick and sturdy compared to most of the other CBGS forms. This form was noted in an archaeological context in the adjacent city block in Sacramento (Praetzellis and Praetzellis 1982:145).

Figure 50(a). Chinese brown glazed stoneware barrel jar rim. *This gray-bodied, recessed rim would have received a lid. It is thinly glazed with a dark brown to almost black glaze on the exterior and interior. Catalog 95-14-902-52. (Illustration by Mike Stoyka)*

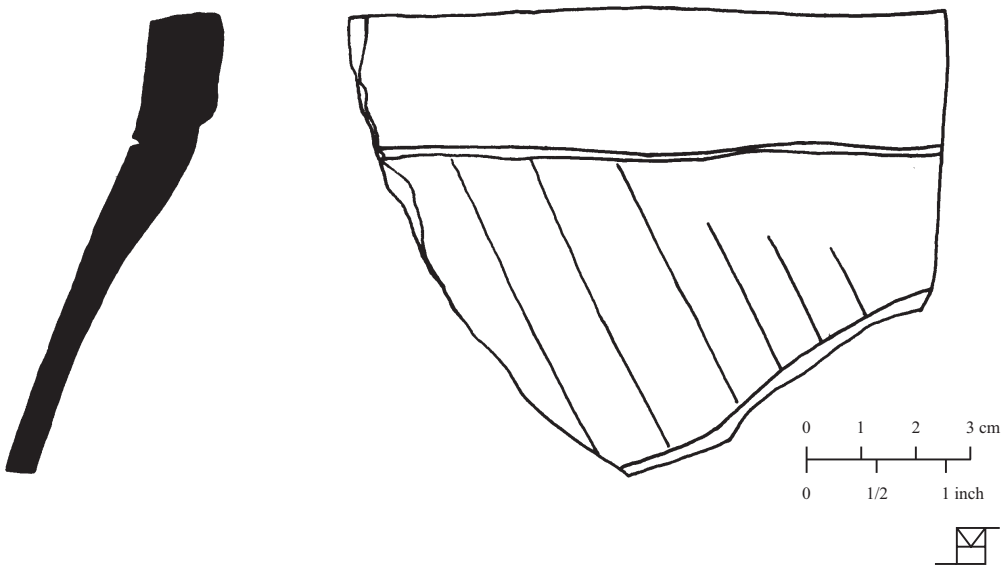


Figure 50(b) Chinese brown glazed stoneware barrel jar rim. *This buff to pink-bodied rim is brown glazed on the exterior and interior. The exterior is decorated with thin parallel ridges. Catalog 95-14-902-52. (Illustration by Mike Stoyka)*

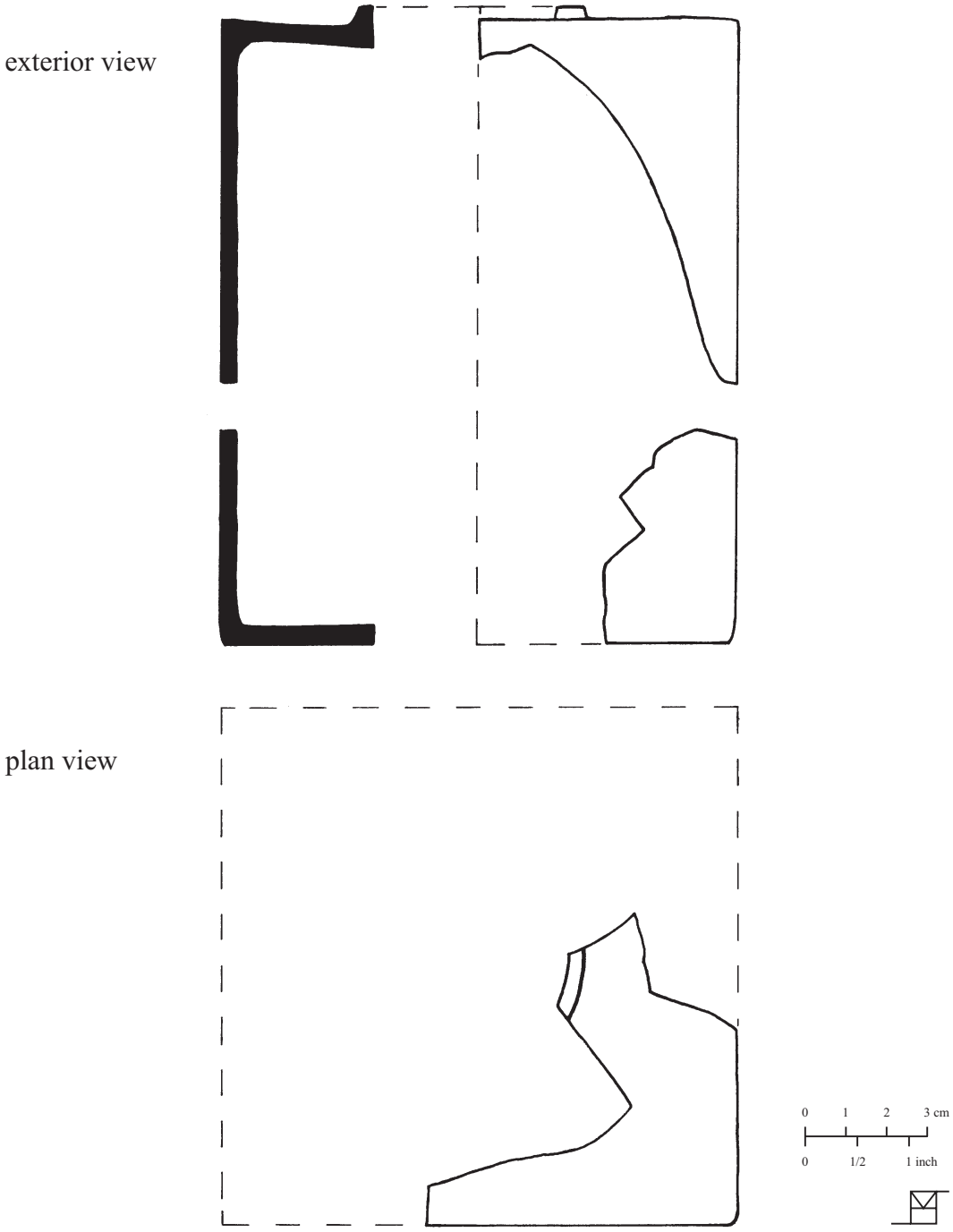


Figure 51. Chinese brown glazed stoneware rectangular vessel. *This thick-bodied vessel has a circular opening on top. Its exact height is unknown because the sherds are incomplete. Catalog 95-14-972-4. (Illustration by Mike Stoyka)*

Recessed-Rim Jar

The recessed-rim jar is globular in form, with a seat for a lid (900-11, 903.46-5, 954.2-26, 954.4-51, 963-14, and 973-21; Figure 52). It is a finer-grained stoneware compared to most of the other CBGS forms, and has a much thinner body than the Globular Jar. Its exterior is lightly glazed in buff.

Lug-Handled Jar

The lug-handled jar fragment (954.2-23) has two or more lugs, and may have resembled the spouted jar with lugs that was recovered archaeologically from a Chinese site in Riverside, California (Brott 1987:239; Figure 53).

Square Straight-Sided Jar

The square straight-sided jar has a square base with a square lip to receive a lid, similar to the straight-sided jars described above (903.68-17, Figure 54). It stands about 4 inches tall, and its contents are very likely to have been the same as that of its circular counterpart. There is a stamped mark at the base of this vessel. The two characters, *sanjì* (三記, 'three mark'), are mirror images of their actual forms; they are printed right-side-left, in other words. The characters may designate the pottery kiln where the vessel was made, or they may refer to a specific store for which the vessel was produced

Miscellanea

Six buff-bodied stoneware lids were recovered. These round, saucer-shaped lids are 3-1/4 inches in diameter. Otherwise unglazed, some have traces of red paint on the interior. It is likely that they were employed to cover wide-mouthed jars.

A number of crudely made, gray-bodied, utilitarian stoneware sherds were found among the 1855 fire deposits at 507 I Street (702.1-7 and 702.2-9). The fragments are roughly 3/4-inch thick, and are much softer than most CBGS. There are not enough fragments to determine the form of this previously undocumented vessel.

Finally, there is an unidentified CBGS object from 513/515 I Street (906-30). This item is approximately 1-1/2 inches high and measures 1/2-inch thick (Figure 56). Although another example has been recovered archaeologically in Sacramento (Praetzellis and Praetzellis 1982:143), there has been no satisfactory explanation for its function. This mysterious object is thinly glazed on the exterior, and bears an impressed symbol of *tongbǎo* on one side (see the discussion on the *tongbǎo* below).

GLASS

Chinese Medicine Vials

Five Chinese medicine vials are represented: two whole or nearly whole vials, one reconstructible, one base sherd, and a distinct midsection. The complete and reconstructible vials measure two inches high. The bottles ranged in color from colorless to light green to aqua, and all of the vials were constructed with a thick glass and a small internal cavity. These small dip-mold bottles have been referred to as "opium bottles" by archaeologists in the past (Blanford 1987; Evans 1980).

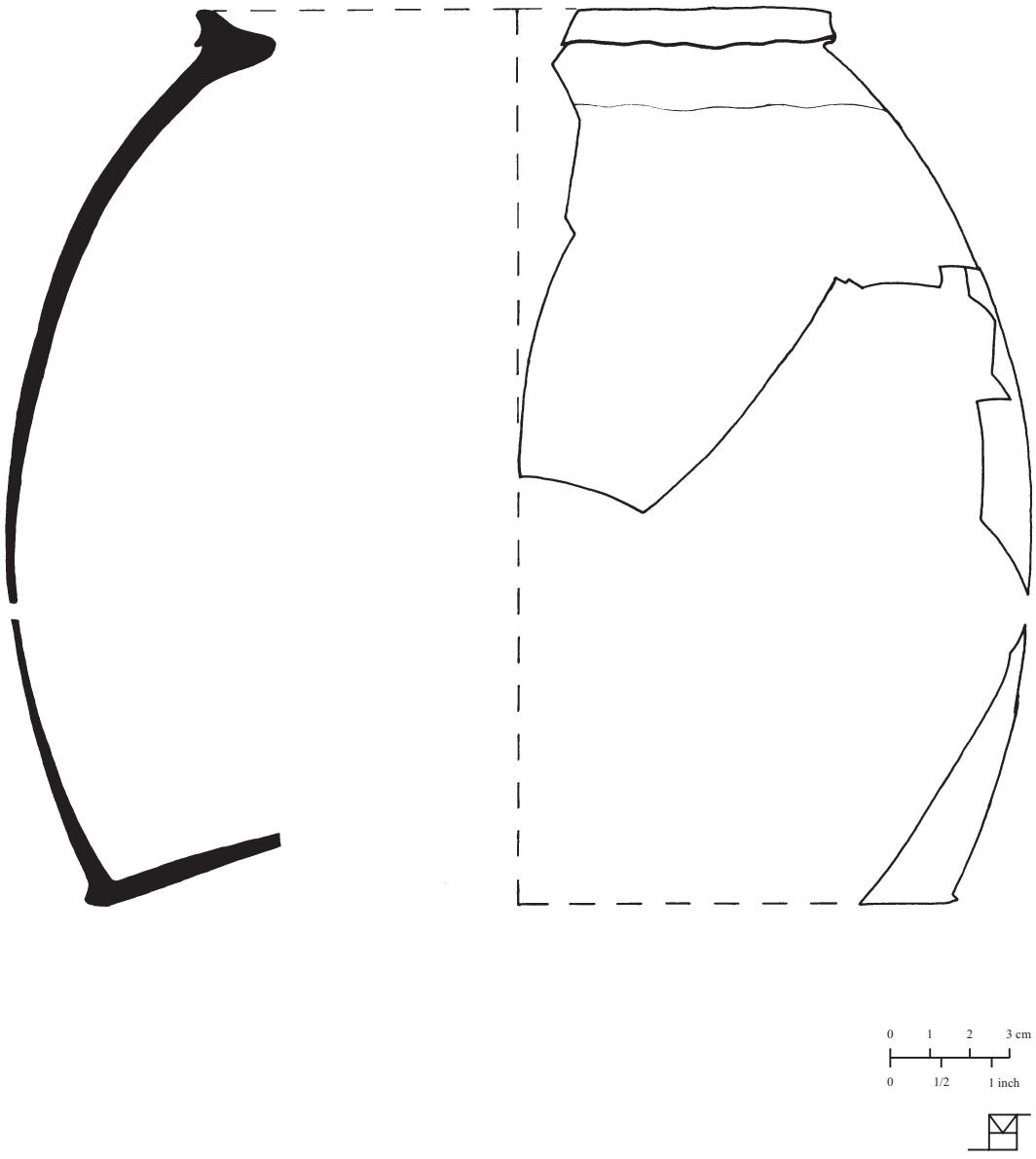


Figure 52. Chinese brown glazed stoneware recessed-rim jar. *This jar is thinner and more fine-grained when compared to most CBGS types. It is lightly glazed in buff on the exterior and has a seat for a lid. Catalog 95-14-900-11, 95-14-903.46-5, 95-14-954.2-26, 95-14-954.4-51, 95-14-963-14, and 95-14-973-21. (Illustration by Mike Stoyka)*

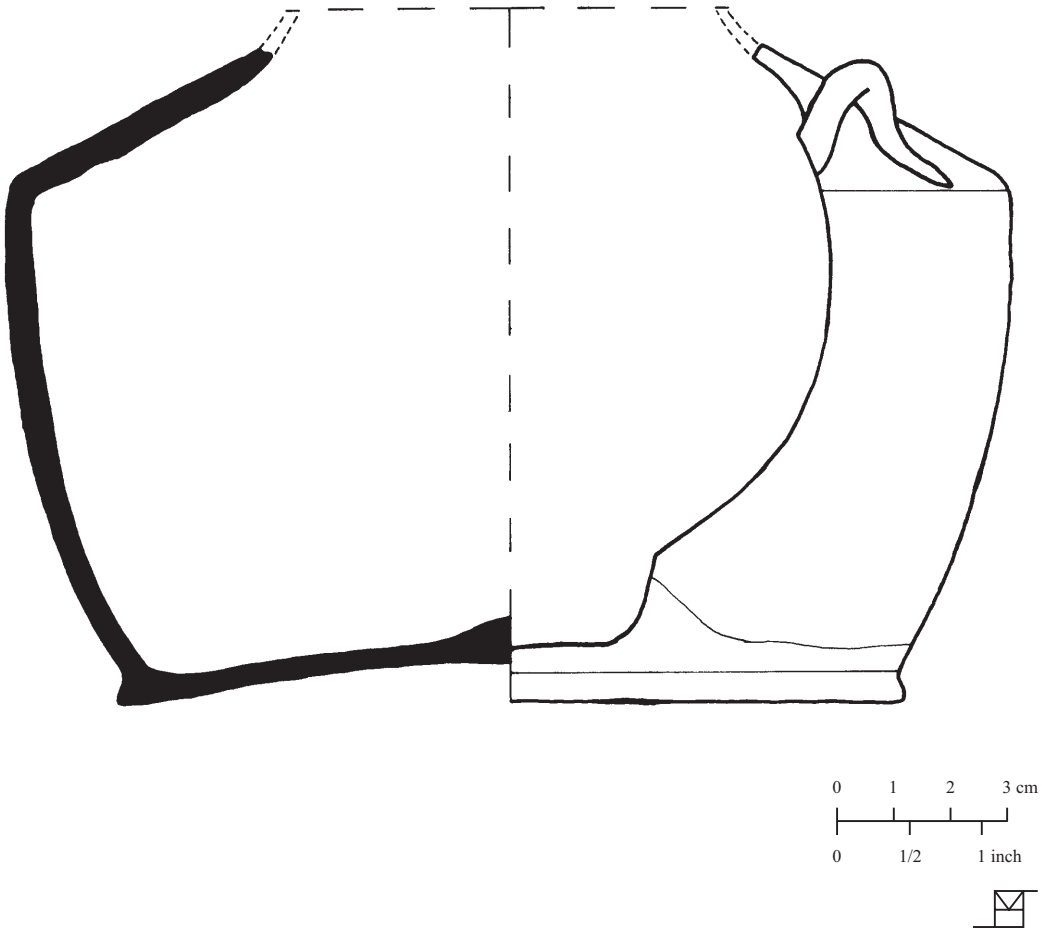


Figure 53. Chinese brown glazed stoneware lug-handled jar. *This vessel, thickly glazed in iridescent brown on its exterior, is similar in form to the spouted jar except for the handmade lug handles. Catalog 95-14-954.2-23. (Illustration by Mike Stoyka)*

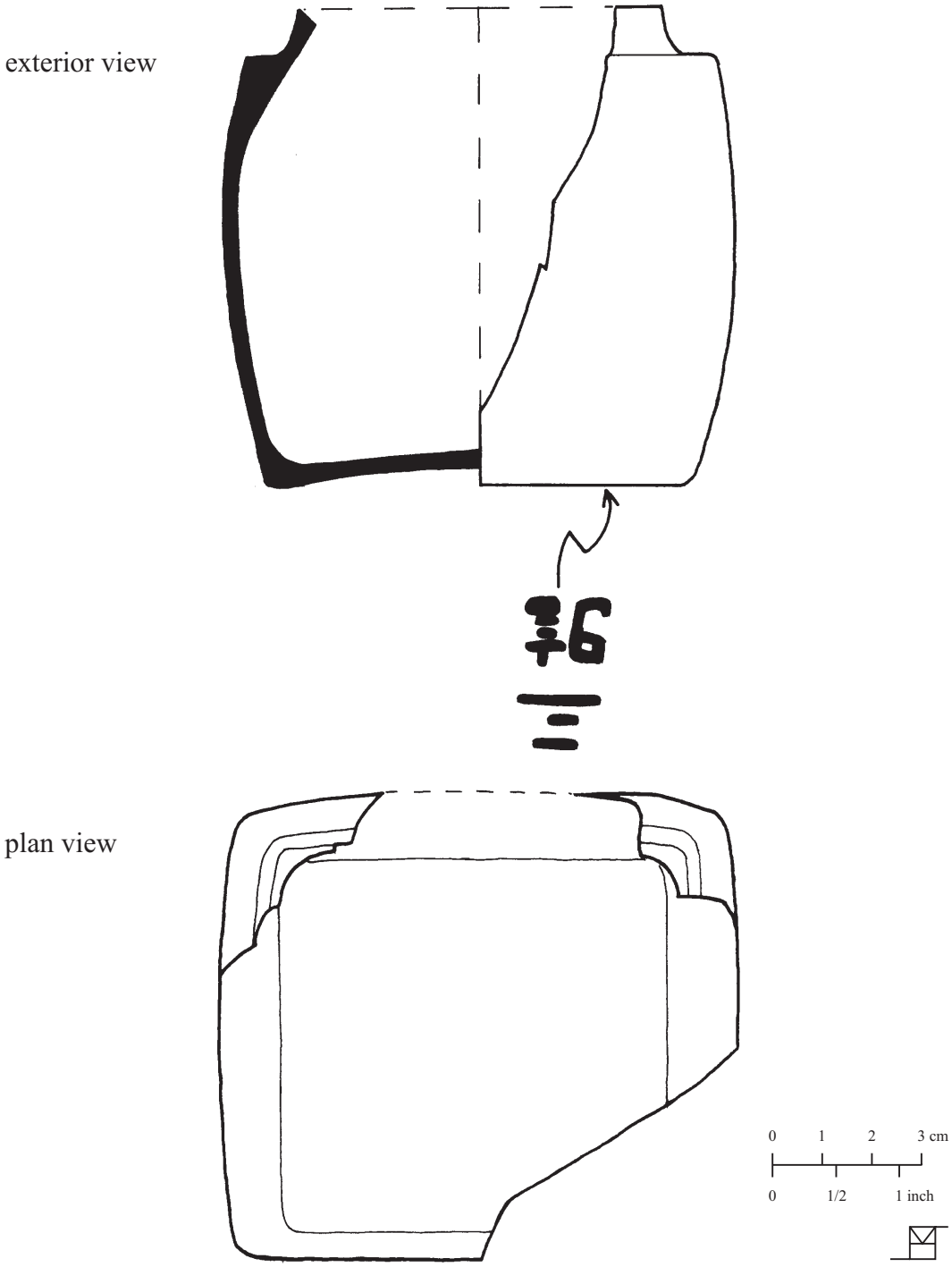


Figure 54. Chinese brown glazed stoneware square straight-sided jar. *The thin-bodied vessel has a square lip for a lid. The stamped mark on its base is a mirror image of* sanjì, *"three mark." Catalog 95-14-903.68-17. (Illustration by Mike Stoyka)*

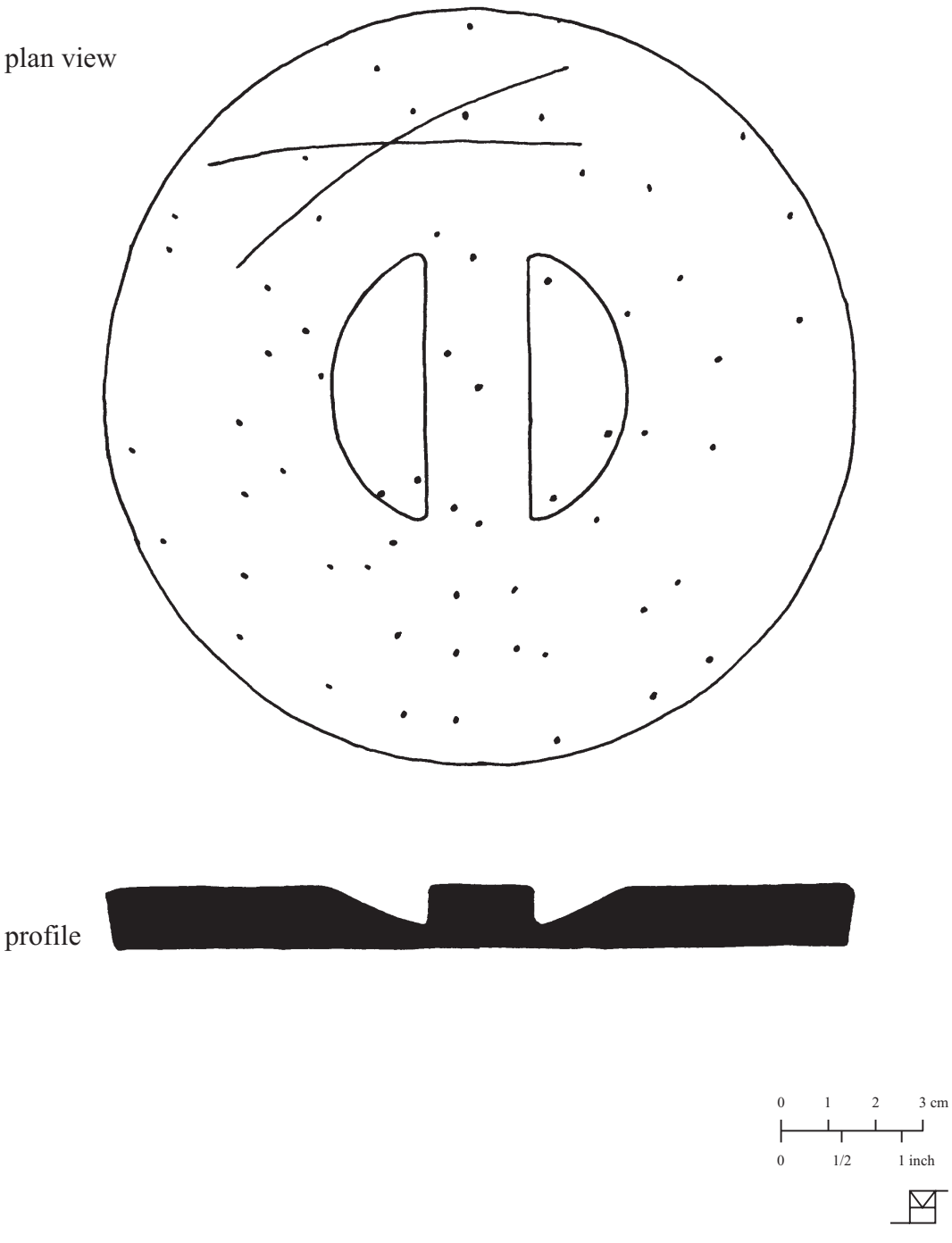


Figure 55(a). Chinese brown glazed stoneware lid. *This lid has a recessed handle and numerous, random perforations on top. The underside and edges are glazed iridescent brown, and bear four stacking marks from the vessel beneath it in the kiln. See also Figure 55(b). Catalog 95-14-711-38. (Illustration by Mike Stoyka)*

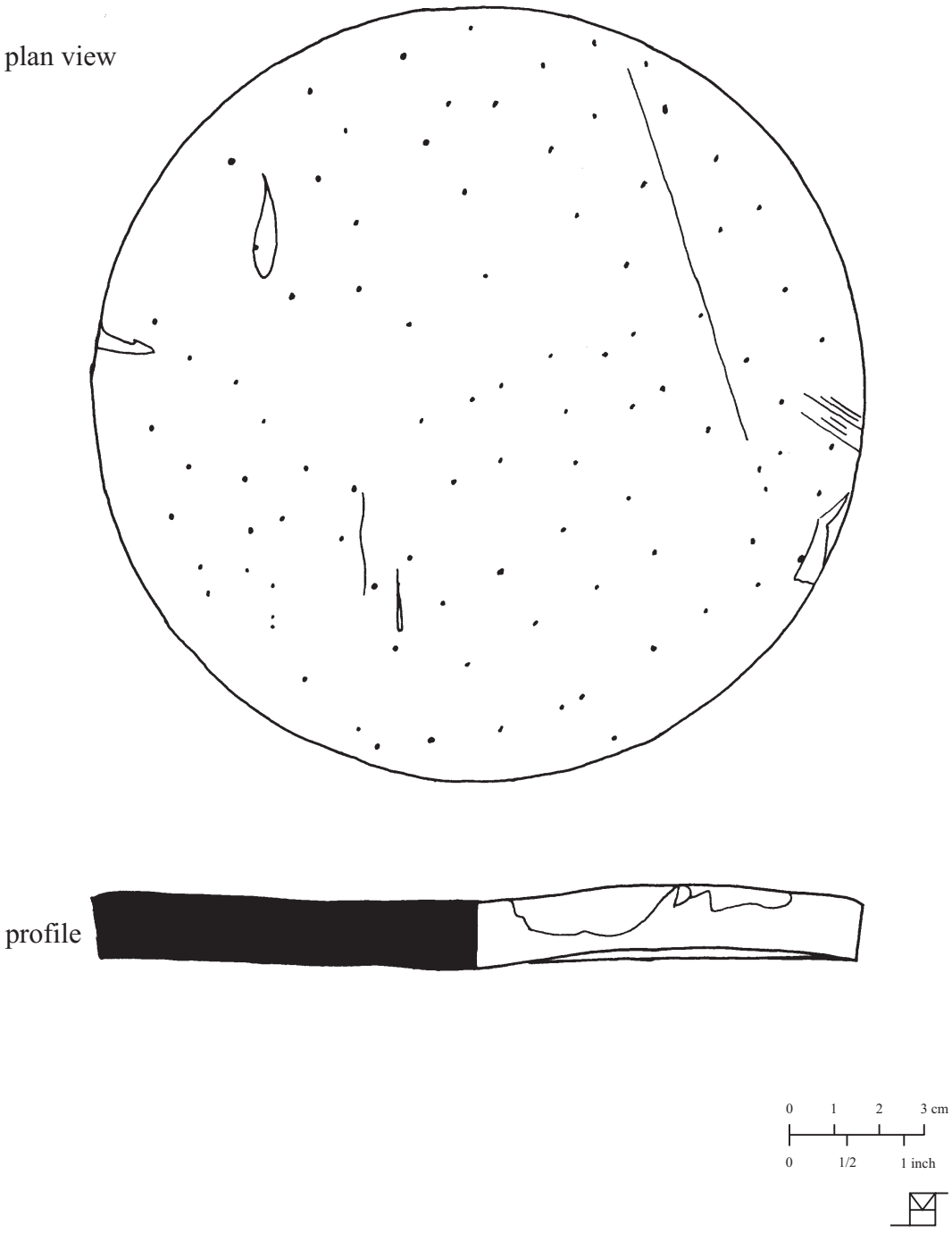


Figure 55(b). Chinese brown glazed stoneware lid. *This lid is unglazed on top, has numerous perforations, and is devoid of any sign of a handle. The underside is thickly glazed brown, and has three stacking marks. See Figure 55(a). Catalog 95-14-711-38. (Illustration by Mike Stoyka)*

Figure 56. Unidentified Chinese brown glazed stoneware object. *It is thinly glazed on the exterior, and bears an impressed design of* tongbao, *a Chinese coin, on one side. Catalog 95-14-906-30. (Illustration by Mike Stoyka)*

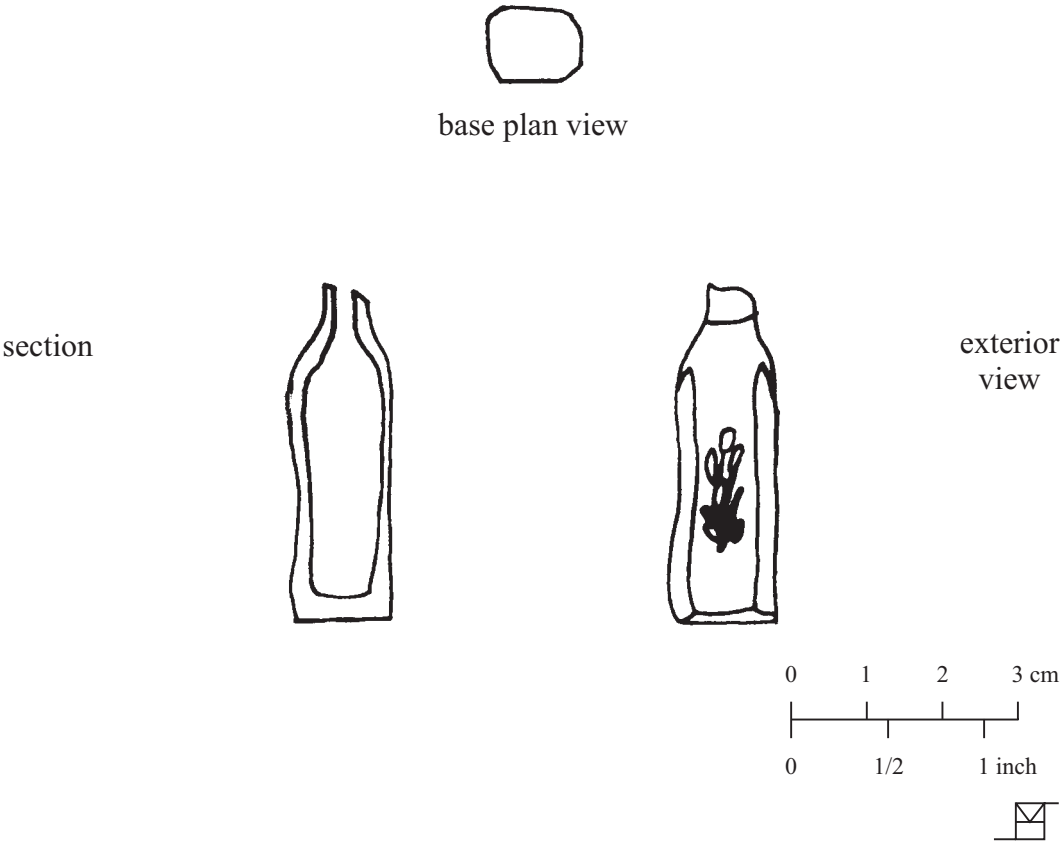


Figure 57. Chinese medicine vial. *This small vial has a thick, colorless glass body and a small internal cavity. It is distinguished from other vials in the collection by the etched floral design on opposing sides of the exterior. Catalog 95-14-720-35. (Illustration by Mike Stoyka)*

Both colorless vials in this collection were distinguished from the others in that their octagonal sides were paneled with an etched floral design on opposing sides (Figure 57). On one (720-35), the etching was colored yellow. All of the vials from this collection are of "Type 1" variety as illustrated in Blandford's (1987:200-201) typology. These are the most common type of Chinese medicine vials seen on Overseas Chinese sites.

OPIUM-RELATED MATERIAL

Pipe Bowls

Fifty-eight opium pipe bowl-sherds were collected, representing 13 bowls. The majority of these artifacts was recovered from the pre-1855 and 1855 fire layers. Minimum numbers were derived by examining body fabric, decoration, and bowl construction (Table 37). Most of the bowls were of earthenware, the cheapest grade of opium pipe bowl available (Etter 1980:100). The earthenware sherds came in two varieties: a fine red earthenware with or without a thin clear glazed exterior, and a more highly refined earthenware with a gray-brown body. Many sherds in the latter group have a polished exterior. One porcelain pipe-bowl sherd, with a celadonlike glaze (711-22) was also recovered. All of the opium pipe-bowl sherds are fragmented, and many are decorated with Chinese characters, and floral or geometric patterns; they have plain, banded, or faceted sides.

Overall, the collection indicates that the cheapest variety of bowls was available to and in use by the Chinese community of Sacramento: the earthenware pipe bowls with circular smoking surfaces (Wylie and Fike 1993:275). The sole exception was the porcelain pipe bowl recovered in a post-1861 deposit. This bowl sherd has a circular smoking surface and straight, faceted sides. Porcelain pipe bowls are known to exist in private collections, but no reference has been found archaeologically (Etter 1980:100).

Tins and Glass Lamps

The collection of opium tins and glass lamps is meager. Seventeen copper-alloy tin fragments were collected from both 1855 burn layers and post-1861 flood deposits. Due to the fragmentary condition of these artifacts, no minimum number of items could be obtained. A complete 1-1/2-inch by 1-1/2-inch opium tin brand label (902-77), which reads *shànghwán lìyuán* (上環麗源 , 'Top Ring Source of Beauty'), was found in the 1861 flood deposit. The mark is identical to that of a stamped tin located archaeologically in a previous excavation in Sacramento (Felton, Lortie, and Schulz 1984:68-9). This brand of opium is one of the most common found on Overseas Chinese sites.

Five opium glass lamp chimney fragments representing three different lamps were collected. Two small straight-sided "Type A" rim fragments (903.30-4, 903.31-1) and a glass wick holder (903.52-10) were recovered from the 1855 fire layer. A nearly complete, "Type B" chimney (902-88), with 11 small panels around the beveled top, was found in the 1861 flood deposit; one small rim fragment (966-7) identical to this nearly complete chimney was found below the 1861 flood deposit (see Wylie and Fike 1990:289 for illustrations of lamp chimney types).

Table 37. Opium pipe bowls

Smoking Surface: Side Decoration	**Circular Plain**	**Circular Banded**	**Circular Faceted**	**Circular Unknown**	**Unknown**	**Total**
Material						
Fine Red Earthenware	22/2	4/1	11/3	6/*	1/*	44/6
Highly Refined Earthenware	3/2	8/3	1/1		1/*	13/6
Porcelain			1/1			1/1

*These sherds fall into the material categories, but are not given Mnis because they are too fragmented.

VARIA

Tongbao

Tongbao refers to Chinese coins that have a square hole in the middle (Figure 58). The Chinese fashioned their coins after the belief that the heavens were round and the earth was square, as expressed in the phrase *tianyuándìfang* (天圓地方). The *tongbao* has been used in China for at least 2,600 years, and always bears four characters in the *han* (漢) script on the obverse side. The character to the left of the center hole reads *tong* (通 , 'through'), and the character to the right reads *bao* (寶 , 'treasure'). Thus, the term *tongbao* means 'a treasure with a hole through it.' The top and bottom characters refer to the emperor's reign during which the coin was minted. Two characters on the reverse, written in the *ching* (清) script, indicate the place where the coin was made.

A total of 32 *tongbao* were found; most came from the 1855 fire-deposit layers and the underlying surface. Nineteen bear legible reign marks, while others are too corroded to offer dating information. The majority of the identifiable coins were struck between 1736-1795, during the reign of *Qíanlóng* (乾隆). The next most frequently encountered coins were those from the reign of *Kangxi* (康熙), who governed China between 1662-1722 and was the paternal grandfather of *Qíanlóng*. It must be noted here that more coins bear marks from these two reigns than from any other period, because both emperors ruled for roughly six decades.[4] Chinese records indicate that *Qíanlóng* decided to step down from the throne after 60 years as a sign of respect, because he did not wish to rule longer than *Kangxi*. The other emperors from the *Ching* dynasty ruled from 3 to 33 years, and as a result did not mint as many coins. Almost all of the identifiable coins were minted in Beijing, capital of imperial China. Only one was minted in the 19th-century, made between 1821-1850 during the reign of *Dàoguang* (道光).

It is difficult to ascertain the function of the *tongbao* in Sacramento without firm association with other artifacts and further research. Previous archaeological reports suggested that these coins were probably used in fortune-telling (as in *ìjing*)[5], as talismans (especially in multiples), and in the gambling game of *fantan* (Akin and Akin 1988:431; Farris 1984:147).

[4] In the 17th century alone, more than 2 billion coins were minted (Beals 1980:59).

[5] In the more recent Pinyin system, the romanization of the Chinese characters 易經 is spelled *ìjing*, while under the old, Wade-Giles system, it is spelled *i-ching* as reported in previous archaeological literature.

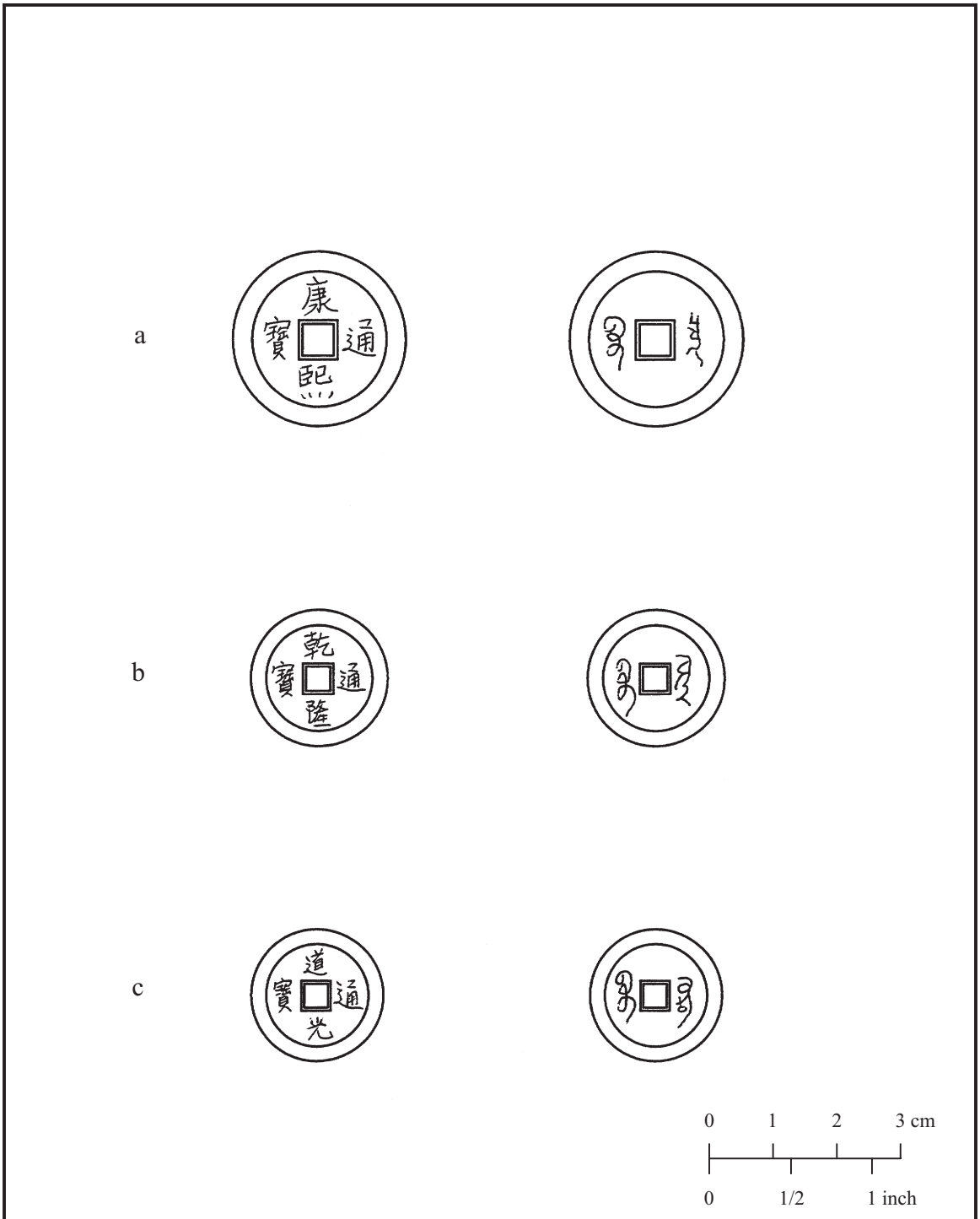


Figure 58. Representative *tongbao* from Sacramento HI56. *58(a)* Kangxi, *1662-1722, Beijing. 58(b)* Qíanlóng, *1736-1795, Beijing. 58(c)* Daòguang, *1821-1850, unknown.*

Locks

Four Chinese padlock fragments representing at least two individual locks were recovered. Measuring 2-3/8 inches and 2-7/8 inches long, respectively, these copper-alloy locks are traditionally used to secure wooden trunks or cabinets. Usually an I-shaped key is inserted into the key hole on one side, thus enabling the spring mechanism within the padlock to pop open.

Zhu

Nine Chinese gaming pieces, or *zhu* (珠 , 'bead'), were identified. Z*hu* is transliterated as *chu* in the old Wade-Giles system used in some archaeological reports. The authors believe these gaming pieces should be termed *zǐ* (子 , 'bead' or 'piece'), because that is the name for the beads in the game *wéichí* (圍棋 , 'surround chess'). In order to avoid further confusion, however, we have elected to follow the old terminology but use the new spelling.

The three black and six white, handmade, convex glass artifacts are 1/2 inch in diameter, and are used in *wéichí*, a strategy game of two players, who each take a different color.[6] The object of *wéichí* is to prevent the opponent from further play by surrounding his/her *zhu*. It has also been proposed that *zhu* may have been used as counters in *fantan* (Mueller 1987:391).

Additionally, a colorless glass disk (954.4-154) was recovered from the sub-1855 fire burn surface. This piece is different from the previously identified *zhu* in that it is flat on both sides and is significantly bigger, with a diameter of 11/16 inch. Although its exact purpose is unknown, the disk may also have served as a gaming piece.

Bracelets

Five bracelet fragments (902-87, 903.6-7, 903.35-6, and 903.39-2), found among the 1855 fire and post-1861 deposits, are of a material referred to as Peking glass (Noah 1987:402). Four are very deteriorated, while one is partially melted. Because of their condition, it was not possible to determine whether the bracelets were originally carved on the surface. These fragments represent at least two individual bracelets, and point to a female presence on the site.

It is the authors' understanding that only women wore bracelets; certainly that is the case in contemporary Chinese society (Yang 1996, pers. comm.). In addition to serving as personal adornment, bracelets are also worn by women to keep away evil spirits. A traditional Chinese belief holds that, if one fell, the bracelet would hit the ground first, thus preventing "one's spirit from being broken." They are never taken off, not even for sleeping, because one must be protected at all times (Yang 1996, pers. comm.).

[6] *Wéichí* is known as *go* in Japanese.

Fans

Three fragments of a fan were found below the 1855 fire surface. These elongated tortoise-shell fragments are 1-7/8 inch long by 1/64 inch thick, and each has a hole drilled on the thinner end. The Chinese considered it elegant to carry a fan in one's sleeve and sway it gently while talking. The fan was carried by both men and women, and thus cannot serve as a gender marker.

Like the flat colorless disk in the *zhu* category, there is also an unidentified artifact that is possibly associated with fans. The mystery object (954.3-37), comprised of three associated fragments, is made of bone and measures 1/16-inch thick. It is carved with an intricate, hollowed-out, floral design, and has a serrated edge on one side. Again, its exact purpose is unknown.

CONCLUSION

The Chinese artifacts recovered from the HI56 site represent a wide range of material. Many of these types are encountered frequently on Overseas Chinese archaeological sites, but there are also several new finds which appear unique and have not been documented previously. This chapter has specifically sought to identify and describe these unusual artifacts, and offer available background information. This section will serve as a descriptive catalog that can assist in identification, as well as a building block for future information on Chinese artifacts.

GLASS BEADS

by Lester A. Ross

Archaeological excavations on the HI56 Block, Sacramento, recovered 382 glass beads of 26 varieties, including 20 varieties of drawn, 4 varieties of wound, and 2 varieties of mold-pressed beads. Although many proveniences can be associated with Chinese occupations, none of the beads appear to be of Chinese origin. Rather, most can be attributed to European manufacture, specifically from Bohemia. Based upon their varieties and colors, three subassemblages are defined: (1) pre-1855 to 1870 Chinese contexts; (2) an 1870 non-Chinese context; and (3) an 1877 non-Chinese context. High percentages of European beads and distributions of bead colors suggest all three contexts may have possible associations with Christian religious beliefs and customs. Evidence for beaded articles attributed to Chinese customs and beliefs was not observed.

BEAD CLASSIFICATION SYSTEMS

Identification and description of beads utilizes procedures based upon a combination of classification systems and strategies developed for archaeologists by Kenneth and Martha Kidd (1970), Karlis Karklins (1982, 1985, 1994), Roderick Sprague (1983, 1985, 1994), and the author (Ross 1994; Ross with Pflanz 1989). Additional descriptive nomenclature follows various authors who have addressed specific bead shapes, groups, and classes (e.g., Allen 1983; Beck 1928).

Beads are analyzed for a variety of attributes, following a four-fold, hierarchic classification scheme:

1. material and manufacturing techniques;
2. stylistic attributes, including color layering, shape, and presence or absence of decoration;
3. stylistic variety attributes, consisting of the type of decoration, diaphaneity, type of finish, mold seams, perforation types, shapes, and orientation, and range of bead color hue, value, and chroma; variability in shape and length; and the probable type of original luster and post-depositional erosion; and
4. bead sizes as defined from measurements of bead least diameter (LD) and length (L).

Bead descriptions are organized to present information by bead class, type, subtype, and variety. In an attempt to compare bead varieties to earlier bead classification systems of Kidd and Kidd (1970) and Karklins (1985), comparative numbers are provided when possible. Because of the difficulties in making comparisons with the varieties defined by Kidd and Kidd, only their class numbers are identified (e.g., IIa, IIIf).

For ease of reference, bead variety numbers consist of a single unique number (e.g., 1, 12, 20, etc.) assigned to the Sacramento Block HI56 bead assemblage, and the descriptions accompanying these numbers do not correspond to descriptions for similar numbered varieties at other sites.

Bead descriptions have been organized to present information by bead class, type, subtype, and variety in tabular format, together with a graphic representation of the bead shape. Discussions of bead-manufacturing techniques are provided in the text, together with relevant comparative data for the occurrence of similar beads from other dated contexts.

Comparative information regarding the occurrence of bead varieties in other archaeological contexts has neither been exhaustive nor complete for all varieties. Rather, varieties that are regarded as unique or possibly significant for geographical, cultural, or temporal affiliations have been documented.

Opinions regarding historic values, temporal ascriptions, and the frequency of occurrence at archaeological sites are based upon the personal knowledge of the author. Published literature documenting the precise temporal placement of beads in the 19th century for western North America is limited. This does not imply a lack of documentary reports (e.g., see Karklins and Sprague 1980, 1987), but rather the lack of comparable bead classifications and descriptions used by various authors who have written descriptive reports, combined with the lack of tightly dated contexts. No authoritative temporal studies for western North America have been published, and extant interpretations vary considerably based upon the experience of each author. Until a major effort is undertaken to review existing historical and archaeological literature, and to document tightly dated collections using a standard classification system, temporal and functional interpretations for glass beads from western North American sites can only be regarded as informative speculation.

CATALOGING PROCEDURES

Prior to initiation of the cataloging procedures discussed below, glass beads had been stored by provenience in resealable polyethylene bags. The author identified the major bead classes (i.e., drawn, wound, mold-pressed) and principal bead attributes. Techniques and methods for sorting beads into preliminary varieties followed procedures established previously by the author for other investigations (e.g., Ross 1990, 1995).

Sorting

Beads from individual proveniences were sorted into varieties and placed into labeled resealable polyethylene bags along with paper catalog slips containing provenience information, variety number, type designation, and bead quantity. Each bag for a single provenience was opened individually, separating beads with similar attributes into like groupings. Incandescent light, water (to wet beads, thus eliminating the appearance of surface patina and removing loose dirt), and magnifying loups or lenses were used to identify bead attributes. Patina and mineral encrustations were removed by briefly immersing beads in a 67% aqueous solution of glycolic acid (hydroxyacetic acid, $C_2H_4O_3$) to soften surface deposits and/or a 30% aqueous solution of muriatic acid (hydrochloric acid, HCl) to dissolve salts. Acids were removed by washing beads in water and again in isopropyl alcohol (C_3H_8O). If necessary, softened deposits were further removed by gently brushing or scraping.

Attributes considered during the sorting process consisted of: the following:

Material
Method of Manufacture
Decoration
Perforation Type, Shape, and Orientation
Mold Seam Orientation (if present)
Diaphaneity
Luster

Layering
Color Chroma, Value, and Hue
Shape
Type of Finishing

Beads from archaeological sites are exposed to a variety of chemical and physical effects as they sit in soil. Some deteriorate physically and chemically due to natural effects of soil pH and contact with minerals and chemicals in solution. Natural corrosion (n-transforms) noted for these beads included formation of patina and mineral encrustations on glass surfaces, staining of glass, transformation of color (notably black to gray for some varieties of opaque beads, presumably those with a relatively high manganese or iron content), and decomposition of glass creating pits in the bead surface (notably red beads). Prior to or after deposition, beads also may have been subjected to cultural alteration (c-transforms), such as breakage. As beads were sorted, the effects of corrosion were considered and overlooked as independent stylistic variables used to define bead varieties.

The sizes of beads also were disregarded during initial sorting. As a dependent variable of individual varieties, size was documented only after final varieties were established.

As with all archaeological assemblages of beads, the separation of beads into discrete varieties relies upon the variability of the attributes present and the ability of the analyst to distinguish groups of attributes consistently. Even though multiple varieties may have been deposited by the historical occupants of a site, once these varieties are mixed, they may or may not be re-sorted into their original groupings. For example, two historical colors of green and blue embroidery beads could result in the creation of a single archeological variety of green to blue beads. As groups of attributes were segregated consistently, individual varieties were defined.

Descriptions were entered by attribute classes into a computer database (beadvrty.db, using Paradox version 4.5), allowing queries to be made using one or multiple attributes. Beads were tallied by variety and provenience with quantities entered into a second database (province.db). Queries of this database allowed distributions of varieties by temporal and cultural provenience (see Volume 2, Appendices 1-3) to be evaluated (e.g., the varieties of beads associated with early proveniences versus later proveniences). Attributes used to recognize final varieties are summarized below.

Material

Beads commonly are manufactured from bone, ceramic, glass, metal, plastic, shell, and stone. For this study, only glass beads were analyzed.

Methods of Manufacture

Methods for manufacturing beads vary by country and temporal period. Common methods for the mid- to late-19th-century include drawn, wound, and mold-pressed techniques.

Drawn Beads. This bead type was manufactured from hollow canes drawn from a molten gather of glass. Canes were chopped, cut, and sawn into bead-length segments for subsequent finishing, sorting, and packaging.

Wound Beads. Simple wound beads were manufactured by wrapping or winding molten glass around a rotating mandrel, such as a wire, rod, or straw coated with a clay slip. Beads were produced individually, then removed from their shafts and annealed, cleaned, sorted, and packaged. Complex and decorated wound beads were altered by molding or shaping, by applying dots, by faceting, etc. Shaped wound beads were manufactured by winding glass on a mandrel then; by using an open mold, the decoration was pressed into the surface while the glass was turned. Wound beads comprise the second most common group at North American sites dating to the mid-19th century. Beads of this type often exhibit spiral striations (either on the surface or within the glass); they may exhibit numerous micro-bubbles within the glass, and may have a pointed tip at one end where the glass rod was removed from the bead.

Mold-Pressed Beads. This bead type was manufactured by pinching or pressing molten glass in a two-part mold. The perforations were produced by pushing a pin into the mold and through the glass. Mold-pressed beads appear to have been produced in Bohemia after the 1820s. Beads of this type are characterized by the presence of a mold line (not necessarily a mold seam, which may have been ground off), and earlier varieties often have conical or biconical perforations.

Decoration

Beads are either decorated or undecorated. Decorations are highly variable; attributes used for identification include the type of decoration (e.g., appliqués, inlays, facets, molded surfaces, shaped surfaces), the color of the decoration, and the style, placement, and orientation of repetitive elements (e.g., rows, sides, facets, dots). Generally, the number of elements is not used in defining varieties, but may be used to identify a subtype or to describe the range of repetitive elements.

The types of decoration recorded for beads from Sacramento Block HI56 consist of the following:

Drawn Beads
- Shaping
- Faceting

Wound Beads
- Shaping
- Inlaid Dotting

Mold-Pressed Beads
- Faceting

Perforation Type, Shape, and Orientation

Types, shape, and orientation of perforations from beads from Sacramento Block HI56 consist of the following:

Type
- Cylindrical
- Conical and Pierced
- Conical, Pierced, and Punched

Shape
- Circular

Orientation
Vertical

Diaphaneity

The clarity of glass is identified as opaque, translucent, or transparent. Bead varieties may exhibit a range of diaphaneity (e.g., translucent to opaque) or may have multiple layers of glass of different diaphaneity (e.g., opaque on transparent). All three variations of diaphaneity were present at Sacramento Block HI56.

Luster

Luster refers to the surface appearance of a bead (excluding the effects of corrosion when possible, see below). The following are possible luster attributes:

Dull - very fine matted surface
Fibrous - exaggerated fibrous surface
Greasy - oil-like surface
Iridized - iridescent sheen
Matte - coarse matted surface
Metallic - metallic sheen
Satiny - fine fibrous surface (ribbon-like)
Shiny - smooth glossy sheen

Beads within a single variety may exhibit a range of luster (e.g., dull to shiny). Variations at Sacramento Block HI56 are limited to dull, fibrous, and shiny.

Layering

Beads may be manufactured from one or more layers of glass (i.e., monochrome or polychrome). Even a single layer of glass may produce multiple fortuitous layers as the glass cools. Polychrome layering can consist of multiple individual layers (e.g., 2-layer, 3-layer, multi-layer with perhaps tens of layers), marbleized layers, or zoned layers. Generally, a single variety exhibits only one type of layering, although some varieties exhibit both monochrome and double-layer polychrome. Most polychrome-layered beads from Sacramento Block HI56 are 2-layer beads (Varieties 15, 19, and 20). Varieties 1 and 4 exhibit multiple fortuitous layers.

Color Chroma, Value, and Hue

Color is one of the principal attributes used to sort trade beads. Beads of a similar color were grouped together; often subtle shades could not be identified consistently, and a single bead variety might exhibit a broad range of color. When describing color, the chroma, value, and hue are recognized by a simplified set of color terms, used individually or in various combinations. The following color terminology was used to describe beads from Sacramento Block HI56:

Value
Very Light
Light
Medium
Dark

Very Dark

Hue, relying on various combinations of

Clear
White
Black
Red
Brown
Yellow
Green
Blue
Purple

Definitive color designations consist of Munsell notations as determined using a Munsell Book of Color (Munsell Color 1994) and a magnifying lamp with a 60-watt incandescent light source approximately 10 cm from the bead. Prior to reading Munsell colors, bead surfaces were cleaned to remove patina and mineral encrustations as described above.

Shape

Shape is a highly variable attribute, often difficult to describe. Shapes identified for beads from Sacramento Block HI56 include the following:

Cylindrical
Ellipsoidal
Multi-Sided
Ovoidal
Spheroidal
Toroidal

Type of Finishing

Drawn and some mold-pressed beads are often finished during manufacture using such techniques as cutting, fire polishing, or hot tumbling. Only drawn beads from Sacramento Block HI56 exhibited the finishing attributes of cutting and hot tumbling.

Corrosion

As discussed above, glass beads are subject to a variety of natural and cultural factors that effect the appearance of their fabric and surface. Visible corrosive appearances for beads from Sacramento Block HI56 include:

Drawn Beads

Eroded (most glass)
Pitted (purplish red glass)
Patined (clear, black, purplish red, red, brownish yellow, green, bluish green, and purple glass)

Wound Beads

Eroded (most glass)
Patined (clear and black glass)

Mold-Pressed Beads
    Eroded (most glass)
    Patined (purplish red glass)

Size

Once all beads were identified and cataloged by variety, then sizes for each variety were determined. Bead sizes are defined using least diameter and length. Sizes were determined by measuring those beads with the smallest and largest least diameters and lengths for a visible range of sizes for each variety. To obtain more precise data for each size, all beads within a variety, or within a representative sample from a variety, were measured. When multiple sizes are reported for a single variety, no beads with measurements outside the sizes recorded were observed.

Photography

Prior to photographing beads, their surfaces were cleaned to remove patina and mineral encrustations as described above. After cleaning, beads with frosted appearances were coated very lightly with canola oil to reduce discoloration. Later, the oil was removed with isopropyl alcohol (C_3H_8O). Beads were grouped by class, type, and variety on a glass pane elevated over an 18% gray card. Two high-intensity electronic flash units were used to illuminate beads, and a color strip was included with each shot to aid color-balancing of the final prints.

BEAD ASSEMBLAGE (*n* = 382)

Drawn Beads (*n* = 366)

Manufactured from hollow canes drawn from a molten gather of glass, canes were chopped into bead-length segments for subsequent finishing, sorting, and packaging. They are the most common beads, comprising 95.8% of the bead assemblage, and are grouped into 20 types or subtypes based on their layering, shape, finish, and decoration.

Monochrome Drawn Beads with Cut Ends (*n* = 112)

Monochrome, Cylindrical, Undecorated Drawn Beads with Cut Ends (*n* = 5; Variety 7). These beads are the simplest of the unfinished monochrome beads. They have circular cross sections, consist of short to long segments cut or chopped from drawn canes, and have not been fire-polished or hot-tumbled. Only one variety is recorded (Figure 59). Variety 7 beads were recovered from a ca. 1877 non-Chinese context (Table 38).

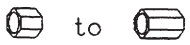
Monochrome, Multisided Drawn Beads with Cut Ends (*n* = 4; Variety 3). The tubes used to make these beads were manufactured from a gather of glass that was probably pushed into a multisided mold to create a polyhedral form, and then drawn into a multisided, hollow cane. These beads were probably manufactured in Bohemia, cut from hollow glass canes used to produce Variety 2 beads (discussed below). Only one variety is represented (Figure 59). No beads of this variety are reported from well-dated, western North American contexts. Variety 3 beads were recovered from a ca. 1870 non-Chinese context (Table 38).

Table 38. Distribution of Beads by Variety, Ethnicity, Provenience, and Time Period

VARIETY	ETHNICITY AND TIME PERIOD				QUANTITY
	Chinese Contexts		Non-Chinese Contexts		
	pre-1855	1855-1870	ca. 1870	ca. 1877	
1	20	2	1		23
2	66	1	1		68
3			4		4
4	7		12		19
5				5	5
6				76	76
7				5	5
8				1	1
9				2	2
10	5	1		7	13
11	44			1	45
12	26	3			29
13	2				2
14	1				1
15	2				2
16	56	5			61
17	1				1
18	5				5
19	1				1
20	7				7
21	2				2
22	1				1
23	5				5
24	1				1
25		2			2
26	1				1
TOTAL	253	14	18	97	382

Monochrome, Cylindrical, Undecorated Drawn Beads with Cut Ends (n = 5)

VARIETY NUMBER	DECORATION NUMBER OF SIDES	DIAPHANEITY LUSTER CORROSION PATINA	LAYERING COLOR MUNSELL NOTATION	SHAPE LENGTH FINISH	SIZE LEAST DIAMETER x LENGTH (mm) PERFORATION DIAMETER (mm)	PLATE NUMBER	COMPARATIVE NUMBERS	QUANTITY
7	Undecorated ---	Opaque Dull No patina	Monochrome Black N 2/	Cylindrical Long Cut	Size 1 1.8–2.3 x 2.3–3.2 0.6–0.8	1a	Kidds' Ia	5



Monochrome, Multi–Sided, Undecorated Drawn Beads with Cut Ends (n = 4)

3	Undecorated 6–sided	Transparent Fibrous No corrosion No patina	Monochrome Green 7.5G3/6	Cylindrical Short to Long Cut	Size 1 5.4–6.2 x 5.3–6.4 3.5–3.8	2a	Kidds' Ic	4

Monochrome, Multi–Sided, Drawn Beads with Two Rows of Ground Facets and Cut Ends (n = 102)

12	2 rows of ground facets 6–sided	Transparent Dull Eroded No patina	Monochrome Clear ---	Cylindrical Short to Long Cut	Size 1 (n = 22) 4.5–5.6 x 5.1–6.2 1.2–2.4 Size 2 (n = 7) 7.4–8.4 x 6.5–8.1 2.5–3.5	2b	Kidds' If	29
2	2 rows of ground facets 6–sided	Transparent Dull & Fibrous No corrosion Patina	Monochrome Bluish–green 10G3/6	Cylindrical Short to Long Cut	Size 1 4.1–5.5 x 4.5–6.3 1.4–3.0	2c	Kidds' If	68
23	2 rows of ground facets 6–sided	Transparent Dull Eroded Patina	Monochrome Dark Purple 7.5PB2/8	Cylindrical Short Cut	Size 1 5.0–6.0 x 4.2–5.3 1.9–3.5	2d	Kidds' If	5

Monochrome, Multi–Sided, Drawn Bead with Four Rows of Ground Facets and Cut Ends (n = 1)

14	4 rows of ground facets 7–sided	Transparent Shiny & Fibrous No corrosion No patina	Monochrome Bluish–green 10G3/6	Cylindrical Short Cut	Size 1 10.1 x 9.4 4.1	2e	Kidds' If	1

Polychrome, Multi–Sided, Drawn Beads with Two Rows of Ground Facets and Cut Ends (n = 42)

4	2 rows of ground facets 6– to 7–sided	Transparent on Translucent Fibrous No corrosion No patina	Polychrome Clear on White N 8.75/	Cylindrical Short to Long Cut	Size 1 (n = 14) 4.4–6.1 x 4.0–5.7 1.5–3.2 Size 2 (n = 4) 6.7–8.0 x 6.5–7.2 2.6–3.3 Size 3 (n = 1) 9.8 x 8.1 2.8	2f	Kidds' IIIf	19
1	2 rows of ground facets 6–sided	Transparent on Translucent Dull & Fibrous No corrosion No patina	Polychrome Purple on Very Light Purple 5PB3/6 on 5PB7/6	Cylindrical Short to Long Cut	Size 1 4.7–5.9 x 4.0–7.9 1.6–2.8	2g	Kidds' IIIf	23

Figure 59. Drawn beads with cut ends (n = 154)

Monochrome, Multisided Drawn Beads with Ground Facets and Cut Ends (*n* = 103). The tubes used to make these beads were manufactured from a gather of glass that was probably pushed into a multisided mold to create a polyhedral form, and then drawn into a multisided, hollow cane. In an earlier report, it was speculated that the multisided shape may have resulted from marvering or an extrusion process (Ross 1976:686, Figure 338). No historical evidence for these alternatives has been located. Two subtypes are identified by the number of rows of ground facets present.

Beads with Two Rows of Ground Facets (*n* = 102; Varieties 2, 12, and 23). Manufactured by grinding two rows of facets, consisting of a facet on each corner of each end. These facets are probably ground before the individual beads are cut, snapped or chopped from their glass cane. From this technique, a 6-sided bead will have 18 flat surfaces, consisting of 6 molded sides and 12 ground facets, and a 7-sided bead will have 21 flat surfaces with 7 molded sides and 14 ground facets. These beads, and their polychrome counterparts (see below), are referenced variously, and incorrectly, as *Russian*, *Bristol*, *Hudson's Bay*, *chief* and *ambassador* beads, or described as *cornerless hexagonal or septagonal*, *short bugle*, *multi-faceted* or *cut* beads (e.g., Mille 1975; Neuwirth 1994; Pfeiffer 1983:209-210; Woodward 1965:12). Three varieties of 6-sided, transparent beads are recorded (Figure 59).

In the Pacific Northwest, these beads along with their polychrome equivalents (discussed below) have been identified incorrectly as *Russian* faceted beads, due to their late-18th- and early-19th-century introduction into the Alaskan region by Russian fur traders. The Russian-American Company did trade these beads, but the Russians probably did not manufacture them. According to Arthur Woodward,

> Other beads, such as the large ultra marine blue faceted beads found along the coast of southern Alaska and British Columbia and as far south as Washington and Oregon, became "Russian beads," in spite of the fact that original packages of these beads, wrapped in grey coarse paper, were found unopened in the warehouse of the Russian American Fur Company at Sitka in 1867, marked "Brussels." In the latter case it was probably a repackaging job done by an export company in the Belgian city [1965:9].

Both monochrome and polychrome versions of these beads were probably manufactured in Bohemia. The Russian-American and Hudson's Bay companies were the primary source for the Pacific Northwest, at least for areas from Alaska to northern California near the Russian trading site of Fort Ross. In the Pacific Northwest, these bead types are associated primarily with post-1820 fur-trade and Native American sites, most of which were not associated with the Russian trade, and thus are not *Russian* beads. It would be just as incorrect to identify them as *Roman* beads because of their association with the Late Roman period site of Corinth in southern Greece (Davidson 1952:294, Plate 122) or as *Viking* beads because of their association with 10th-century Viking sites in Europe (Klindt-Jensen 1970:170-171).

Six and seven-sided varieties are reported at many western archaeological sites including 1829-1860 HBC Fort Vancouver, Washington (Ross 1990:Type If-d). Variety 2, 12, and 23 beads from Sacramento Block HI56 were recovered principally from pre-1855 Chinese contexts, with a few (Varieties 2 and 12) from 1855-1870 Chinese contexts, and one (Variety 2) from a ca. 1870 non-Chinese context (Table 38).

Beads with Four Rows of Ground Facets (*n* = 1; Variety 14). Manufactured by grinding four rows of facets, consisting of two rows with a facet on each corner of each end and two rows between the end rows and the molded sides. This results in a 7-sided bead having 35 flat surfaces, consisting of 7 molded sides and 28 ground facets. Only one variety of a transparent bead is recorded (Figure 59). The single Variety 14 bead was recovered from a pre-1855 Chinese context (Table 38).

Polychrome Drawn Beads with Cut Ends (*n* = 42)

Beads of this class have multicolored layers produced in at least two manners: (1) when one or more layers of glass were applied to a central core, and (2) when layers were fortuitously created. Beads with applied layers were drawn from a gather of glass of one color then covered with one or more layers of differently colored glass. Beads with fortuitous layers appear to have been produced from a gather of one color that, upon cooling, created multicolored layers (generally of the same color hue, but with a different chroma, color value, and/or diaphaneity). It is speculated that this phenomenon results as glass cools from its surface to its interior, causing different chemical elements to migrate slower or faster. As coalescing elements "freeze," concentric layers that are brighter or duller, lighter or darker, or more opaque, translucent or transparent than adjacent layers are created. Whether or not beadmakers consciously created polychrome beads to exhibit these traits remains unknown. Once cooled, the polychrome canes were cut or chopped into bead-length segments for subsequent sorting and packaging. Beads of this class were not fire-polished or hot tumbled.

Polychrome, Complex, Multisided Drawn Beads with Ground Facets and Cut Ends (*n* = 42). These are fortuitously layered, polychrome beads, manufactured in the same manner as their monochrome equivalent (discussed above), and one subtype is recorded.

Beads with Two Rows of Ground Facets (*n* = 42; Varieties 1 and 4). Two varieties of transparent/translucent six-sided beads were recovered (Figure 59); each has two rows of ground facets. For a further discussion on this bead subtype, its sizes and cultural affiliation, see the discussion above for similar monochrome beads. Variety 1 beads were recovered principally from pre-1855 Chinese contexts, with two from an 1855-1870 Chinese context, and one from a ca. 1870 non-Chinese context (Table 38). Variety 4 beads were recovered principally from a ca. 1870 non-Chinese context, with some from a pre-1855 Chinese context (Table 38).

Monochrome Drawn Beads with a Hot-Tumbled Finish (*n* = 201)

These are hot-tumbled versions of monochrome beads with cut or chopped ends. Some specimens may exhibit a second layer of glass similar in color to its principal color (Kidd and Kidd 1970:48-49). After drawn canes were cut into bead-length segments, these segments were tumbled over a fire in a rotating container or drum that, during the mid-19th century, may have contained ash and sand (Hoppe and Hornschuch 1818), lime, and charcoal (Anonymous 1835; Bussolin 1847; Carroll 1917; Karklins with Adams 1990:72), plaster and graphite, or clay and charcoal dust (Francis 1979:10). This method of rounding sharp edges of beads cut from a drawn cane was invented by the Italian Luigi Pusinich and perfected in

1864 by Antonio Frigo (Gasparetto 1958:198). Prior to the invention of hot-tumbling, or the rotating-drum method, a less efficient furnace method was used:

> In this process, the tubes [cut bead segments] were placed in a large copper pan with a mixture of powdered charcoal or ash and sand. The pan was placed in a *ferraccia* (*ferrazza*) furnace and the contents stirred until the tube segments were sufficiently rounded (Karklins and Adams 1990:72-73; Karklins and Jordan 1990:6). Although this method was used to round large and very large beads as well (Karklins and Adams 1990:73), it was a time-consuming operation as it took a long time for the thick tube segments to soften and become rounded [Karklins 1993:27].

It is difficult to impossible to distinguish furnace-rounded and hot-tumbled beads from one another. It is assumed that most rounded drawn beads manufactured prior to the adoption of hot-tumbling were generally larger, and may exhibit flat surfaces caused by contact of bead surfaces with the rounding pan. Hot-tumbled beads also can have flattened surfaces, generally created when a hot and plastic drawn cane was placed too quickly on a cooling floor or table. An earlier process for rounding drawn beads was in use at least from the early 17th century to the late 18th century. This method, called the *a speo* method, was used to round bead segments generally larger than 4 mm in diameter (Karklins 1993). For western North American sites, *a speo*-rounded beads have yet to be recognized in archaeological assemblages.

Monochrome, Cylindrical, Undecorated Drawn Beads with a Hot-Tumbled Finish (*n* = 201; Varieties 6, 8, 10, 11, 16, 21, 22, and 25). The simplest type of finished, monochrome, drawn beads is an undecorated one with a circular cross section. It is the most common type at western archaeological sites, and for Sacramento Block HI56 comprises 52.6% of the bead assemblage. From this site, these beads exist in one form: short (with a torus to round shape), and were manufactured from transparent and opaque glass. Eight varieties are recorded (Figure 60).

From the analysis of beads from other archaeological sites (e.g., Ross 1990), it has been ascertained that sizes can occur at regular intervals (e.g., 0.45-0.56 and 0.8-mm intervals). For beadmakers to obtain sizes measured to such fine intervals, they sorted beads by sieving, using stacked, graded wire screens (Bussolin 1847; Karklins with Adams 1990:73) with mesh openings decreasing 0.4 to 0.8 mm per screen. Hand-sorting might have resulted in the creation of these subtle and regular sizes, but it would have been labor intensive, more costly, and perhaps not as accurate.

Varieties of beads of this type found at western archaeological sites cannot be adequately evaluated due to the lack of comparable color terminology used by various authors; and no correlations of age for specific colors have been reported. Variety 6, 8, 10, and 11 beads from Sacramento Block HI56 were recovered from a ca. 1877 non-Chinese context (Table 38). Variety 16 (*n* = 56), 21, and 22 beads from Sacramento Block HI56 were recovered from pre-1855 Chinese contexts, while Variety 16 (n = 5) and 25 beads were recovered from 1855-1870 Chinese contexts (Table 38).

Monochrome, Cylindrical, Undecorated Drawn Beads with Hot-Tumbled Ends (n = 201)

VARIETY NUMBER	DECORATION	DIAPHANEITY LUSTER CORROSION PATINA	LAYERING COLOR MUNSELL NOTATION	SHAPE LENGTH FINISH	SIZE LEAST DIAMETER x LENGTH (mm) PERFORATION DIAMETER (mm)	PLATE NUMBER	COMPARATIVE NUMBERS	QUANTITY
10	Undecorated	Transparent Dull & Pitted Eroded Some w/ patina	Monochrome Clear ---	Cylindrical Short Hot Tumbled	Size 1 1.9-2.4 x 0.8-1.9 0.6-1.2	1b	Kidds' IIa	13
11	Undecorated	Opaque Dull Eroded No patina	Monochrome White to White on White N 9.5/	Cylindrical Short Hot Tumbled	Size 1 1.6-2.9 x 1.0-1.9 0.5-0.9	1c	Kidds' IIa	45
6	Undecorated	Opaque Dull to Shiny Eroded Patina	Monochrome Black N 2.0-2.75/	Cylindrical Short Hot Tumbled	Size 1 (n = 73) 2.1-3.4 x 1.4-2.3 0.3-1.2 Size 2 (n = 3) 4.8-5.0 x 3.4-3.8 1.3	1d	Kidds' IIa	76
16	Undecorated	Transparent Dull Eroded & Pitted Patina	Monochrome Red 5R3/8	Cylindrical Short Hot Tumbled	Size 1 1.9-2.6 x 0.8-1.4 0.5-1.0	1e	Kidds' IIa	61
22	Undecorated	Opaque Dull & Fibrous Eroded & Pitted Patina	Monochrome Brownish-yellow 7.5YR7/10	Cylindrical Short Hot Tumbled	Size 1 1.9 x 1.3 0.5	1f	Kidds' IIa	1
25	Undecorated	Transparent Dull Eroded No patina	Monochrome Yellowish-green 7.5GY7/8	Cylindrical Short Hot Tumbled	Size 1 1.5-1.6 x 0.8-0.9 0.4-0.5	1g	Kidds' IIa	2
8	Undecorated	Opaque Dull & Fibrous Eroded & Pitted Patina	Monochrome Green 5G5/6	Cylindrical Short Hot Tumbled	Size 1 1.7 x 0.8 1.1	1h	Kidds' IIa	1
21	Undecorated	Transparent Dull Eroded No patina	Monochrome Green 2.5G5/6	Cylindrical Short Hot Tumbled	Size 1 (n = 1) 1.5 x 0.8 0.6 X Size 2 (n = 1) 3.1 x 1.3 1.4	1i	Kidds' IIa	2

Polychrome, Cylindrical, Undecorated Drawn Beads with Hot-Tumbled Ends (n = 11)

15	Undecorated	Transparent on Opaque Dull Eroded & Pitted Patina	Polychrome Purplish-red on White 2.5R3/8 on N 9.5/	Cylindrical Short Hot Tumbled	Size 1 3.4-3.5 x 2.0-2.7 0.8	1j	Kidds' IVa	2
26	Undecorated	Transparent on Opaque Dull Eroded & Pitted Patina	Polychrome Purplish-red on Very Light Purplish-red 5R3/10 on 2.5R8/2	Cylindrical Short Hot Tumbled	Size 1 5.5 x 5.0 1.4	1k	Kidds' IVa	1
20	Undecorated	Transparent on Opaque Dull Eroded & Pitted No patina	Polychrome Red on White 5R3/10 on N 9.5/	Cylindrical Short Hot Tumbled	Size 1 2.0-3.3 x 0.8-2.0 0.5-1.3	1l	Kidds' IVa	7
19	Undecorated	Opaque on Transparent Dull No corrosion No patina	Polychrome Brownish-red on Very Light Green 7.5R4/8 on 10G9/	Cylindrical Short Hot Tumbled	Size 1 1.6 x 1.4 0.5	1m	Kidds' IVa	1

Figure 60. Drawn beads with hot-tumbled ends (n = 212)

Polychrome Drawn Beads with a Hot-Tumbled Finish (*n* = 11)

These are hot-tumbled versions of polychrome beads with cut or chopped ends, finished in the same manner as the monochrome beads with a hot-tumbled finish. Only polychrome beads with distinctive layers of color are recorded within this bead grouping.

Polychrome, Cylindrical, Undecorated Drawn Beads with a Hot-Tumbled Finish (*n* = 11; Varieties 15, 19, 20, and 26). This is the second most common bead type recovered from western archaeological sites; it was relatively rare at this site, however, with only 2.9% of the bead assemblage consisting of four varieties (Figure 60).

The red-on-white, red-on-light pink, and brownish red-on-green varieties are often termed *cornaline d'Aleppo* or *Hudson's Bay Company* beads (e.g., Jenkins 1975; Mille 1975). They are commonly associated with Native American sites, and were especially common in the early and mid-19th century.

Ranking beads by color and value using the 1831-1851 inventories for Fort Union, North Dakota (DeVore 1992:117-127), indicates that red was the most expensive of the colors, followed by blue, green, and white, with black and yellow the least expensive. It is inferred from these relative values that polychrome red-on-green, red-on-white, red-on-yellow, and red-on-black beads were manufactured not for their aesthetic appeal, but for economic considerations. Expensive ruby-red glass used gold as a coloring agent, and to reduce costs it was layered on inexpensive green, white, black, and yellow glass.

Variety 15, 19, 20, and 26 beads were recovered from pre-1855 Chinese contexts (Table 38).

Wound Beads (*n* = 10)

Simple wound beads were manufactured by wrapping or winding molten glass around a rotating mandrel, such as a wire, rod, or straw coated with a clay slip. Beads were produced individually or conjoined (probably accidentally) and were then removed from their shafts, annealed, cleaned, sorted, and packaged. At this site, complex and decorated wound beads were altered by molding or shaping, or by applying dots. Shaped wound beads were manufactured by winding glass on a mandrel and then, by using (a) an open or trench mold, the decoration was pressed (inlaid) into the surface while the glass was turned, or (b) a pinching tool with molded faces (similar to a bullet mold) was used to press the decoration into the surface while the glass was stationary.

Wound beads comprise the second most common group at western archaeological sites dating to the 18th and 19th centuries. Because of the lack of comparative terminology for wound bead shapes, it is difficult to compare wound bead descriptions among the archaeological reports for the region. At this site, wound beads only comprised 2.6% of the bead assemblage, comprised of a two major classes on the basis of manufacturing techniques.

Monochrome Wound Beads (*n* = 8)

These consist of a monochrome body that could have been unshaped or shaped, either undecorated or decorated.

Monochrome, Ovoidal, Undecorated Wound Beads (*n* = 2; Variety 9). These are roughly ovoidal or barrel-shaped, and only one variety is recorded (Figure 61a). Beads of this variety are reported from 1829-1860 HBC Fort Vancouver, Washington (Ross 1990: Variety WIc-bops-2) and the 1812-1840 Fort Ross Native Alaskan Village Site (CA-SON-1897/H) (Ross 1995:Variety 63). Variety 9 beads from Sacramento Block HI56 were recovered from a ca. 1877 non-Chinese context (Table 38).

Monochrome, Ovoidal Wound Beads with Inlaid Complex Dots (n = 2; Variety 13). These are ovoidal, having received their shape by trough-molding after application of complex (i.e., multicolored) decorative dots. Only one variety is recorded (Figure 61a). No beads of this variety are reported from well-dated, western North American contexts. Variety 13 beads from Sacramento Block HI56 were recovered from a pre-1855 Chinese context (Table 38).

Monochrome, Ellipsoidal Undecorated Beads (*n* = 1; Variety 17). These are roughly ellipsoidal with no decoration, and only one variety is recorded (Figure 61a). This bead appears to be a core from a polychrome bead, probably one which had a wound outer red layer of glass. No beads of this variety are reported from well-dated, western North American contexts. The single Variety 17 bead from Sacramento Block HI56 was recovered from a pre-1855 Chinese context (Table 38).

Monochrome, Toroidal Undecorated Beads (*n* = 5; Variety 5). These are roughly doughnut-shaped with no decoration, and only one variety is recorded (Figure 61a). Beads of this type, but larger and generally colored, commonly occur on Chinese baskets. Based upon the high frequency of beads attributed to European manufacture within this assemblage and the lack of any positively identified beads from China, it is inferred that these Variety 5 beads represent *ring* beads known to have been manufactured in Europe (e.g., Neuwirth 1994:316) No beads of this variety are reported from well-dated, western North American contexts. Variety 5 beads from Sacramento Block HI56 were recovered from an 1877 non-Chinese context (Table 38).

Mold-Pressed Beads (*n* = 6)

Manufactured by pinching or pressing molten glass in a two-part mold. The perforations were produced by pushing a pin into the mold and through the glass. Mold-pressed beads from this site are the least common, comprising 1.6% of the bead assemblage.

Monochrome Mold-Pressed Beads (n = 6)

Monochrome Spheroidal Mold-Pressed Beads with Ground Facets (n = 6; Varieties 18 and 24). Probably manufactured in Bohemia, and during the first half of the 19th century they were molded individually or in pairs by pressing glass in iron tongs equipped with opposing hemispherical cavities. Perforations were partially formed by either a tapered pin that appears to have been an integral part of one cavity (Ross 1974:17 and Fig. 3; 1976:759-762), or by a pin inserted through one cavity (Neuwirth 1994; Ross with Pflanz 1989). Upon removal from the mold, the preform had a partially formed perforation and a

Figure 61a. Wound beads (n = 10)

Monochrome, Ovoidal, Undecorated Wound Beads (n = 2)

VARIETY NUMBER	DECORATION COMMENTS	DIAPHANEITY LUSTER CORROSION PATINA	LAYERING COLOR MUNSELL NOTATION	SHAPE LENGTH	SIZE LEAST DIAMETER x LENGTH (mm) PERFORATION DIAMETER (mm)	PLATE NUMBER	COMPARATIVE NUMBERS	QUANTITY
9	Undecorated	Opaque Dull Eroded Patina	Monochrome Black N 1/	Ovoidal Short	Size 1 5.2-5.6 x 3.2-4.4 1.8-2.3	2h	Kidds' WIc to WIb	2

Monochrome, Ovoidal Wound Beads with Inlaid Complex Dots (n = 2)

13	5 rows of inlaid complex dots Transparent Purple on Opaque White dots 5PB4/6? on N 9.5/	Opaque Dull Eroded Patina	Monochrome Black N 1.25/	Ovoidal Short to Long	Size 1 9.5-10.6 x 9.8-10.0 1.9-2.7	2k	Kidds' WIIIb	2

Monochrome, Ellipsoidal Undecorated Wound Bead (n = 1)

17	Undecorated Possibly the core of a red-on-yellow polychrome bead	Opaque Dull Eroded No patina	Monochrome Yellow 2.5Y8/8	Ellipsoidal Long	Size 1 3.6 x 4.9 2.1	2i	Kidds' WIc	1

Monochrome, Toroidal Undecorated Wound Beads (n = 5)

5	Undecorated	Transparent Shiny No corrosion Patina	Monochrome Clear ---	Toroidal ---	Size 1 9.0-9.5 x 2.8-3.4 4.8-5.3	2j	Kidds' WId	5

Figure 61b. Mold-pressed beads (n = 6)

Monochrome, Spheroidal Mold-Pressed Beads with Ground Facets (n = 6)

	DECORATION COMMENTS	DIAPHANEITY LUSTER CORROSION PATINA	LAYERING COLOR MUNSELL NOTATION	SHAPE LENGTH	SIZE LEAST DIAMETER x LENGTH (mm) PERFORATION DIAMETER (mm)	PLATE NUMBER	COMPARATIVE NUMBERS	QUANTITY
24	5 rows of random ground facets with ground top facet Biconical, pierced, and punched perforation	Transparent Dull No corrosion Patina	Monochrome Yellowish-green 7.5GY5/8	Spheroidal Short	Size 1 10.9 x 10.3 Top 0.8/Bottom 3.0	2l	Kerklins MPIIa	1
18	3 rows of random ground facets w/ ground top and some bottom facets Conical pierced perforation	Transparent Dull Eroded Patina	Monochrome Purplish-red 2.5R3/8	Spheroidal Short	Size 1 5.0-5.4 x 4.7-5.2 Top 0.9-1.0/Bottom 1.7-1.8	2m	Kerklins MPIIa	5

mold seam around its circumference with fine glass fins protruding from the seam. Facets were subsequently ground on the bead, thus removing the fins (the fins also could be removed prior to faceting by sieving or abrasion), and the incomplete perforation was punched through, forming a roughly spherical faceted bead with a bi-conical perforation.

A few specimens from Fort Vancouver exhibit a vertical cleft (Ross 1990:Plate IVy), possibly caused by an insufficient amount of glass that could not completely fill the lower hemisphere of the mold as glass flowed around the post or as a pin was inserted for form the perforation. It may also be possible that this cleft was produced by a three-part mold, although no historical evidence for such a mold has been located.

These beads emulate the appearance of cut crystal or cut jewelry beads, and the products from the Bohemian industry were collectively referred to as artificial jewelry. In addition, unfinished beads (those with an incomplete perforation) could be used as heads for hat pins. Just such an "unfinished" bead is reported from a ca. 1900 context in Old Sacramento, California (Motz and Schulz 1980:57, Type 49, Figure 4e).

Among collectors, beads similar to these, but of later manufacture, are called *cut*, *Czech*, or *vaseline* beads (e.g., Johnson 1975), presumably for their technique of manufacture emulating cut stone beads, their country of manufacture, or their glossy appearance, respectively. This glossy finish may have been created by washing the beads in an acid bath, similar to the 20th-century technique used to polish cut, lead crystal glassware (Jones and others 1985:55, 56). Presumably, if such a bath was employed for later beads, it was not used in the mid-19th century.

Two varieties are recorded (Figure 61b), one with a pierced perforation (Variety 18) and the other with a pierced and punched perforation (Variety 24). Variety 18 and 24 beads were recovered from pre-1855 Chinese contexts (Table 38).

ETHNIC, TEMPORAL, AND ECONOMIC INFERENCES

Beads from Sacramento Block HI56 were recovered from four datable and two ethnic contexts (Table 38). Embroidery or seed beads (monochrome and polychrome, cylindrical, undecorated drawn beads with hot-tumbled ends including Varieties 6, 8, 10, 11, 15, 16, 19-22, 25, and 26) comprise 55.5% of the entire bead assemblage, or 47.0% of the beads from pre-1855 Chinese contexts, and 87.6% of the beads from 1877 non-Chinese contexts. Faceted beads (drawn and mold-pressed beads including Varieties 1, 2, 4, 12, 14, 18, 23, and 24) comprise 39.3% of the entire bead assemblage, 49.4% of the beads from pre-1855 Chinese contexts, and 77.8% of the beads from 1870 non-Chinese contexts. These distributions suggest that three ethnic subassemblages exist:

- pre-1855 to 1870 Chinese context
- a ca. 1870 non-Chinese context
- a ca. 1877 non-Chinese context

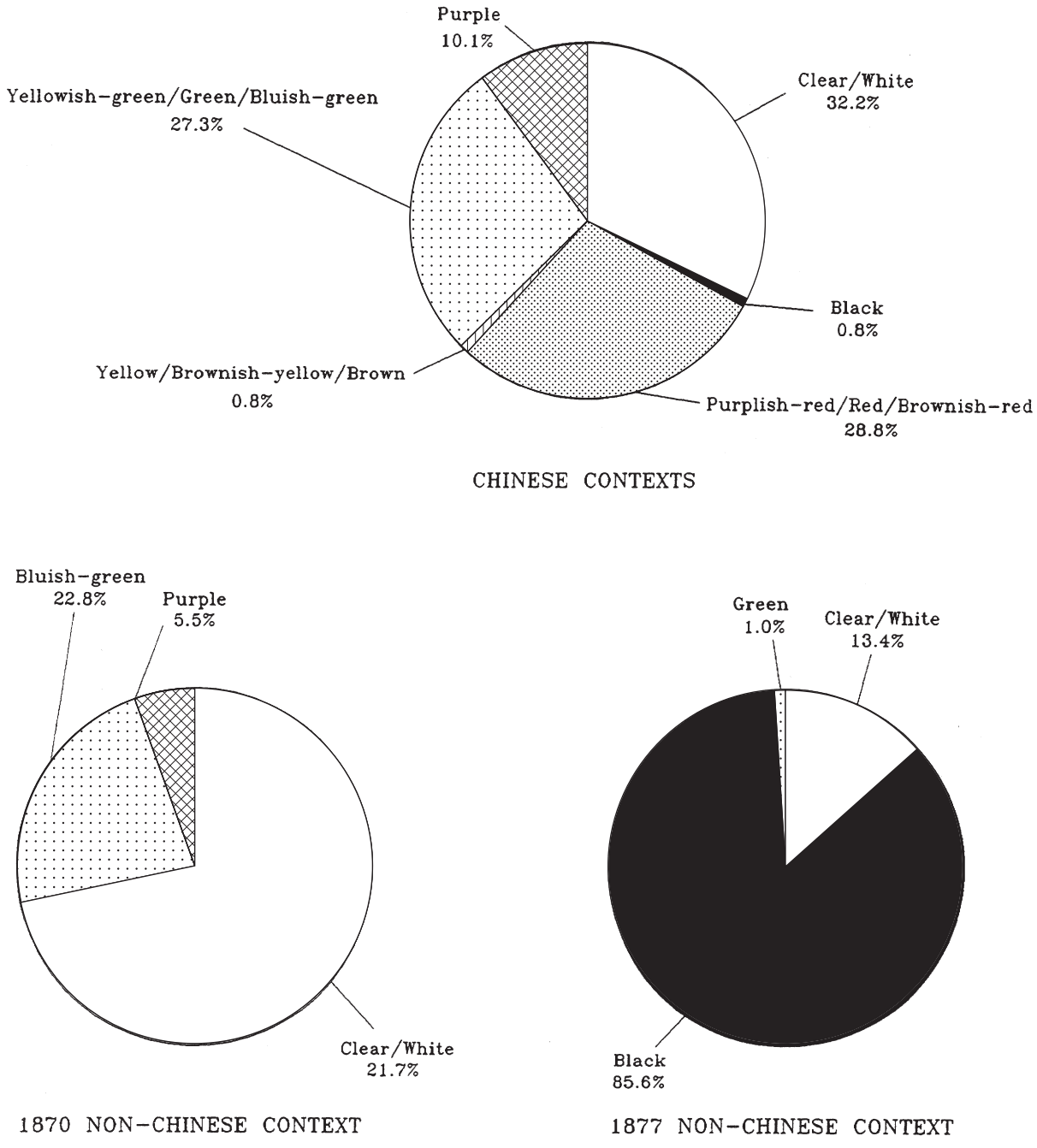


Figure 62. Comparison of bead color frequencies for Chinese and non-Chinese Contexts

The Chinese subassemblages are characterized as follows:

- a high percentage of large, relatively expensive, faceted beads (50.9%)
- a high percentage of small, relatively inexpensive, embroidery (47.6%) beads
- high percentages of clear/white (32.2%), reddish (28.8%), and greenish (27.3%) beads, a moderate percentage of purple beads (10.1%), and very low percentages of black, yellow, and brown beads (Figure 62)
- relatively expensive polychrome beads
- relatively expensive decorated beads

None of beads in the Chinese subassemblage appear to have been manufactured in China; rather most are attributed to European sources. This suggests that occupants of the Chinese contexts were acquiring beads from American suppliers.

Large faceted beads are often used for religious articles, such as rosaries, altar decorations, and funerary or mourning articles. Their presence within the Chinese subassemblage suggests that occupants may have adopted European religious beliefs, or may have been acquiring beads from Christian sources. The presence of relatively expensive and inexpensive beads suggests the occupants of the Chinese contexts may have had a moderate socioeconomic status.

The ca. 1870 non-Chinese context is characterized as having:

- only large, relatively expensive, sided or faceted beads, with a very high percentage of faceted beads (77.8%); and
- a very high percentage of clear/white beads (66.7%), a high percentage of greenish beads (22.8%), and a low percentage of purple beads (5.5%), to the total exclusion of any other colors (Figure 62).

As with the beads from Chinese contexts, the presence of the large, sided or faceted European beads suggests some relationship with European religious articles. The colors of these beads are somewhat similar to colors associated with Chinese contexts, but due to the low frequencies of beads recovered, any comparisons among these contexts is tentative. In contrast, a comparison with the colors associated with the ca. 1877 non-Chinese context clearly demonstrates a difference. The presence of relatively expensive beads suggests the occupants of the ca. 1870 non-Chinese context may have had a moderately high socioeconomic status.

The ca. 1877 non-Chinese context is characterized as having:

- a very high percentage of small, relatively inexpensive, embroidery beads (87.6%);
- a moderate percentage of more expensive plain decorative beads (12.4%); and
- a very high percentage of black beads (85.6%), a moderate percentage of clear/white beads (13.4%), and a minor percentage of green beads (1.0%), to the total exclusion of any other colors.

This subassemblage appears to contain beads used principally for decorating clothing, personal articles, or household items. However, the large quantity of black beads suggests beaded articles may have been related to mourning customs. The presence of relatively inexpensive beads suggests that occupants of the ca. 1877 non-Chinese contexts may have had a low to moderate socioeconomic status.

ANALYSIS OF ANIMAL BONES

by Sherri M. Gust

METHODOLOGY

Data on provenience, taxon, element, portion, side, epiphyseal fusion status, butchering cuts, tool marks, taphonomic factors, and evidence of heat alteration were recorded for each specimen in the HI56 Block faunal collection using a computerized data-entry system (Gust 1995). The comparative collections of the Anthropological Studies Center at Sonoma State University, the California Academy of Sciences, the Museums of Vertebrate Zoology and Paleontology of the University of California at Berkeley, the George C. Page Museum, and the Natural History Museum of Los Angeles County were used for identification. Mammals and birds were identified by Sherri Gust, Scott McCartney, and Samantha Schell. Turtles were identified by Howard Hutchinson.

The faunal data are available on disk upon request to Anthropological Studies Center, Sonoma State University, Bldg. 29, 1801 E. Cotati Blvd., Rohnert Park, CA 94928. There may be an administrative charge to cover cost of disks and photocopying of accompanying documentation.

The butchering units and pounds of meat weight were calculated as specified in Gust (1996). Economic ranking of meat cuts follows Schulz and Gust (1983) and Gust (1996). The age-at-slaughter profiles are cumulative death curves based on times of epiphyseal fusion for domestic animals given in Silver (1969). Characteristics of butchering-tool marks are given in Gust (1983). Retail divisions of the carcass are illustrated in Figures 63 to 65.

FINDINGS

818 Sixth Street

Privy 500

Cattle bones were the most abundant faunal remains from Privy 500, followed by sheep and pig (Table 39). A few specimens of small food animals were present, namely jackrabbit, chicken, turkey, wild ducks and geese, and dove. One specimen of dog and several of cat were also present.

Beef accounted for 85% of the meat represented, with 10% from mutton and only 4% from pork (Table 40). Most of the meat was from the round and chuck. Overall, only 13% of the meat was from high-priced cuts, 68% was from moderately priced cuts, and 19% was from low-priced cuts. Most of the high-priced cuts were pork and mutton. The other food animals represented contributed variety, but no substantial amount of meat.

The majority of butchering tool marks were from handsaws (77%). Cleavers and axes accounted for 20% and knife marks 3%. Butchering marks were typical of the time and place.

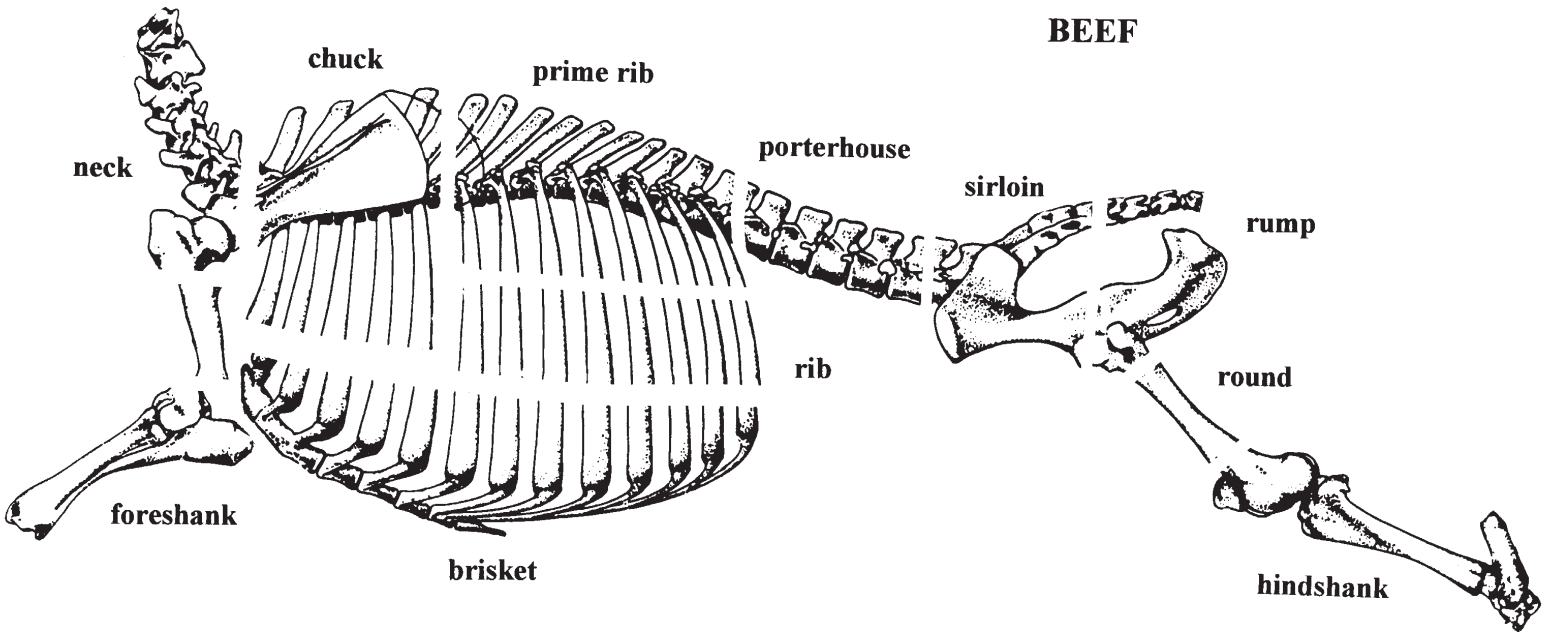


Figure 63. Retail butchering divisions, beef.

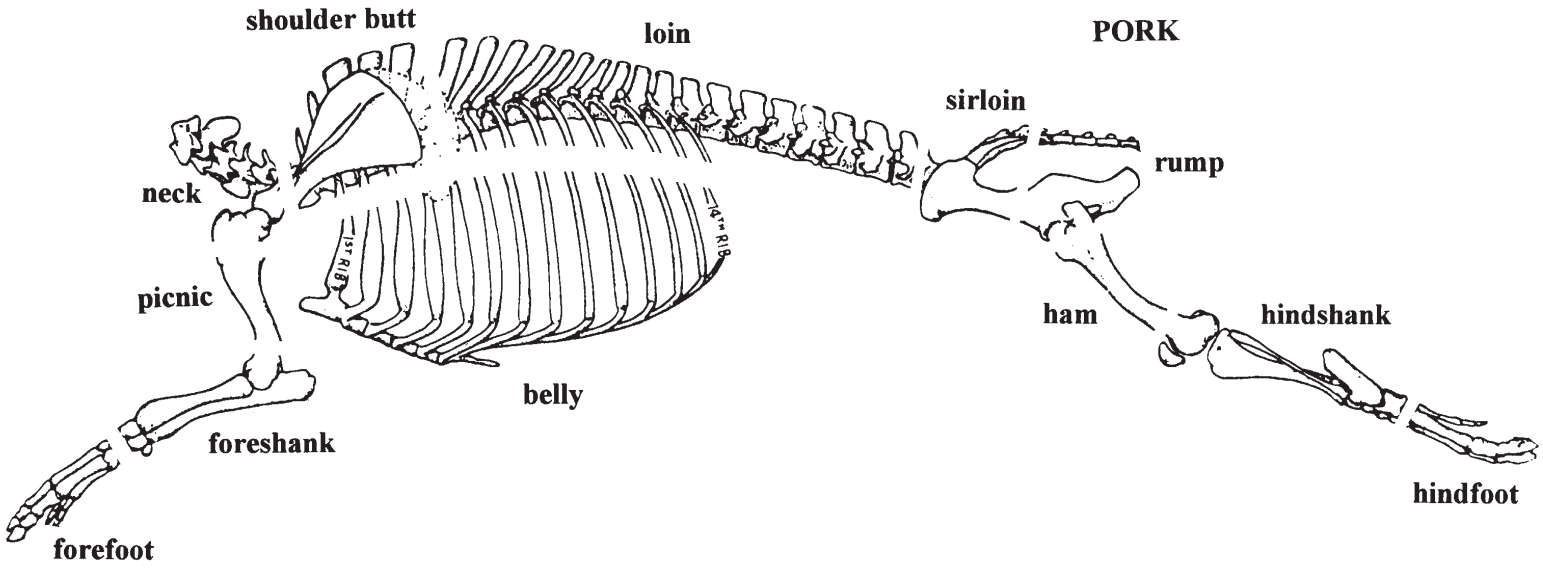


Figure 64. Retail butchering divisions, pork.

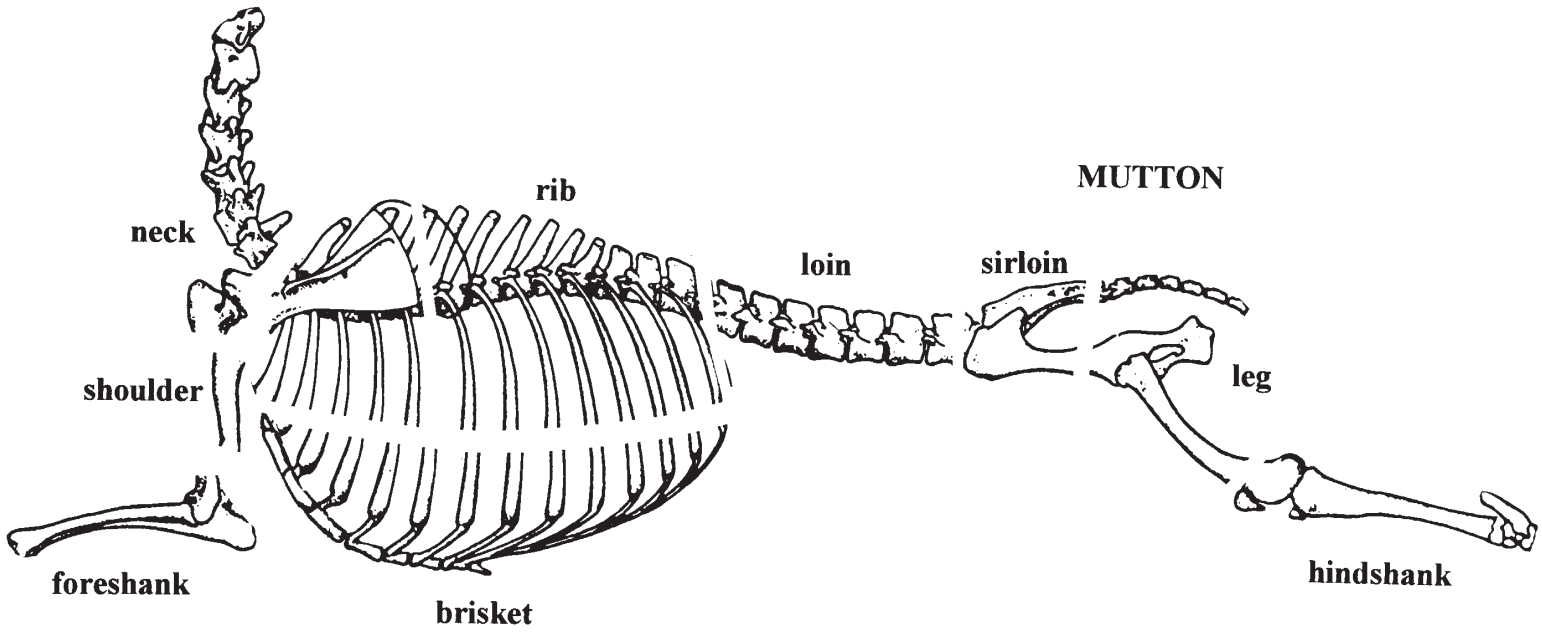


Figure 65. Retail butchering divisions, mutton.

Table 39. Animals Represented by Number of Identified Specimens for Privy 500, HI56 Block Sacramento

Common Name	Scientific Name	P500
Major Meat Animals		
cattle	*Bos taurus*	123
sheep	*Ovis aries*	62
pig	*Sus scrofa*	26
artiodactyl	Artiodactyla	44
Minor Meat Animals		
jackrabbit	*Lepus californicus*	4
Incidental Animals		
dog	*Canis familiaris*	1
cat	*Felis catus*	10
TOTAL		270
Domestic Poultry		
chicken	*Gallus gallus*	3
turkey	*Meleagris gallopavo*	*1*
Wild Game Birds		
Canada goose	*Branta canadensis*	1
goose	Anseridae	1
duck	Anatidae	2
mourning dove	*Zenaidura macroura*	1
Incidental Birds		
Unidentified Birds	Aves	6
TOTAL		15

Table 40. Meat Weight by Economic Status for Privy 500, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	9.0	3.5	
sirloin	8.1	3.1	
prime rib	1.4	0.5	
moderate			
round	72.8	28.0	
rump	19.2	7.4	
chuck	91.2	35.0	
rib	10.5	4.0	
low			
hindshank	0.0		
brisket	12.3	4.7	
foreshank	5.8	2.2	
neck	30.0	11.5	
TOTAL	260.3	100.0	85
MUTTON			
high			
loin	4.4	13.9	
sirloin	1.5	4.7	
leg	6.9	21.8	
moderate			
rib	2.8	8.8	
shoulder	8.0	25.2	
low			
hindshank	0.8	2.5	
brisket	1.2	3.8	
foreshank	0.5	1.6	
neck	5.6	17.7	
TOTAL	31.7	100	10
PORK			
high			
sirloin	1.4	10.8	
loin	4.2	32.3	
ham	1.6	12.3	
moderate			
rump	2	15.4	
shoulder butt	0.7	5.4	
picnic	-	0.0	
low			
belly	-		
neck/shanks	2.4	18.5	
jowl/feet	0.7	5.4	
TOTAL	13	100	4
GRAND TOTAL	305.0		

525/527 I Street

Pit 69

Cattle bones dominated in this feature, followed by sheep and pig (Table 41). Elk, antelope, and jackrabbit were also present in small quantity. Chicken was relatively abundant, while turkey, wild duck and goose, and dove were represented. Dog, cat, and bobcat were represented by a couple of specimens each. The bobcat may have represented an animal shot while out hunting and brought back for its pelt.

Most of the meat weight was from beef—85% (Table 42). The round and chuck were the predominate cuts, but sirloin and porterhouse were also present. Overall, 21% of the meat was from high-priced cuts, 57% was from moderately priced cuts, and 23% was from low-priced cuts.

Most of the butchering tool marks were from handsaws (76%). Cleavers and axes accounted for 20% and knife marks 4%. Butchering marks were typical of the time and place.

Pit 83

Most of the bones represented in this feature were from cattle, while sheep and pig were also represented (Table 43). There were additional food bones from sheep, pig, elk, jackrabbit, chicken, turkey, wild duck, and goose. At least three kittens and one bobcat were present in the trash pit. One human tooth was also present and contained a large cavity. It probably represents a tooth extraction.

About 76% of the meat weight was beef and an additional 16% was mutton (Table 44). Chuck cuts were most abundant, but porterhouse and sirloin were also relatively abundant. Overall, 31% of the meat was from high-priced cuts, 51% was from moderately priced cuts, and 17% was from low-priced cuts.

The butchering-tool marks were mostly from handsaws (77%). Cleavers and axes accounted for 19% and knife marks for 4%. Butchering marks were typical of the time and place.

Pit 16 Early

Chicken bones were more abundant than any other animal remains in this feature (Table 45). It contained numerically equal amounts of cattle and pig bone. Sheep, deer, jackrabbit, turkey, and wild duck, and goose also contributed to the diet. The specimen of pheasant recovered did not appear to be the species released in California and may represent an import from China. Two kinds of Chinese turtles were also represented in the sample and were certainly imported. One of the turtles would have exceeded 2 feet in length in life. Incidental animals included dog, cat, rat, and gopher.

Using meat weight, beef dominated the sample with 79% (Table 46). Mutton contributed 6% and pork 15%. The amount of meat represented by the chicken remains would have been approximately equal to the amount of both the mutton and the pork. No one cut of meat was most abundant. The feature was characterized by small amounts of many sources of meat. Overall, 23% of meat was from high-priced cuts, 48% was from moderately priced cuts, and 29% was from low-priced cuts.

Table 41. Animals Represented by Number of Identified Specimens for Pit 69, HI56 Block Sacramento

Common Name	Scientific Name	P69
Major Meat Animals		
cattle	*Bos taurus*	138
sheep	*Ovis aries*	82
pig	*Sus scrofa*	44
artiodactyl	Artiodactyla	49
Minor Meat Animals		
elk	*Cervus elaphus*	1
antelope	*Antilocapra americana*	1
jackrabbit	*Lepus californicus*	1
Incidental Animals		
dog	*Canis familiaris*	1
cat	*Felis catus*	3
bobcat	*Lynx rufus*	1
Unidentified Mammals	Mammalia	1
TOTAL		322
Domestic Poultry		
chicken	*Gallus gallus*	39
turkey	*Meleagris gallopavo*	*5*
Wild Game Birds		
goose	Anseridae	3
duck	Anatidae	6
mourning dove	*Zenaidura macroura*	1
Unidentified Birds	Aves	54
TOTAL		108

Table 42. Meat Weight by Economic Status for Pit 69, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	18.0	6.3	
sirloin	16.2	5.7	
prime rib	8.6	3.0	
moderate			
round	72.8	25.5	
rump	26.4	9.2	
chuck	76.0	26.6	
rib	2.1	0.7	
low			
hindshank	11.5	4.0	
brisket	16.1	5.6	
foreshank	20.2	7.1	
neck	18.0	6.3	
TOTAL	285.9	100.0	85
MUTTON			
high			
loin	3.2	11.6	
sirloin	2.5	9.1	
leg	9.5	34.5	
moderate			
rib	1.6	5.8	
shoulder	6.4	23.3	
low			
hindshank	2.1	7.6	
brisket	1.6	5.8	
foreshank	0.6	2.2	
neck	-		
TOTAL	27.5	100	8
PORK			
high			
sirloin	7.7	31.2	
loin	4.2	17.0	
ham	-		
moderate			
rump	4.0	16.2	
shoulder butt	2.8	11.3	
picnic	-		
low			
belly	-		
neck/shanks	4.6	18.6	
jowl/feet	1.4	5.7	
TOTAL	24.7	100	7
GRAND TOTAL	338.1		

Table 43. Animals Represented by Number of Identified Specimens for Pit 83, HI56 Block Sacramento

Common Name	Scientific Name	P83
Major Meat Animals		
cattle	*Bos taurus*	78
sheep	*Ovis aries*	48
pig	*Sus scrofa*	32
artiodactyl	Artiodactyla	38
Minor Meat Animals		
elk	*Cervus elaphus*	2
jackrabbit	*Lepus californicus*	3
Incidental Animals		
cat	*Felis catus*	20
bobcat	*Lynx rufus*	2
human	*Homo sapiens*	1
Unidentified Mammals	Mammalia	9
TOTAL		233
Domestic Poultry		
chicken	*Gallus gallus*	14
turkey	*Meleagris gallopavo*	*2*
Wild Game Birds		
goose	Anseridae	3
duck	Anatidae	6
Unidentified Birds	Aves	29
TOTAL		54

Table 44 Meat Weight by Economic Status for Pit 83, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	21.6	13.2	
sirloin	16.2	9.9	
prime rib	1.4	0.9	
moderate			
round	13.0	7.9	
rump	9.6	5.9	
chuck	69.6	42.5	
rib	2.1	1.3	
low			
hindshank	7.7	4.7	
brisket	5.2	3.2	
foreshank	7.7	4.7	
neck	9.6	5.9	
TOTAL	163.7	100.0	76
MUTTON			
high			
loin	0.4	1.2	
sirloin	1.5	4.4	
leg	18.9	55.8	
moderate			
rib	3.2	9.4	
shoulder	5.8	17.1	
low			
hindshank	1.3	3.8	
brisket	0.4	1.2	
foreshank	0.8	2.4	
neck	1.6	4.7	
TOTAL	33.9	100	16
PORK			
high			
sirloin	2.1	12.8	
loin	5.3	32.3	
ham	-		
moderate			
rump	5.0	30.5	
shoulder butt	-	-	
picnic	1.0	6.1	
low			
belly	-		
neck/shanks	1.0	6.1	
jowl/feet	2.0	12.2	
TOTAL	16.4	100	8
GRAND TOTAL	214.0		

Table 45. Animals Represented by Number of Identified Specimens for Pit 16, Early, HI56 Block Sacramento

Common Name	Scientific Name	P16E
Major Meat Animals		
cattle	*Bos taurus*	38
sheep	*Ovis aries*	18
pig	*Sus scrofa*	38
artiodactyl	Artiodactyla	10
Minor Meat Animals		
deer	*Odocoileus hemionus*	1
jackrabbit	*Lepus californicus*	2
Incidental Animals		
dog	*Canis familiaris*	5
cat	*Felis catus*	17
rat	*Rattus* sp.	21
pocket gopher	*Thomomys bottae*	3
rodent	Rodentia	2
Unidentified Mammals	Mammalia	29
TOTAL		184
Domestic Poultry		
chicken	*Gallus gallus*	68
turkey	*Meleagris gallopavo*	*22*
Wild Game Birds		
goose	Anseridae	3
duck	Anatidae	4
pheasant	*Phasianus sp*.	1
Unidentified Birds	Aves	146
TOTAL		244
Reptiles		
Chinese turtles		
soft shell	*Trionyx sp*.	3
Batagurid	Batagurinae	14
TOTAL		17

Table 46. Meat Weight by Economic Status for Pit 16, Early, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	3.6	4.4	
sirloin	5.4	6.7	
prime rib	4.3	5.3	
moderate			
round	13.0	16.0	
rump	14.4	17.7	
chuck	4.6	5.7	
rib	10.5	12.9	
low			
hindshank	11.5	14.2	
brisket	1.9	2.3	
foreshank	9.6	11.8	
neck	2.4	3.0	
TOTAL	81.2	100.0	79
MUTTON			
high			
loin	2.0	33.9	
sirloin	-	-	
leg	1.9	32.2	
moderate			
rib	-		
shoulder	0.5	8.5	
low			
hindshank	0.5	8.5	
brisket	-		
foreshank	0.2	3.4	
neck	0.8	13.6	
TOTAL	5.9	100	6
PORK			
high			
sirloin	2.8	18.1	
loin	3.5	22.6	
ham	-		
moderate			
rump	1.0	6.5	
shoulder butt	4.9	31.6	
picnic	-		
low			
belly	-		
neck/shanks	1.0	6.5	
jowl/feet	2.3	14.8	
TOTAL	15.5	100	15
GRAND TOTAL	102.6		

Handsaws made most of the butchering-tool marks in this feature (65%). Cleavers and axes accounted for 30% and knife marks 5%. Butchering marks were typical of the time and place.

Pit 16 Late

Cattle, sheep, pig, jackrabbit, chicken, and duck bones were remnants of meals recovered (Table 47), while rat bones were incidental. Beef constituted 59% of the meat weight represented in the sample (Table 48). Pork contributed 8% and mutton 33%. Most of the beef was from the chuck and round. Overall, 46% of the meat was from high-priced cuts, 33% was from moderately priced cuts, and 22% was from low-priced cuts. Most of the high-priced meat was leg of mutton and would have been porterhouse steaks and most of the low-priced meat was beef brisket.

Handsaws made most of the butchering-tool marks in this feature (69%). Cleavers and axes account for 27%, and knife marks for 4%. Butchering marks were typical of the time and place.

513/515 I Street

Layer 954

This sheet of refuse contained an extremely large and diverse collection of animal bone from the largest sample of bone on this block. Cattle were far more abundant than any other animal numerically (Table 49). Pig, sheep, deer, and elk were the other large animals represented. Chicken, wild goose, wild ducks, and doves were part of the diet also. Additionally, Sandhill crane and tundra swan were present in the sample. These two large birds, along with most of the wild ducks and geese, were only present in California during the winter season and must represent deposition during that period. Incidental animals included rat, dog, cat, squirrel, gopher, and crow. Two human teeth were recovered also. Both had large cavities and one had very distinct plier marks where it was gripped during extraction.

Beef constituted most of the diet by meat weight, with 87% (Table 50). Pork accounted for 10% and mutton for 3%. The meat weight represented by the domestic poultry and wild game birds would have been about 100 pounds, which is about mid-way between the amount of mutton and the amount of pork. Overall 18% of the meat was high-priced, 46% was moderately priced, and 36% was low-priced. This is a rather interesting distribution. Shank cuts comprised most of the low-priced category, chuck most of the moderately priced, and porterhouse steaks most of the high-priced.

The butchering-tool marks were 64% from handsaws, 29% from cleavers and axes, and 7% from knives. There was a relatively high amount of "kitchen" butchering (removal of meat from bone) that is reflected in the number of knife and cleaver scores. Otherwise, butchering was typical of the time and place.

Table 47. Animals Represented by Number of Identified Specimens for Pit 16, Late, HI56 Block Sacramento

Common Name	Scientific Name	P16L
Major Meat Animals		
cattle	*Bos taurus*	28
sheep	*Ovis aries*	14
pig	*Sus scrofa*	16
artiodactyl	Artiodactyla	7
Minor Meat Animals		
jackrabbit	*Lepus californicus*	1
Incidental Animals		
rat	*Rattus* sp.	3
TOTAL		69
Domestic Poultry		
chicken	*Gallus gallus*	3
Wild Game Birds		
duck	Anatidae	4
Unidentified Birds	Aves	13
TOTAL		20
Other		
crustacean	Crustacea	2
TOTAL		2

Table 48. Meat Weight by Economic Status for Pit 16, Late, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	9.0	15.3	
sirloin	-	-	
prime rib	-	-	
moderate			
round	10.4	17.6	
rump	7.2	12.2	
chuck	11.2	19.0	
rib	2.1	3.6	
low			
hindshank	1.9	3.2	
brisket	9.5	16.1	
foreshank	7.7	13.1	
neck	-	-	
TOTAL	59.0	100.0	59
MUTTON			
high			
loin	0.4	1.2	
sirloin	0.5	1.5	
leg	31.5	94.3	
moderate			
rib	-		
shoulder	0.5	1.5	
low			
hindshank	-		
brisket	-		
foreshank	0.1	0.3	
neck	0.4	1.2	
TOTAL	33.4	100	33
PORK			
high			
sirloin	2.1	25.6	
loin	1.8	22.0	
ham	0.8	9.8	
moderate			
rump	-		
shoulder butt	1.4	17.1	
picnic	-		
low			
belly	-		
neck/shanks	-		
jowl/feet	2.1	25.6	
TOTAL	8.2	100	8
GRAND TOTAL	100.6		

Table 49. Animals Represented by Number of Identified Specimens for Layer 954, HI56 Block Sacramento

Common Name	Scientific Name	L954
Major Meat Animals		
cattle	*Bos taurus*	1320
sheep	*Ovis aries*	177
pig	*Sus scrofa*	309
artiodactyl	Artiodactyla	173
Minor Meat Animals		
elk	*Cervus elaphus*	11
deer	*Odocoileus hemionus*	*26*
Incidental Animals		
dog	*Canis familiaris*	1
cat	*Felis catus*	2
rat	*Rattus* sp.	30
pocket gopher	*Thomomys bottae*	*2*
rodent	Rodentia	2
ground squirrel	*Spermophilus beechyii*	2
human	*Homo sapiens*	2
Unidentified Mammals	Mammalia	19
TOTAL		2076
Domestic Poultry		
chicken	*Gallus gallus*	29
turkey	*Meleagris gallopavo*	*6*
Wild Game Birds		
goose	Anseridae	26
duck	Anatidae	37
Canada goose	*Branta canadensis*	2
coot	*Fulica americana*	2
ruddy duck	*Oxyura jamaicensis*	1
tundra swan	*Cygnus columbianus*	*2*
sandhill crane	*Grus canadensis*	*2*
mourning dove	*Zenaidura macroura*	1
Incidental Birds		
crow	*Corvus corax*	1
Unidentified Birds	Aves	283
TOTAL		392

Table 50. Meat Weight by Economic Status for Layer 954, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	163.8	9.9	
sirloin	67.5	4.1	
prime rib	46.1	2.8	
moderate			
round	161.2	9.7	
rump	117.6	7.1	
chuck	379.8	22.9	
rib	123.9	7.5	
low			
hindshank	224.6	13.6	
brisket	173.8	10.5	
foreshank	148.8	9.0	
neck	50.4	3.0	
TOTAL	1657.5	100.0	87
MUTTON			
high			
loin	15.6	27.9	
sirloin	3.0	5.4	
leg	7.6	13.6	
moderate			
rib	8.8	15.7	
shoulder	9.5	17.0	
low			
hindshank	1.8	3.2	
brisket	2.4	4.3	
foreshank	0.8	1.4	
neck	6.4	11.4	
TOTAL	55.9	100	3
PORK			
high			
sirloin	14.7	7.8	
loin	13.3	7.0	
ham	14.4	7.6	
moderate			
rump	57.0	30.1	
shoulder butt	13.3	7.0	
picnic	0.5	0.3	
low			
belly	0.3	0.2	
neck/shanks	63.8	33.7	
jowl/feet	11.9	6.3	
TOTAL	189.2	100	10
GRAND TOTAL	1902.6		

Layer 903

The numerical majority of animals from this layer were cattle, closely followed by pigs (Table 51). Sheep, elk, jackrabbit, wild ducks, chicken, wild geese, and turkey were also present in the food remains. Rats, gophers, and a hawk were incidentally present.

Beef contributed 80% of the meat in the diet by weight (Table 52). The remainder was evenly divided between pork and mutton. Overall, 4% of meat was from high-priced cuts, 37% from moderately priced cuts, and 59% from low-priced cuts. The low-priced cuts were mostly from the neck and shank.

The butchering tool marks reflected a high percentage of cleaver and ax marks 40%. Handsaws made up 55% of the marks and knife scores 5%. Butchering was typical of the time and place.

Pit 979

Cattle were the most abundant animal remains in this feature (Table 53). Sheep, pigs, elk, deer, and wild duck were also present. By meat weight, beef contributed 90% of the meat in the diet (Table 54). Overall, the cuts represented were 34% high-priced, 26% moderately priced, and 40% low-priced. Shank cuts comprised most of the low-priced category, chuck most of the moderately priced, and porterhouse and sirloin steaks most of the high-priced. Most of the butchering-tool marks resulted from handsaws (67%). Cleavers and axes made 28% of the marks and knives 5%.

Pit 953

Pigs numerically dominate the faunal sample, followed by cattle and sheep (Table 55). Chicken, wild duck, elk, deer, and jackrabbit contributed to the diet. Rat was also present. The sample was rather small, with pork and beef contributing most of the meat weight. Most of the cuts were moderately priced and low-priced. Pork rump accounted for almost half of the meat represented. The number of tool marks present was insufficient for analysis.

Pit 962

Cattle, sheep, pig, and elk bones were remnants of meals (Table 56), while rat and gopher bones were incidental. Beef constitutes 87% of the meat weight represented in the sample (Table 57). Most of the beef was from the round. Overall, 23% of the meat was from high-priced cuts, 55% was from moderately priced cuts, and 22% was from low-priced cuts. The tool marks indicated very intensive kitchen butchering, with 60% cleaver marks.

507 I Street

Layer 702

Pig bones were most abundant in the limited faunal sample, followed by cattle bones (Table 58). The only other specimen recovered was a heron. Pork accounted for about 60% of the meat in the sample by weight and beef for about 40%. The cuts represented were mostly low-priced shank cuts. The number of butchering-tool marks present was insufficient for analysis.

Table 51. Animals Represented by Number of Identified Specimens for Layer 903, HI56 Block Sacramento

Common Name	Scientific Name	L903
Major Meat Animals		
cattle	*Bos taurus*	91
sheep	*Ovis aries*	23
pig	*Sus scrofa*	66
artiodactyl	Artiodactyla	32
Minor Meat Animals		
elk	*Cervus elaphus*	1
jackrabbit	*Lepus californicus*	1
Incidental Animals		
rat	*Rattus* sp.	5
pocket gopher	*Thomomys bottae*	*1*
rodent	Rodentia	2
TOTAL		222
Domestic Poultry		
chicken	*Gallus gallus*	3
turkey	*Meleagris gallopavo*	*1*
Wild Game Birds		
goose	Anseridae	2
duck	Anatidae	6
ruddy duck	*Oxyura jamaicensis*	1
Incidental Birds		
hawk	*Buteo sp*.	1
Unidentified Birds	Aves	39
TOTAL		54
Reptiles		
native turtles		
Western pond turtle	*Clemmys marmorata*	1
TOTAL		1

Table 52. Meat Weight by Economic Status for Layer 903, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	-		
sirloin	-		
prime rib	1.4	1.8	
moderate			
round	15.6	19.9	
rump	4.8	6.1	
chuck	8.8	11.3	
rib	2.1	2.7	
low			
hindshank	13.4	17.1	
brisket	1.9	2.4	
foreshank	8.6	11.0	
neck	21.6	27.6	
TOTAL	78.2	100.0	80
MUTTON			
high			
loin	-		
sirloin	0.5	5.0	
leg	1.9	19.0	
moderate			
rib	1.2	12.0	
shoulder	2.7	27.0	
low			
hindshank	0.2	2.0	
brisket	-		
foreshank	0.3	3.0	
neck	3.2	32.0	
TOTAL	10.0	100	10
PORK			
high			
sirloin	-		
loin	-		
ham	-		
moderate			
rump	1.0	9.7	
shoulder butt	-		
picnic	-		
low			
belly	-		
neck/shanks	4.7	45.6	
jowl/feet	4.6	44.7	
TOTAL	10.3	100	10
GRAND TOTAL	98.5		

Table 53. Animals Represented by Number of Identified Specimens for Pit 979, HI56 Block Sacramento

Common Name	Scientific Name	P979
Major Meat Animals		
cattle	*Bos taurus*	76
sheep	*Ovis aries*	20
pig	*Sus scrofa*	9
artiodactyl	Artiodactyla	10
Minor Meat Animals		
elk	*Cervus elaphus*	5
deer	*Odocoileus hemionus*	2
TOTAL		122
Wild Game Birds		
duck	Anatidae	1
Unidentified Birds	Aves	6
TOTAL		7

Table 54. Meat Weight by Economic Status for Pit 979, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	18.0	13.5	
sirloin	16.2	12.1	
prime rib	7.2	5.4	
moderate			
round	10.4	7.8	
rump	-		
chuck	20.2	15.1	
rib	6.3	4.7	
low			
hindshank	9.6	7.2	
brisket	13.3	10.0	
foreshank	28.8	21.6	
neck	3.6	2.7	
TOTAL	133.6	100.0	90
MUTTON			
high			
loin	4.0	43.5	
sirloin			
leg	3.2	34.8	
moderate			
rib	0.4	4.3	
shoulder	1.6	17.4	
low			
hindshank	-		
brisket	-		
foreshank	-		
neck	-		
TOTAL	9.2	100	6
PORK			
high			
sirloin	1.4	26.9	
loin	0.4	6.7	
ham	-		
moderate			
rump	-		
shoulder butt	-		
picnic	-		
low			
belly	-		
neck/shanks	2.8	53.0	
jowl/feet	0.7	13.4	
TOTAL	5.2	100	4
GRAND TOTAL	148.0		

Table 55. Animals Represented by Number of Identified Specimens for Pit 953, HI56 Block Sacramento

Common Name	Scientific Name	P953
Major Meat Animals		
cattle	*Bos taurus*	3
sheep	*Ovis aries*	2
pig	*Sus scrofa*	9
artiodactyl	Artiodactyla	7
Minor Meat Animals		
elk	*Cervus elaphus*	1
deer	*Odocoileus hemionus*	1
jackrabbit	*Lepus californicus*	1
Incidental Animals		
rat	*Rattus* sp.	1
rodent	Rodentia	1
TOTAL		26
Domestic Poultry		
chicken	*Gallus gallus*	4
Wild Game Birds		
duck	Anatidae	1
Unidentified Birds	Aves	4
TOTAL		9

Table 56. Animals Represented by Number of Identified Specimens for Pit 962, HI56 Block Sacramento

Common Name	Scientific Name	P962
Major Meat Animals		
cattle	*Bos taurus*	51
sheep	*Ovis aries*	11
pig	*Sus scrofa*	7
Minor Meat Animals		
elk	*Cervus elaphus*	1
Incidental Animals		
rat	*Rattus* sp.	2
pocket gopher	*Thomomys bottae*	1
TOTAL		73
Unidentified Birds	Aves	2
TOTAL		2

Table 57. Meat Weight by Economic Status for Pit 962, HI56 Block Sacramento

	Meat Wt. in lbs.	Percent within type	Percent of total
BEEF			
high			
porterhouse	3.6	5.2	
sirloin	5.4	7.9	
prime rib	4.3	6.3	
moderate			
round	20.8	30.3	
rump	-		
chuck	4.8	7.0	
rib	14.7	21.4	
low			
hindshank	1.9	2.8	
brisket	-		
foreshank	9.6	14.0	
neck	3.6	5.2	
TOTAL	68.7	100.0	87
MUTTON			
high			
loin	-		
sirloin	-		
leg	3.2	57.1	
moderate			
rib	-		
shoulder	1.1	19.6	
low			
hindshank	0.8	14.3	
brisket	-		
foreshank	0.5	8.9	
neck	-		
TOTAL	5.6	100	7
PORK			
high			
sirloin	1.4	30.4	
loin	0.4	8.7	
ham	-		
moderate			
rump	-		
shoulder butt	2.1	45.7	
picnic	-		
low			
belly	-		
neck/shanks	0.7	15.2	
jowl/feet	-		
TOTAL	4.6	100	6
GRAND TOTAL	78.9		

Table 58. Animals Represented by Number of Identified Specimens for Layer 702, HI56 Block Sacramento

Common Name	Scientific Name	L702
Major Meat Animals		
cattle	*Bos taurus*	3
pig	*Sus scrofa*	20
artiodactyl	Artiodactyla	7
TOTAL		30
Wild Game Birds		
Louisiana heroin	*Hydranassa tricolor*	1
Unidentified Birds	Aves	9
TOTAL		10

Pit 719

Pig bones dominated the Pit 719 fauna, with cattle, sheep, chicken, antelope, elk, and wild duck also present (Table 59). Rat was the only incidental animal recovered. The meat weight sample was only 24 pounds, with pork in the majority. Shanks were the most abundant cuts followed by pork sirloin. The number of butchering-tool marks were insufficient for analysis.

FAUNAL SUMMARY

Native and Domestic Fauna

The native fauna of the Sacramento Valley was rich and diverse (McGowen 1961; Storer 1965). Elk, deer, antelope, and rabbit were abundant local game animals. A huge assortment of migratory birds (duck, goose, and others) passed through in fall and spring. All of these animals were professionally hunted and offered for sale in the markets of Sacramento (McGowen 1961; Storer 1965). Their presence in urban faunal samples may reflect hunting by members of the household, but could also represent purchases.

The standard domestic animals were introduced to California during the Mission years. The environment of California was better suited to range animals like cattle and sheep than to pigs (Burcham 1957). This fact is well reflected in the livestock statistics for Sacramento City and County for 1861-1862 (Table 60). There are three times as many cattle and sheep as pigs. Because of the availability factor, pork was relatively expensive.

Table 60. Livestock Statistics for Sacramento City and County, 1861-1862

Domestic Animal	Number
Stock cattle	34,357
Beef cattle	4,475
Cows	8,884
Calves	6,312
Oxen	1,413
Sheep	37,155
Goats	1,270
Hogs	12,821
Chickens	51,487
Turkeys	4,690
Ducks	627
Geese	570
(Sacramento City Directory 1861-1862:162)	

Age at Slaughter

The age of animals at slaughter in urban environments is indicative of market trends in the sale of meats, and to some extent, the availability of meat animals. The sample of age data for HI56 is strongly dominated by material from Layer 954, which dates from 1848 to 1855. In addition, the sample for cattle is much larger than those for sheep and pig. HI56 is contrasted here to Old Sacramento sites dating from the 1870s to

Table 59. Animals Represented by Number of Identified Specimens for Pit 719, HI56 Block Sacramento

Common Name	Scientific Name	P719
Major Meat Animals		
cattle	*Bos taurus*	1
sheep	*Ovis aries*	9
pig	*Sus scrofa*	69
artiodactyl	Artiodactyla	22
Minor Meat Animals		
elk	*Cervus elaphus*	1
Incidental Animals		
rat	*Rattus* sp.	9
rodent	Rodentia	1
TOTAL		112
Domestic Poultry		
chicken	*Gallus gallus*	10
Wild Game Birds		
duck	Anatidae	1
Unidentified Birds	Aves	12
TOTAL		23

the 1890s (unpublished data of the author). The cattle slaughter curve for HI56 is dramatically different from the Old Sacramento curve, showing utilization of much younger animals, with almost half of the cattle slaughtered by two years of age (Figure 66). The curves converge at four years of age. The sheep slaughter curves are basically similar, but indicate more use of lamb and less use of yearlings at HI56 (Figure 67). The pig slaughter curves show more use of younger and older animals at HI56 (Figure 68). The Old Sac sample has 75% of the animals slaughtered between two to three years, while HI56 has only about 35% in that interval.

The explanation for the prevalence of young cattle in the 1848-1855 interval probably has to do with the high demand created by the influx of population in response to the Gold Rush. Cattle from local areas, southern California, and the Midwest were driven to Sacramento to meet the huge demand, and top prices were paid regardless of condition (Warren 1967:17). Since the primary reason for feeding cattle until three years of age was to maximize the profit per pound, inflated prices would have released livestock raisers from this consideration by giving them more money for less weight and saving them the cost of another year's feeding.

Butchering of Major Meat Animals

The butchering pattern evident in all features and layers of HI56 is the standard 19th-century retail pattern previously delineated for Sacramento (Gust 1982, 1990a-d, 1993). This pattern is characterized by very regular horizontal division of each meaty part of the carcass into steaks and roasts and vertical division of bone ends for use in soups. Domestic sites like HI56 are dominated by steaks, in contrast to commercial sites like hotels and restaurants in Old Sac which contained many roasts. Because of the large sample size, the pattern is fully represented at HI56. Enumeration of the number of occurrences of each mark would only duplicate information on the number of steak equivalents from each carcass portion. For example, if the most butchering marks were found on the shaft of the ilium of the pelvis, it would indicate an abundance of sirloin steaks in the particular sample rather than anything about the underlying pattern itself.

In addition to the retail pattern, there are a relatively large number of shallow cuts, nicks and scores on some bones resulting from meat removal. These types of marks were termed "kitchen butchering" in the Chinese sample from IJ56 (Gust 1982). They were even more abundant in the samples from Chinese contexts at HI56, while the Euroamerican contexts had very few such marks. Many of the kitchen-butchering marks from HI56 were on bones with low meat content. This fact may indicate very intensive meat recovery to maximize utilization of purchased meat.

Butchering of Minor Meat Animals

Butchering marks present on elk bones were similar to the pattern for beef, while marks on deer and antelope were similar to those for sheep. Marks present on jackrabbits and birds were all from cleavers or knives. Virtually all were located at the ends of bones where joints were separated. Twenty-two such marks were found on chicken, turkey, and duck bones, and three on rabbit bones.

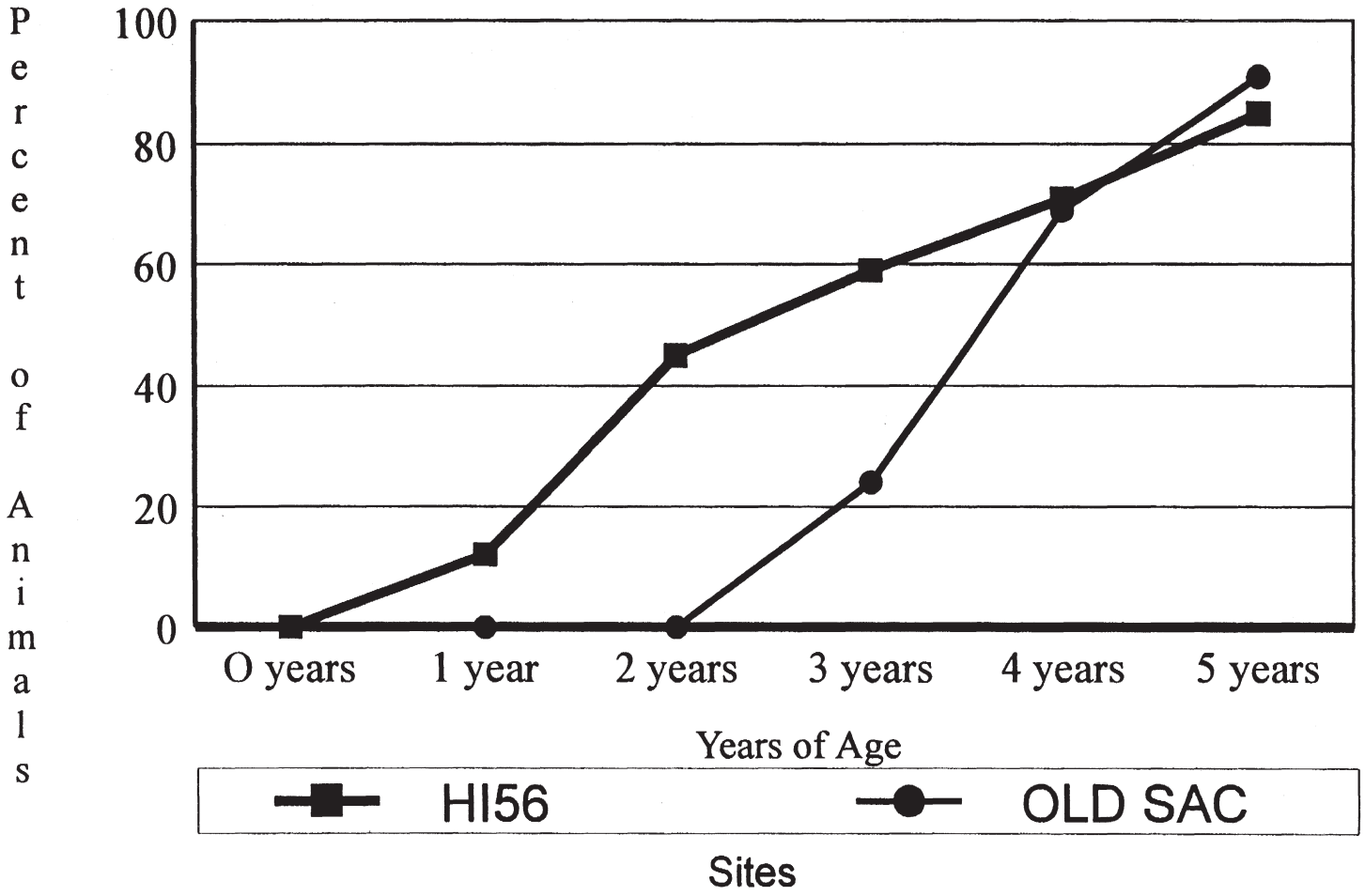


Figure 66. Age at slaughter curves for cattle

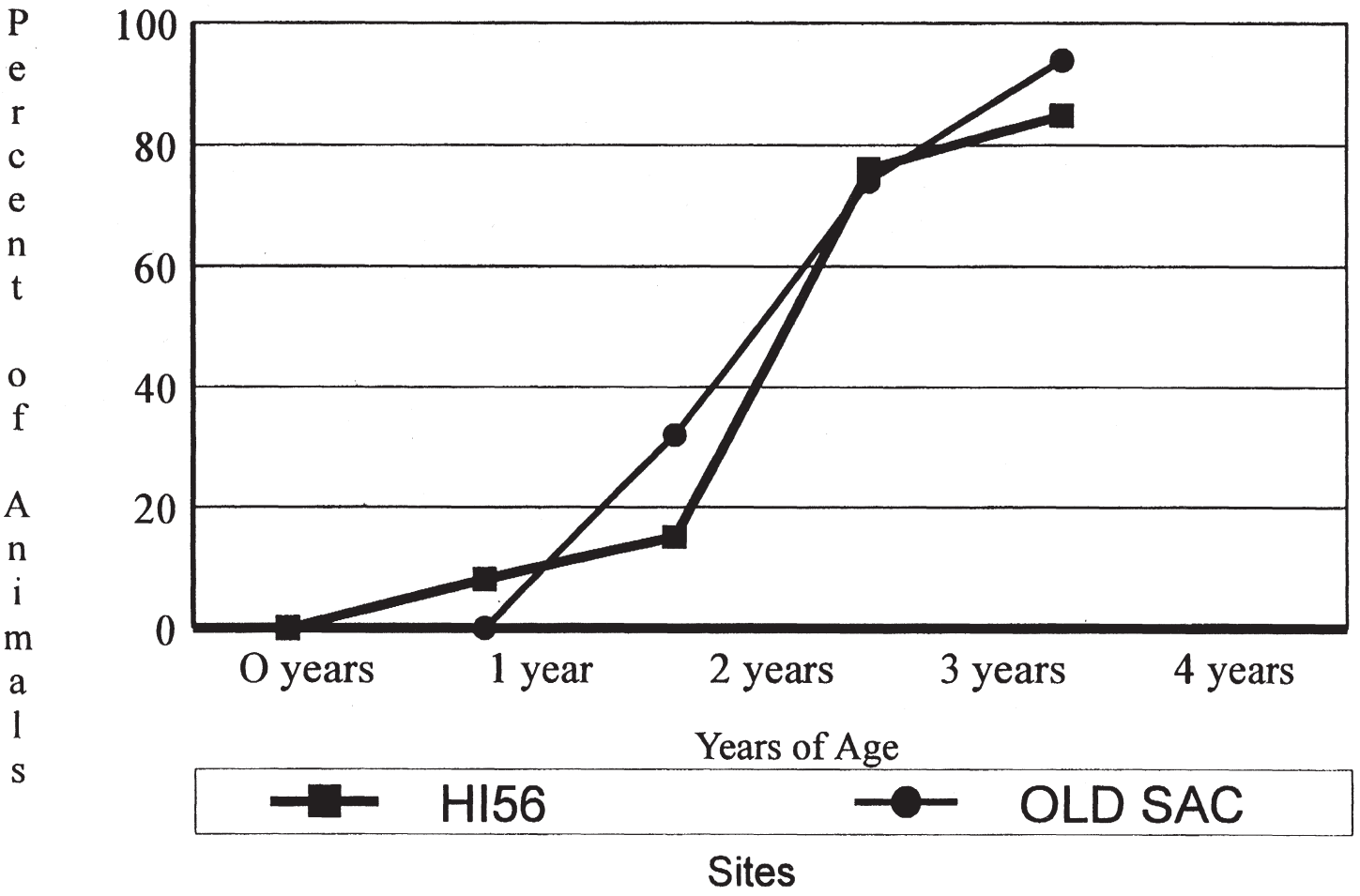


Figure 67. Age at slaughter curves for sheep

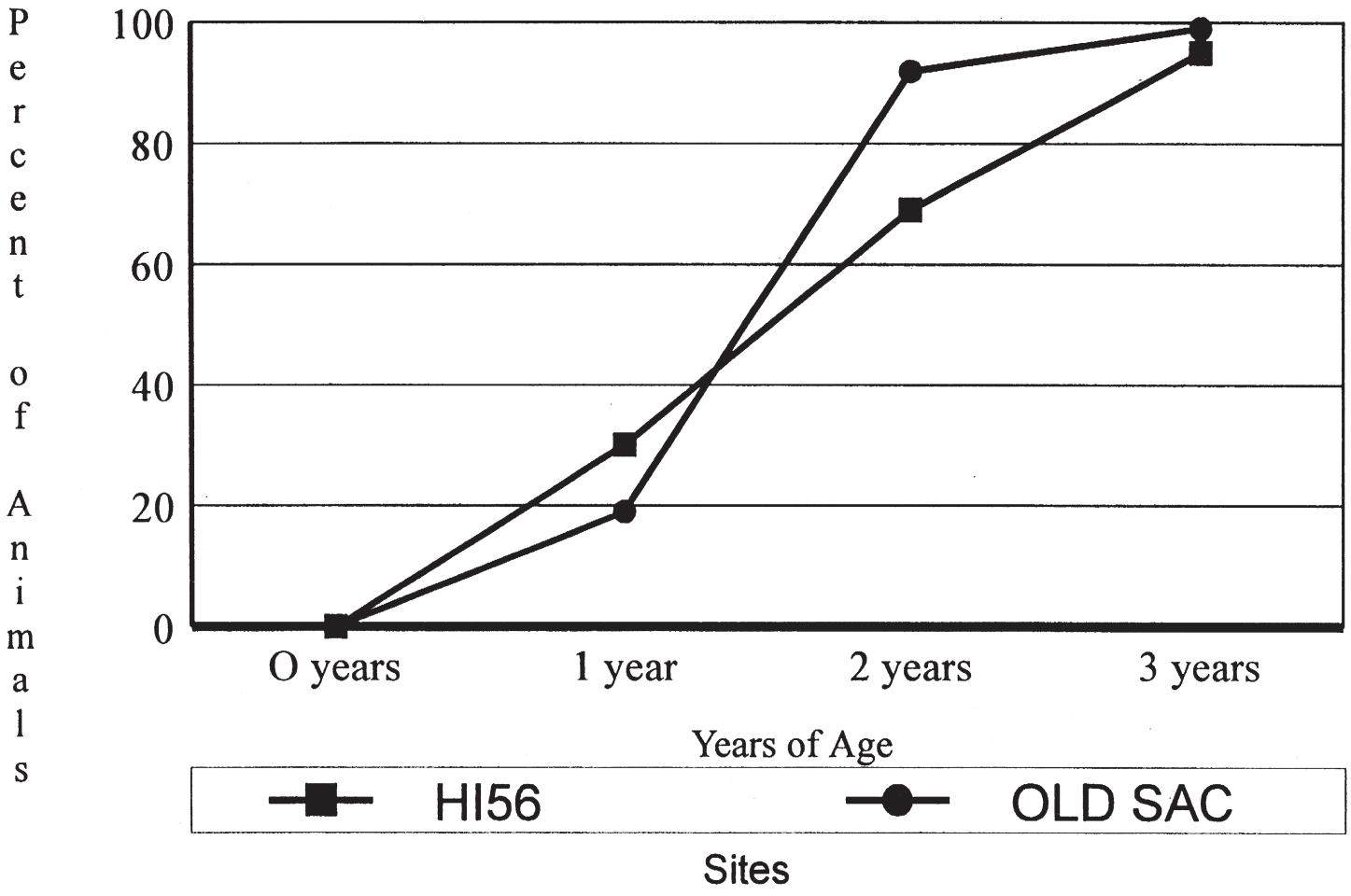


Figure 68. Age at slaughter curves for pigs

Meat Cut Units Represented for Beef

With a view toward reconstructing meals from the bone remains present, the actual number of steak, roast, and soup bones are given in Table 61 for the most abundant meat source. An appropriate caution in this regard—there are substantial sources of meat in items such as sausage, bacon, etc. that do not have bones, and are therefore not represented anywhere in this paper.

Overall, most high-priced cuts are steaks, with a few roasts. The moderately priced cuts are divided between steaks and roasts. The low-priced cuts are all stewing meats or soup bones.

Euroamerican Contexts Compared

There are three Euroamerican contexts on the HI56 block, Pits 69, 83, and Privy 500. All date to the 1870s and have similar sample sizes. A comparison of the percentages of meat types shows them to be roughly similar, with beef contributing at least 80% (Table 62). The sample from Pit 83, however, had a slightly smaller amount of beef and more mutton in the sample.

In terms of economics reflected by meat purchases, Privy 500 had about 10% high-priced cuts, 70% moderately priced, and 20% low-priced. Pit 83, and to a lesser extent, Pit 69 have more high-priced cuts and less moderately priced ones. Pit 83's exceptions reflect more consumption of leg of mutton than seen in the other sites, accounting for both the greater amount of mutton and the greater amount of high-priced cuts.

Chinese Contexts Compared

Nine contexts are wholly or partially Chinese. Pits 16 Early and 16 Late were associated with the Yeung-wo Company. Layers 954 and 903 and Pits 953, 962 and 979 were associated with Yu Chung and Company. Layer 702 and Pit 719 were associated with Sang Lee and Company. Pit 16 (Late Deposit) and Layer 954 probably have admixtures of non-Chinese materials. All date between 1848 and 1862.

All the significant samples from these deposits are dominated by beef (Table 63). The Sacramento IJ56 Chinese sample,However, has a substantial total meat weight of 507 pounds, yet has 95% pork, 4% beef and 1% mutton. There has been a persistent mythology that early Chinese immigrants ate only pork and chicken, the food-bone facts from Chinatown sites do not bear this out (Gust 1993). Beef was well-represented in most samples studied.

Only one HI56 context appears relatively affluent in terms of meat purchases, Pit 16 Late. This deposit has higher priced meat cuts than the IJ56 sample. IJ56 has 28% high-priced cuts and 36% of both moderately priced and low-priced cuts. Most of the HI56 Chinese contexts have considerable representation of moderate-to-low-priced meats and have intensive kitchen butchering. In addition the small amounts of pork may be related to the relative expense of that meat. All of these facts would argue for the lower economic status of the Chinese creating these deposits.

Table 61. Number of Beef Cut Units for HI56 Block Sacramento

	P16E	P16L	L954	L903	P979	P962	P69	P83	P500
BEEF									
high									
porterhouse steaks	2	5	58		6	2	10	12	5
porterhouse roasts			9		2				
sirloin steaks	2		15		1		6	7	3
sirloin roasts			4		2	1			
prime rib steaks	4		32	1	5	3	6	1	1
moderate									
round steaks	2	4	42	6	4	2	10	5	28
round roasts	2		4			2	6		
rump steaks	2		22					1	2
rump roasts	2	1	19	2			6	1	4
chuck steaks		4	86	4	4		12	5	26
chuck roasts	1		51		2		5	8	2
rib steaks	5	1	59	1	3	7	1	1	5
low									
hindshank stew/soup	6	2	152	10	6	2	12	7	
brisket stew/soup	1	5	102	1	7		9	3	7
foreshank stew/soup	3	3	53	3	6	2	8	3	4
neck stew/soup	2		42	18	3	3	15	8	25

Table 62. Comparative Information for Euroamerican Contexts, HI56 Block Sacramento

	P69	**P83**	**P500**
date	**1870s**	**late 1870s**	**late 1870s**
Total meat weight sample	338 lbs.	214 lbs.	305 lbs.
Percent beef	85	76	85
Percent mutton	8	16	10
Percent pork	7	8	4
Percent high-priced	21	31	13
Percent moderately priced	57	51	68
Percent low-priced	23	17	19

Table 63. Comparative Information for Chinese Contexts, HI56 Block Sacramento

	P16E	**P16L***	**L954***	**L903**	**P979**	**P962**
date	**1855**	**1860s**	**1849-55**	**1955**	**1855**	**1855-61**
Total meat weight sample	103	101	1902	99	148	79
Percent beef	79	59	87	80	90	87
Percent mutton	6	33	3	10	6	7
Percent pork	15	8	10	10	4	6
Percent high-priced	23	46	18	4	34	23
Percent moderately priced	48	33	46	37	26	55
Percent low-priced	29	22	36	59	40	22

* indicates admixture of Euroamerican artifacts in deposit

MID-19th-CENTURY FISH REMAINS

by Peter D. Schulz
Brienes, West & Schulz

INTRODUCTION

The Gold Rush transformed much of California into an urban frontier, the focus of worldwide immigration whose object was the extraction of the region's mineral wealth. The instant population of hopeful extractors was initially supplied—with clothing, tools, utensils, building supplies, and an endless variety of other items—not by exactions on the local environment or the preexisting economy, but primarily by appeal to the same sources and routes that brought the argonauts themselves. Perhaps the earliest exception to this rule of imported supply was in regard to food. Even before the Gold Rush, California had a flourishing livestock industry, and other sources of local food supply were soon brought into production.

One of these other sources was the local fisheries. Although commercial salmon packing was initiated on the Sacramento River in the mid-1840s, the endeavor was of limited scope, never involving the full-time efforts of any of its participants. By about 1850, however, full-time professional fishermen began operating on the Sacramento and on San Francisco Bay. Their enterprises are briefly and sporadically chronicled by contemporary observers, but we have no information on the contribution of their landings *vis a vis* the import trade in salt fish that provided the cod, mackerel, and sardines that were staple commodities listed daily in newspaper ads and wholesale market reports.

Archaeological investigation offers an opportunity to study aspects of Gold Rush life that may be poorly documented in archival records. The present study, focusing on fish remains from Gold Rush-era deposits in Sacramento, is a small effort toward this end. It offers a look at an aspect of material culture that reflects both ethnic trade networks and the exploitation of the local environment, and it offers an initial quantitative assessment of local vs. imported sources in one aspect of the food supply in this transitional era.

Three contexts associated with Chinese occupants contained fish remains: Layer 903, Layer 954, and Pit 16 at 513/515 I Street consisted of the burned remains from the fire of July 1855 and was associated with the Yu Chung Company. Layer 954 predates the 1855 fire, being overlain by Layer 903. Unfortunately there was much trampling by livestock after the fire, so there may be some mixing of the levels in places. The deposit dates from probably 1848 until mid-1855. By the end of this period the occupants were Chinese, but the remains from the earliest years were presumably left by transient immigrants of various origins. Pit 16 seems to have been an open sump or well located behind the wooden building that fronted on I Street (525/527) at the time of the 1855 fire. After the fire it was quickly filled with several layers of debris (here noted as Lots 59, 60, 63, and 86) prior to the construction of wood frame tenements on the lot. The depositing population was clearly Chinese and probably the Yeung-wo Company.

METHODS

The three deposits were excavated under close stratigraphic control, and the soil was passed through 1/16-inch or 1/8-inch mesh screens. Fish remains from these deposits were saved, cleaned, and submitted to the author for identification.

The remains were examined by the author using an illuminated hand lens, and were identified to the most specific taxonomic level that could be confidently assigned. Identification of native California species was relatively routine, comparative material being readily available. Commercial species from the North Atlantic were identified using comparative specimens obtained from the Canadian Museum of Nature. Identification of Chinese species relied on comparative material collected by the author: salt fish specimens obtained during two trips to Hong Kong, Guangzhou, and Macao, and salt, frozen, and fresh specimens collected over several years in Asian markets in Sacramento and other Pacific Coast cities. The availability of this material allowed the secure identification of the vast majority of the submitted elements. Most of the material that remains unidentified is too fragmentary for any secure analysis. The collection does, however, contain several distinctive elements that remain unidentified for lack of appropriate comparative material.

Weight estimations for the fish are derived either from bone dimension: live weight regressions provided by Casteel (1972) for native California species, or by extrapolation from known-weight museum specimens. For consistency, the figures used are all live weights. The drawback in this approach is that the imported fishes did not reach the consumer in whole form; they were salted, dried, and sometimes minus the heads. As will be seen, however, occasionally local fishes were similarly prepared and we have as yet no means to determine the extent to which salt-dry preparations affected the present sample. Consistent use of live weight estimations thus offers a ready initial approximation of dietary importance that is at least more meaningful than simple element counts or estimations of minimum individuals.

RESULTS

Of 2,847 bones and fragments recovered from the three deposits, 2,077 were identified at least to superfamily. The identified remains include 272 elements from Layer 903, 1,690 from Layer 954, and 115 from Pit 16 (Table 64; Volume 2:Appendixes 4-8). These materials represent at least 17 species of fish. The collection can, for the most part, be readily grouped into three associations: local California species, North Atlantic species and Chinese species (Tables 64 and 65).

California Fishes

The great majority of the identified remains in each deposit represent California fishes, most of them locally abundant freshwater and anadromous forms. Of these species, salmon, a commercially important and highly favored food fish, feature most prominently in the literature of the day. As will be seen, however, many other species found buyers in the market, and in the case of the community reflected here, these little-known species were important indeed.

Sacramento Perch

The most abundantly represented species in each deposit was the Sacramento perch (*Archoplites interruptus*). The only sunfish native to the Pacific slope, this species was once common in the lakes, sloughs, and sluggish streams of the lower Sacramento Valley, particularly in those habitats with abundant rooted and emergent vegetation. The adults are

Table 64. Fish Remains, by Provenience, from HI56 Block Sacramento

		No.:			MNI:		
SPECIES	COMMON NAME	903	954	Pit 16	903	954	PIT 16
Califomia Fishes							
Acipenser sp.	Sturgeon	2	6			1	
Oncorhynchus tshawytscha	Chinook Salmon	6	18			1	
Catostomus occidentalis	Sacramento Sucker	7	20	6		2	
Gila crassicauda	Thicktail Chub	2	7	3		4	
Lavinia exilicauda	Hitch		3			2	
Mylopharodon conocephalus	Hardhead		4			3	
Pogonichthys macrolepidotus	Splittail		1			1	
Ptychocheilus grandis	Sacramento Squawfish	3	8	2		3	
Cyprinidae	Minnows	48	238	17			
Cyprinidae or Catostomidae	Suckers or Minnows	76	295	18			
Scorpaenidae	Rockfish	1	8		1	3	
Archoplites interruptus	Sacramento Perch	126	1044	29	4	31	2
Sum		271	1652	75	10	51	5
North Atlantic Fishes							
Clupea harengus	Herring						
Gadus sp.	Cod		4			1	
Scomber scombrus	Atlantic Mackerel		20			2	
Sum		0	24	1	0	3	
Chinese Fishes							
Ilisha e!ongata	White Herring						
Nemipterus virgatus	Golden Threadfin			12			3
Lutjanus sp.	Snapper		12			1	
Sparidae	Sea Bream		1	27		1	2
Sum			14	39		3	5
TOT AL IDENTIFIED		272	1690	115	11	57	11
Unidentified		56	645	69			
Total specimens		328	2335	184			

Table 65. Fish Remains, Weight Estimates for HI56 Block Sacramento

	AVE. WT.:	MNI			Total Weight:		
SPECIES	(gm)	903	954	Pit 16	903	954	Pit 16
CALIFORNIA FISHES							
Sturgeon.	6800	1	1		6800	6800	
Chinook Salmon	5100	1	1		5100	5100	
Sacramento Sucker	720	1	2	1	720	1440	720
Thicktail Chub	400	1	4	1	400	1600	400
Hitch	450		2			900	
Hardhead	800		3			2400	
Splittail	850		1			850	
Sacramento Squawfish	3000	1	3	1	3000	9000	3000
Rockfish	2000	1	3		2000	6000	
Sacramento Perch	440	4	31	2	1760	13640	880
Sum		10	51	5	19780	47730	5000
NORTH ATLANTIC FISHES							
Herring	300			1			300
Cod	5000		1			5000	
Atlantic Mackerel	650		2			1300	
Sum		0	3	1	0	6300	300
CHINESE FISHES							
White Herring	250					250	
Golden Threadfin	250			3			750
Snapper	700		1		700	700	
Sea Bream	350		1	2		350	700
Sum		1	3	5	700	1300	1450
TOTAL		11	57	11	20480	55330	6750

piscivorous but opportunistic, and invertebrates are often of greater dietary importance than fish. They concentrate in shallow waters in the spring to spawn.

Until the last quarter of the 19th century, this species was abundant in local lentic environments, and its bones often outnumber those of all other fishes in prehistoric sites near Sacramento (Schulz 1995). They are also the most ubiquitously represented of fish in historic deposits in Sacramento, having been recovered from virtually all the 19th-century features studied to date (Schulz 1980, 1982, n.d.)

This species presumably accounted for the "strings of pan-fish" reported as objects of eager barter at Sutter's Fort in 1846. By the early 1850s it was considered "one of our most esteemed fishes" and was being shipped in quantity to the San Francisco market (Ayres 1854; Bryant 1936:243; Girard 1857:9). Later observers note it as being particularly favored by Chinese consumers (Jordan 1884:405; Lockington 1879:21).

Unfortunately, Sacramento perch were unsuccessful in surviving the environmental changes that affected their habitat during the ensuing decades. They disappeared from the market early in the present century and have now vanished from most of their native range.

Sacramento Sucker

This fish (*Catostomus occidentalis*) is represented in all three samples, although never as abundantly as Sacramento perch. The only sucker found in the Central Valley, it occupies a wide variety of aquatic environments, from cold, rapidly flowing streams to warm, nearly stagnant sloughs. Spawning usually occurs in streams over gravel riffles.

Remains of this species are a common component of prehistoric middens in the region. They are not abundantly represented in sites on the valley floor, but increase in relative importance in the lower foothills. Suckers are often represented in local 19th-century deposits of Chinese origin but seldom in Euroamerican deposits (Schulz 1980, 1982, 1984).

Squawfish

Present in all three archaeological contexts, the squawfish (*Ptychocheilus grandis*) is the most abundantly represented of the five species of minnows in the present sample. The largest freshwater fish of the Central Valley, this species is also the most piscivorous of the native minnows. Squawfish are adapted to clear flowing streams and spend most of their time in deep well-shaded pools.

Although squawfish were a common market fish in the last century (then known as "pike," or sometimes as "salmon trout"), archaeological evidence indicates that they found more favor with Chinese than with other consumers (Schulz 1980, 1982, 1984, n.d.).

Thicktail Chub

Also represented in all three deposits was the thicktail chub (*Gila crassicauda*), a relatively large, now-extinct minnow. Once a common inhabitant of the overflow lakes and sloughs of the valley floor, its population declined rapidly in the early 20th century. It was last taken in the 1950s.

Thicktail chub are abundantly represented in local prehistoric middens and are often mentioned in 19th-century market reports. Most contemporary accounts suggest that they found their readiest buyers among the Chinese population, an impression that the archaeological data tend to confirm (Schulz 1980, 1982, 1984, 1995, n.d.).

Hardhead

Represented only in Layer 954, the hardhead (*Mylopharodon conocephalus*) is a sizable minnow generally found in large flowing streams, often in association with squawfish and suckers. They are bottom browsers, feeding on small invertebrates and aquatic plants. Extensive upstream migrations to spawn in smaller tributaries are common (Reeves 1964).

Judging by the paucity of 19th-century accounts, this species was never of much commercial importance, although one might expect that its external similarity to the more common squawfish may account for much of its historical obscurity. Nonetheless it forms only a very minor component of the prehistoric fish landings represented in local middens (Schulz 1995), There is only one previous 19th-century archaeological record (Schulz n.d.).

Hitch

A second species found only in Layer 954, the hitch (*Lavinia exilicauda*) is a relatively large omnivorous minnow. Adapted to warm low-lying lakes and sloughs and slow-moving streams, the adults tend to school in open waters.

Hitch were important to local prehistoric fisheries but seem to have been neither especially popular nor especially common in the last century. They have been previously recorded only twice from 19th-century deposits, the association in both cases being with Chinese consumers (Schulz 1982, 1984).

Splittail

Yet another species found only in Layer 954, the Sacramento splittail (*Pogonichthys macrolepidotus*) is a relatively large minnow found in low-lying, fast-moving streams as well as in sloughs. The bulk of the population seems to concentrate in the Delta, with upstream movement of the adults in the spring to feed and spawn over flooded vegetation.

Chinook Salmon

This species (*Oncorhynchus tshawytscha*) was by all accounts the most important food fish of this region in the latter half of the 19th century, but it is represented here in only two of the deposits (Layers 903 and 954). Chinook salmon move up the main channel of the Sacramento River to spawn in cold, rapidly flowing streams over gravel bottoms. Four spawning runs now occur in the Sacramento system, and adults are present year-round in the lower Sacramento. These migrations, however, have been affected by modern water regime alterations. Historically two major runs--one in the spring, the other in the autumn--were recognized, the former consisting of fish that moved up the river beginning in April or May and then oversummered in deep pools in higher tributaries before spawning in the fall (Stone 1874).

The commercial fishery for salmon on the lower Sacramento began before the Gold Rush and expanded rapidly once a growing population provided a reliable market for the product. By 1853 about 300 men were engaged in the lower Sacramento fishery, providing fresh, salted, and smoked salmon (Barber and Baker 1855: 71, 92).

Not surprisingly, the historic archaeological record of this fish is extensive, its remains having been recovered from the majority of deposits investigated in Sacramento.

Sturgeon (魚鱘)

Sturgeon remains, although not abundant, were recovered from Layers 903 and 954. Sturgeon occur on the Atlantic coast as well as on the coast of China. In both regions they were valued as food fishes, but in neither case was there an export trade of any note. An active and productive fishery did develop on the Sacramento and on San Francisco Bay in the 1850s, and this was undoubtedly the source of the present remains.

Two species of sturgeon occur in California, the white sturgeon (*Acipenser transmontanus*) and the green sturgeon (*A. medirostris*). Osteological differentiation has not been seriously studied, and considerable individual variation occurs within sturgeon species. Consequently, no attempt at specific identification has been made.

Both of these anadromous fishes spawn in the Sacramento River, white sturgeon being by far the more common. Adult white sturgeon are present in the lower Sacramento throughout the year, although they may be at their height in the spring as large numbers of fish migrate from the estuary--where the bulk of the population is concentrated--to the upper Sacramento to spawn.

Green sturgeon are known to be more marine, and may be present in the river only during spawning runs, which presumably occur at about the same time as those of the more common species.

In the early 1850s, Chinese fishermen on San Francisco Bay were landing sturgeon and drying them for export to the mines. They were also taken by American fishermen on the Sacramento. By the 1870s, they were perhaps the second most common fish in the market, though never highly regarded in the market reports. In the late 19th century, the population went into decline, and commercial fishing was banned in 1901 (*Alta California* 1853, 1855; Ayers 1854b; *Chambers's Journal* 1854; Stone 1874; Skinner 1962).

Not as frequently recovered as some other species, sturgeon are nonetheless widely represented in 19th-century deposits, their remains reflecting the diets of both Chinese and non-Chinese consumers (Schulz 1980, 1982, 1984, n.d.).

Rockfish

A few bones from Layers 903 and 954 represent rockfish (family Scorpaenidae). Fishes of this marine family are quite common along the Central California coast, including San Francisco Bay, where they have contributed significantly to commercial landings since the 1850s (*Alta California* 1855). Many species of this family also occur in the South China Sea, although they are of relatively little commercial importance. Consequently, the bones are presumed to be from fish taken in California. Most of the bones resemble those of the China rockfish (*Sebastes nebulosus*), but absent a fuller comparative collection, no attempt was made at definitive identification.

North Atlantic Fishes

The salt fisheries of the North Atlantic have been of great importance for centuries, their products being exported first to Europe, then to all the ports served by American commerce. The appearance of these products in the California goldfields is amply documented in newspapers, diaries, and account books. It is no surprise here to find their physical manifestation.

Cod

The few cod remains—found only in Layer 954—undoubtedly represent Atlantic cod (*Gadus morhua*), even though the elements themselves are not specifically diagnostic. Large populations of Pacific cod (*G. macrocephalus*) occur off Alaska but were not commercially exploited until the 1860s. North Atlantic cod, on the other hand, have been the focus of commercial exploitation for centuries. Salt fish from this source were on the California market by the 1830s (Spear 1835) and became a staple during the Gold Rush and thereafter. Not surprisingly, they occur frequently in archaeological contexts (Schulz 1980, 1984, n.d.). While it might be expected that the market for this product in California was among Americans and Europeans, occasional references indicate that salt cod attracted Chinese purchasers as well (Buck 1930:122; Speer 1856:23-24).

Atlantic Mackerel

Occurring only in Layer 954, the Atlantic mackerel (*Scomber scombrus*) was another mainstay of the North Atlantic salt-fish industry. Salt mackerel was a market staple during the Gold Rush and thereafter, but it is represented in the archaeological record less commonly than cod (Schulz n.d.).

Herring

A single bone from Pit 16 is the sole representative of the common herring (*Clupea harengus*). This species occurs in the North Atlantic as well as on both sides of the North Pacific (stocks in the latter area sometimes being classed as *Clupea pallasii*). Local fish were being landed fresh in San Francisco by the mid-1850s, and this source could account for the archaeological specimen (*Chambers's Journal* 1854; *Alta California* 1855). Nonetheless, the North Atlantic salt fishery was of vastly greater importance, and even in California the Atlantic was preferred to the Pacific product as late as the 20th century. Only two previous records are available from local 19th-century deposits (Schulz n.d.).

Chinese Species

The salt-fish industry along the Chinese coast was of considerable importance. Although its products were intended for domestic consumption, they offered a readily exportable source of traditional foods when emigration opened markets overseas. None of the three Chinese fishes recovered here has been previously identified in New World sites.

Snapper (笛鯛)

Included in Layers 903 and 954 were the remains of a snapper (*Lutjanus* sp.). Fishes of this genus occur worldwide in tropical and subtropical seas. Although one species occurs off southern California, it clearly does not account for the present bones,

which are almost certainly those of salt fish imported from China. More than 20 species of this genus are found in the South China Sea. Almost all of them are commercially important, and several species are commonly salted for the market (Allen 1985). They were readily available in the latter form in Hong Kong and Guangzhou in 1986 and 1989. (The archaeological bones agree perfectly with comparative specimens from this region; no specific identification is offered, however, because skeletal material from most species was not available for analysis. The lutjanid fishes now available in Asian markets in California, generally sold fresh—although sometimes seen frozen—appear to be mostly imported from the Atlantic.)

Sea Bream (海魴科, 鯛科)

Included in two contexts were the remains of at least one species of sea bream (family Sparidae). Perhaps a dozen species of this family occur along the coast of Guangdong, but comparative specimens were available for only one of these species. Included in the sparid bones from each context, however, was a distinctive fused frontal. These elements are virtually identical and clearly derive from the same species. Fortunately, this element has been considered of some taxonomic importance, and its characteristics among several species have been reported (Tomiyama 1934; Yasuda and Mizuguchi 1969a, 1969b). The archaeological frontals resemble most closely those reported for the yellow-back sea bream *Taius tumifrons,* 黃魚鯛). This species is reported as a "good food fish" by Herklots and Lin (n.d.:37). Fischer and Whitehead (1974) report that it is usually marketed fresh but is also dried-salted. (The only western Pacific sparid currently observed in California markets is the red sea bream [*Pagrus auratus*], which is commonly retailed fresh. This species is raised commercially in Japan and Taiwan, but those seen here evidently are from New Zealand.)

Golden Threadfin (金絃魚,)

The golden threadfin (*Nemipterus virgatus*) is represented by a dozen bones from Pit 16. This species is one of the most important commercial fishes of the northern South China Sea (Anderson 1972:105, 125; Au 1970; Li 1954; Williamson 1968). It is marketed mainly fresh, but it is available as a salt fish in Hong Kong and Guangdong. (In Asian markets in California, it is abundantly stocked in whole frozen form, but the author has never seen it sold here as salt fish.)

White Herring (長鰳)

The white herring (*Ilisha elongata*) is represented by only a single bone from Layer 954. This species is reported by Anderson as "a mainstay of the [Hong Kong] salt-fish industry, and . . . the most highly valued salt fish" (1972:110). Yang and Chen note that it is caught only in small quantities in Taiwan, but that it is "highly esteemed when salted Cantonese style" (1971:8). Salt specimens were readily obtainable in Hong Kong and Macau markets in 1986 and 1989. In spite of this popularity in southeast China, the species is not at all common on the overseas salt-fish market in California, and has never been observed here by the author.

DISCUSSION

Documentary sources are informative about some aspects of the salt-fish trade and about some of the local fisheries. These sources, however, provide unsystematic coverage. Thus we know quite well which fishes provided the bulk of the salt product from the North Atlantic, while the going prices for these varieties through most of the Gold Rush are readily obtainable. Yet the total volume of this trade, and its impact on the California diet remains unknown. Meanwhile, of the salt-fish trade from China we have virtually no written documentation beyond anonymous listings in customs-house records. Concerning the local fisheries, numerous brief accounts are available, but only for the salmon fishery do we have anything approaching statistical data.

The present collection advances our knowledge in this area in various ways. First, it provides material evidence of seven fishes offered in the salt-fish trade, including four Chinese fishes nowhere else documented. It also offers the possibility of looking at various other questions, among which are the connection of product sources with ethnic preferences, the importance of imported vs. local fish products, and the nature of the local fisheries.

Intrasite Comparisons

Since the present collection contains the remains of salt fish imported from two very different sources, the North Atlantic and China, we might expect the distribution of these remains to be correlated with historical and archaeological evidence for depositing populations reflecting this ethnic dichotomy. Thus, since Layer 903 and Pit 16 date to a period when this area was overwhelmingly occupied by Chinese residents, we might expect imported fish to be exclusively from China. Layer 954, on the other hand, representing an ethnically mixed history of occupation, we might expect to exhibit imported food stuffs, including salt fish, from a wide variety of sources.

These expectations are for the most part confirmed. Layer 954 yielded 24 elements derived from North Atlantic fish but only 14 from Chinese fish; the other two features produced only a single element from the former category but 40 from the latter. Use of estimated weights provides us with a less dramatic but still consistent picture: the balance of North Atlantic to Chinese fish in Layer 954 is 6,300 vs. 1,300 g; in the other two features, it is 300 vs. 2,150 g. So far as small sample sizes allow us to judge, then, the origin of the imported salt fish correlates here with the origin of the consumers.

Imported vs. Local Fish

As mentioned above, the HI56 Block assemblage allows us to weigh the dietary contributions of the local fisheries against those of the import trade in salt fish. It should be noted, of course, that there are some restrictions on the value of this comparison. First, the sample sizes used are not especially large. Second, we are dealing here mostly with evidence from a minority community; we cannot assume that any patterns reflected here were the same in the larger population. Finally, the weight estimations used will overvalue the importance of salt fish.

Whether the data used are element numbers (Table 64) or estimated product weight (Table 65), the evidence is quite clear: in every feature, local product was more important than the imported one. Thus for the collection as a whole, 73.4% of elements and 87.8%

of estimated product weight represent local fishes. Clearly, by the mid-1850s, local fisheries were supplying a greater share of the diet—at least in Sacramento's Chinese community—than was supplied by the import trade.

Local Fisheries

Another interesting aspect of this collection is the light it throws on the nature of the local fisheries. Among these fisheries, there seems little doubt that, given the number of men employed and the volume of the landings, the salmon fishery was the most important (cf. Kirkpatrick 1860; Skinner 1962:57-65). It was not unique, however. By the mid-1850s both Chinese and European fishermen were working on San Francisco Bay, while the latter extended their operations outside as well. On the lower Sacramento, salmon fishermen turned their attention in the off season to other species. Additionally, Chinese fishermen directed their attention specifically to these freshwater species, an industry chronicled only in a few passing remarks such as that of Barber and Baker: "There are large numbers of a variety of smaller fish caught and cured, principally by the Chinese" (1855:92). The present collection clearly documents the "variety" of these landings. The remaining question goes to their importance.

The weight calculations (Table 65) indicate that so far from constituting the bulk of the local fish on the market, salmon constituted only 14% of the total. Similarly, marine fish provided only 11% of the total. The remainder consisted of local freshwater and anadromous fishes, the product of those fisheries least chronicled in the records of the day. In fact the largest single contributor (22%)—that is, the most important fish on the market reflected here—was the Sacramento perch.

There are several possible explanations for these apparently anomalous results. First, the salmon runs were highly seasonal. Since the landings exceeded the market demand for fresh fish, the majority of the catch was processed into salt or smoked salmon and distributed to the interior or exported (Kirkpatrick 1860:534). Second, the archaeological data reflect a community with a highly eclectic valuation of fish varieties and no prior cultural preference for salmon. And finally, those few accounts we have of the small fish trade suggest that the trade was substantial and that the market was reliant on heavy demand within the Chinese community:

> Besides salmon, large quantities of perch, pike, chub and suckers (the last two best known as "China fish") are taken in the Sacramento. The perch is highly esteemed among the lovers of fresh fish. The others are in demand chiefly among the Chinese in our city, who have contract with some of our fishermen for the supply of the chief article of their food [*Sacramento Bee* 1 January 1859:4].

FLORAL REMAINS

by Madeline Hirn (identification by Elizabeth Honeysett)

METHODS

Seeds recovered from the Pit 719, Layer 903, and Layer 954 soil samples screened through 1/16-inch (1.5mm) mesh were given to Elizabeth Honeysett for identification. A 10X dissecting microscope was used to examine and sort the seeds. Identifications were verified against a type collection.

FINDINGS

The identifications and numbers of specimens are given in Table 66. Four kinds of gourds, five kinds of fruits, two kinds of nut, and four kinds of grain are represented. A number of these items have a permanent place in Chinese foodways and folk medicine.

Bitter Melon *(Momordica charantia)*

Bitter Melon is also called balsam pear, *fu gwa*, or 'leprosy gourd' because of its use in Asia as a cure for leprosy (Heiser 1979:63). Bitter melon is a green fruit about the size of a cucumber with a warty skin. Its cool and bitter taste is due to its quinine content, which increases with maturity. The immature green fruits are usually used for food; the mature fruit turns yellow or orange and contain seeds with an edible scarlet aril (Yamaguchi 1983:341-342). Bitter melons should not be peeled prior to use; the pulp and seeds are cut out before cooking. Usually served with black bean sauce for flavoring, it can be sliced for stir frying with meat slices or shrimp or both, or halved for stuffing. The melon brings out the flavor of the other foods, while they counteract the melon's bitterness (Yee and Taylor 1993:81). Bitter melon is thought to be an acquired taste, but one "well worth the trouble of acquiring" (Anderson and Anderson 1977:329).

Winter Melon *(Benincasa hispida)*

The Chinese winter melon (*tung kua*) has a common and interesting place in southern Chinese cooking. According to Anderson and Anderson, "winter melons are huge, dark-skinned, hard-rined, and used most characteristically as soup kettles: filled with various ingredients and sometimes carved on the outside into lovely designs, they are steamed, adding to the finished soup their faintly spicy flavor and their tendency to absorb overgreasy or overspicy tastes" (1977:329).

Chinese Date (*Zizphus jujuba*)

The Chinese date, or jujube, looks like a date (although it is sometimes red), tastes a little like a date, and has a datelike stone, but it is not related to the date. The jujube thrives in dry climates and thus not extensively grown in the wet environs of southern China (Anderson and Anderson 1977:334). The southern Chinese import the "dates" fresh or more often as jujube nuts that have been dried, sugared, stewed, or smoked (Poterfield 1951:26). The jujube or red date is used in soups or in steamed dishes to give a subtle

Table 66. Floral Remains

Common Name	*Scientific Name*	Number/Description
Pit 719, Context 738		
Watermelon	*Citrullus lanatus*	616+fragments
Sweet Melon	*Cucumis melo*	47
Grape	*Vitis vinifera*	71
Chinese Date	*Zizphus jujuba*	8
Chinese Olive	*Canarium album*	3
Bitter Melon	*Momordica charantia*	1
Peanut	*Arachis hypogeaea*	8 shell fragments
Coconut	*Cocos nucifera*	3 shell fragments
Rice	*Oryza sativa*	several seed hulls
Chinese Winter Melon	*Benincasa hispida*	2
Wheat	*Triticum aestivum*	1
Walnut	*Juglans sp.*	4 shell fragments
Unknown		3
Layer 903		
Watermelon	*Citrullus lanatus*	9+fragments
Grape	*Vitis vinifera*	4
Chinese Date	*Zizphus jujuba*	1
Chinese Olive	*Canarium album*	2
Peanut	*Arachis hypogaea*	shell fragments
Wheat	*Triticum aestivum*	2
Peach	*Prunus persica*	1
Layer 954		
Watermelon	*Citrullus lanatus*	4+fragments
Wheat	*Triticum aestivum*	3
Wild Oat	*Avena sp.*	1
Wild Barley	*Hordeum sp.*	1

sweetness (Yee and Taylor 1993:87). An archaeological excavation of a tomb dating to between 175 and 145 B.C. found several hemp bags once filled with agricultural products, including the jujube (Ying-Shih Yu 1977:55-56).

The jujube is also used for medicinal purposes. The seed kernels are sometimes used as a sedative (Porterfield 1951:26). The medicinal use of the fruit varies with its color: "black dates tonify the yang of the stomach and spleen; red dates tonify the yang of the circulatory system; brown dates, sweetened with honey, moisten the internal organs" (Kang-Yang and Dahlen 1994:32). They are prescribed as soups, teas, and candies. The black date, the most potent of the three, regularly accompanies and complements angelica root in prescriptions (Kang-Yang and Dahlen 1994:32).

Peach *(Prunus persica)*

The peach, with its long history in China, is one of the foodstuffs that characterize Chinese foodways through the ages (Chang 1977:7). The peach figures prominently in Chinese folklore, traditional religion, literature, and popular culture (Schafer 1977:93-94). The peach is the Taoist symbol of long life and the center motif of the Four Flowers ceramic pattern. The god of longevity is often pictured as issuing from a peach, and families protected their children from death with peach-stone amulets carved in the shape of a lock (Williams 1941:316).

Peach seeds are used in Chinese herbal medicine to treat circulation problems, certain traumatic injuries, and some cases of high blood pressure. They are prescribed as dessert soups (Kang-Yang and Dahlen 1994:40).

Chinese Olive *(Canarium album)*

The Chinese olive is comparable to the jujube in size and is prized in northern and southern China. If eaten fresh the fruit is sour, but they are remarkably sweet when steamed in honey. The fruit is said to be superior to cloves as a breath freshener (Schafer 1977:97). The Chinese olive (*lam*) is often preserved by salting, which is the form most commonly found in the United States. The approximately 1-inch-long ribbed seed tapers to a point at both ends. It is crushed and used medicinally as a poultice and in the treatment of disease (Porterfield 1951:28).

Peanut *(Arachis hypogaea)*

The peanut is a native of South America (Yamaguchi 1983:275). It has been written about in China as early as the 16th century and was being exported as early as the 17th century (Kent et al. 1987:157). Honeysett and Schulz (1984:153) state that peanuts were not commonly eaten by Americans until the end of the 1900s, but were being grown by the Chinese as early as the 1860s.

Watermelon *(Citrullus lanatus)*

The Watermelon is indigenous to southcentral Africa and was introduced into China through India some time in the 10th or 11th centuries (Kent et al. 1987:159; Yamaguchi 1983:32). Seeds are used in China for oil and sometimes ground and baked in breads. Watermelon seeds are served along with other sweets at special festivals such as New Year's Day (Hsu and Hsu 1977:299).

Sweet Melon *(Cucumis melo)*

Sweet melon is an inclusive term used for melons of the muskmelon, cantaloupe, or honeydew varieties. Some species of sweet melons are indigenous to China (Yamaguchi 1983:323).

Coconut *(Cocos nucifera)*

According to Honeysett and Schulz, "coconuts seem to have been a fairly exotic food among Euroamericans, but a more ordinary one among the Chinese" (1984:153).

DISCUSSION

The bitter melon and winter melon were probably grown at one of the Chinese truck gardens within the city limits. The exotic appearance and flavor of these gourds indicate that the Chinese gardeners catered, at least in part, to the local Chinese community. These gourds suggest the spicy cuisine of southern China. The Chinese olives and dates were probably imported in ceramic jars preserved with salt and sugar.

POLLEN ANALYSIS OF SEDIMENT SAMPLES: A RECORD OF VEGETATION CHANGE

By G. James West
Brienes, West & Schulz

INTRODUCTION

The first gold-seekers reaching the Sacramento area encountered plant communities already directly and indirectly modified by human activities. Native peoples who had occupied the area are thought to have changed the vegetation through the use of fire and may have affected the distribution of some species by other subsistence-related activities. John Sutter and other early settlers had cleared the land, planted crops, purposely and accidentally introduced plants that rapidly became weeds, cut down trees for lumber and fuel, and introduced herds of domestic animals that significantly altered the vegetation.

Based on differing dominant land-use patterns, these perturbations in the natural vegetation of the Sacramento area can be divided into three periods: Aboriginal (pre-1769), Hispanic-Sutter (1769-1848), and Gold Rush (1848 to approximately 1852). It is these transformations that are to be examined here.

Prior to 1769 four plant communities were of paramount importance in the Sacramento area: the Riparian Gallery Forest, Oak Woodland, Valley Grassland, and Freshwater Marsh. The only true forest in the area was the Riparian Gallery Forest, which lined portions of the Sacramento and American rivers (Jepson 1893; Stebbins and Taylor 1973; Thompson 1961). Located on the alluvial fan and flood-plain soils of the river levees, these forests formed a dense multistoried vegetational community with a greater niche diversity than any other native ecosystem. Mature stands were typified by a dense crown cover and thick understory; these forests could be subdivided further based on elevation in relation to the river, the amount of seasonal flooding, and substrate. Tall cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), walnut (*Juglans hindsii*), California sycamore (*Platanus racemosa*), and Oregon ash (*Fraxinus latifolia*) formed the deciduous canopy, with white alder (*Alnus rhombifolia*), box elder (*Acer negundo*), and elderberry (*Sambucus mexicana*) dominating the subcanopy. The understory was a dense tangle of willows (*Salix* spp.), lianas, grapevines (*Vitis californica*), and numerous tall herbaceous plants.

The riparian Oak Woodland community, usually associated with alluvial mineral soils formed on overbank deposits, paralleled the Riparian Gallery Forest, and also occurred as discontinuous stands on the better-drained soils. The dominant arboreal form was the valley oak, although box elder and Oregon ash were also common. The Oak Woodland was characterized by only a sparse understory, consisting of poison-oak (*Rhus diversiloba*), elderberry, buckeye (*Aesculus californicus*), wild rose (*Rosa californica*), and a few other woody shrubs. The herbaceous layer of the understory was similar in composition to the Valley Grassland, but with increased abundance of wild rye (*Elymus triticoides*), one of the few rhizomatous grasses common to the pristine Central Valley (Stebbins and Taylor 1973). It is thought that this grass formed a sod in some areas of Oak Woodland (Clements and Shelford 1939). The open and parklike appearance of this community probably was accentuated by aboriginal burning practices.

The Valley Grassland or Central Valley Prairie, also restricted to alluvial mineral soils but generally ones with poorer drainage, flanked the Oak Woodland and extended into the lower foothills before giving way to the Blue Oak Woodland. Perennial bunch grasses such as needle grass (*Stipa* spp.), blue grass (*Poa* spp.), and three-awn (*Aristida* spp.) were the dominant species (Barry 1972). This community was regularly burnt by aborigines to enhance reproduction of specific taxa, gather edible insects and control others, and drive game.

Freshwater Marsh, which formerly covered large areas of low-lying ground in the area, flooded periodically and retained standing water throughout most of the year (Mason 1969). Soils associated with the marshlands were clay loams to peats. Although dominated by tules (*Scirpus* spp.), this community also contained cattails (*Typha* spp.), reeds (*Phragmites communis*), and other marsh plants. Aquatic species, common in places that had deeper permanent water, included pondweed (*Potamogeton* spp.), yellow pond lily (*Nuphar polysepalum*), and knotweed (*Polygonum* spp.).

From 1769 to 1848, the vegetation of the lower Sacramento Valley changed radically. Many alien species, mainly derived from southern Eurasia, were introduced and began to displace native taxa. Agriculture and uncontrolled livestock grazing had drastic impacts on the native vegetation. These changing land-use patterns, in turn, altered the subsistence system of the native peoples and thus their effect on the vegetation. Co-occurring with these events was the rapid and devastating decline in the native population due to introduced diseases, particularly smallpox and malaria (Cook 1943).

John Sutter, who settled in the area in 1839, immediately set about clearing, plowing, planting, building, and grazing cattle, horses, and sheep. By 1840 he had the first enclosed wheat field; it lay just to the north of the fort he had constructed (Thompson and West 1880). In 1846 Sutter had about five or six hundred acres under cultivation, over 7,000 head of cattle, 1,000 sheep, and 1,200 horses. Between 1841 and 1845, Heinrich Leinhard had settled in the area and was cultivating the tract of land between Sutter's Fort and the mouth of the American River.

The large influx of people with the Gold Rush amplified both the direct and indirect changes in the vegetation. As a result, remnants of native vegetation in the project area were almost totally eliminated. The floods of 1850, 1852, and 1853 created a demand for levees and the filling of low-lying areas (Brienes 1979). These activities destroyed the vegetation and changed the habitats to such an extent that the former vegetation could not re-establish itself. China Lake (Sutter Lake), which had supported freshwater marsh flora during the early Gold Rush, was affected. It became, like several other low-lying areas, a dump for the waste created by the rapidly growing city. By about 1910, China Lake was completely filled to enlarge the railyards.

METHODS

Six samples collected, by Mike Meyer and Jack Meyer of the ASC, from geotechnical studies made for the new Federal Courthouse were provided for analysis. Standard palynological techniques were used to process the samples. Prior to chemical treatment, the samples were swirled to concentrate the pollen-size fraction of the sediments by the method outlined in Mehringer (1967). Four tablets with exotic *Lycopodium* spores were added to each sample to monitor processing and determine pollen concentration

values (Stockmarr 1971). A Nikon Labophot microscope with phase contrast was used to scan the samples. Pollen identifications are based on herbarium specimens obtained from the Jepson Herbarium, UC Berkeley, and the Tucker Herbarium, UC Davis, as well a standard texts. Vials of the remaining processed samples, as well as a fraction of the original samples, are stored at the Department of Anthropology, UC Davis.

RESULTS

Five of the of the six samples examined contained pollen, 3 (27-27.5'), 4 (33-33.5'), 6 (37.5-38'), 7 (49-49.5'), 9 (52-53'). Pollen is very sparse and with little exception poorly preserved in Sample 3, a black clay. Pollen preservation in the remaining samples from the gray sandy silt ranges from fair to good, but in all instances pollen concentration is low. All the samples contained charcoal. Sample 2 (25'), also a black clay, had no pollen grains but charcoal was very abundant. Counts were made for four samples (3, 4, 6, 7).

Thirty-five different pollen types were recognized: 11 arboreal forms, 20 nonarboreal, and 4 aquatic-emergent types (Table 67). Arboreal types dominated the counts, with pine (*Pinus*) being the most common taxon. Unknown and undifferentiated grains ranged from about 10% to over 31%. Many of the unknown grains were small tricolpate and tricolporate grains that were most likely derived from nonarboreal species. No pollen grains from alien taxa were observed.

DISCUSSION

The boring for the samples was made at the HI56 Block of Sacramento, some 400 feet north of I Street. The edge of China Lake was roughly 50 feet north of I Street and it is assumed that the 60-foot-deep boring penetrated the middle of the lake. The core profile and sample location is presented in Figure 69. Three main units were identified by Meyer and Meyer—an upper historic-age brown silt and sand (0-24'), a dark clay (24-27.5'), and a lower unit of gray sand, silt, and clay (>27.5'). No samples were provided from the upper unit. The samples examined and discussed here came from the dark clay and gray sand, silt, and clay units. It is thought that the dark clay is representative of China Lake, a former oxbow lake of the American River. The gray sand, silt and clay is, by definition and elevation, prehistoric. At the time the boring was made, the top of the water table was about 22 feet below the surface. Present day sea level is about 26 feet below the surface, just above the gray sand, silt, and clay unit.

There is insufficient pollen in Sample 3, the dark clay China Lake sediments, for meaningful discussion. Bladderwort (*Uticularia*) pollen suggests that this aquatic was growing in the lake. No pollen grains from other aquatic-emergent plants are present, suggesting either differential preservation or that these plants had already been extirpated from the lake. The increased biological activity brought on by dumping may also have contributed to the poor pollen preservation, but specific proof is lacking.

The samples from the gray sand, silt, and clay unit have high pine pollen values of 33 to 51%. As many as 10 species could be contributors to the *Pinus* category. The values are far greater than modern surface samples from the Sacramento-San Joaquin River drainage (Table 68), where the highest values observed are almost 15% for a Riparian Forest along the Sacramento River and 23.6% for one of the open-water samples at Stone

Table 67. Pollen Counts for HI56 Block Sacramento

Sample:	3		4		6		7	
Depth:	27		33		37.5		49	
Pinus 3rds	4		20		20		12	
Pinus	3		110		59		40	
Total Pinus	4		130	51.0%	79	40.1%	62	32.6%
Abies	0		13	5.1%	13	6.6%	5	2.6%
TCT	1		12	4.7%	10	5.1%	18	9.5%
Quercus	3		24	9.4%	12	6.1%	22	11.6%
Alnus	0		26	10.2%	16	8.1%	20	10.5%
Fraxinus	1		1		0		0	
Pseudotsuga	0		3	1.2%	1		2	
Tsuga mertensiana	0		0		0		0	
Acer	0		1		0		0	
Corylaceae	0		1		0		1	
Platanaceae	1		0		0		1	
Rhus	0		2		2		1	
Rhamnaceae	3		3		5	2.5%	3	1.6%
Rosaceae	4		7	2.7%	14	7.1%	10	5.3%
Artemisia	1		4	1.6%	1		3	1.6%
Composite Hi Spine	3		4	1.6%	5	2.5%	8	4.2%
Composite Lo Spine	0		3		10	5.1%	1	
Liguliflorae	0		3		0		0	
Gramineae	0		6	2.4%	4	2.0%	6	3.2%
Chenopodiaceae	1		2		1		5	2.6%
Polygonaceae	0		3		5	2.5%	3	1.6%
Rumex	0		1		0		1	
Gilia	0		0		0		1	
Onagraceae	0		0		1		0	
Umbellifereae	0		2		2		1	
Malvaceae	0		0		1		0	
Ranunuclaceae	1		1		1		0	
Ericaceae	0		0		1		0	
Cruciferae	0		0		0		1	
Arceuthobium	0		0		0		1	
Linaceae	0		0		1		0	
Cyperaceae	0		2		6	3.0%	8	4.2%
Salix	0		0		5	2.5%	5	2.6%
Isotes	0		1		1		1	
Utricularia	1		0		0		0	
Total:	24		255		197		190	
Unkn/Undiff	11	31.4%	28	9.9%	47	19.3%	30	13.6%
Grand total:	35		283		244		220	
Lycopodium	350		288		365		>325	

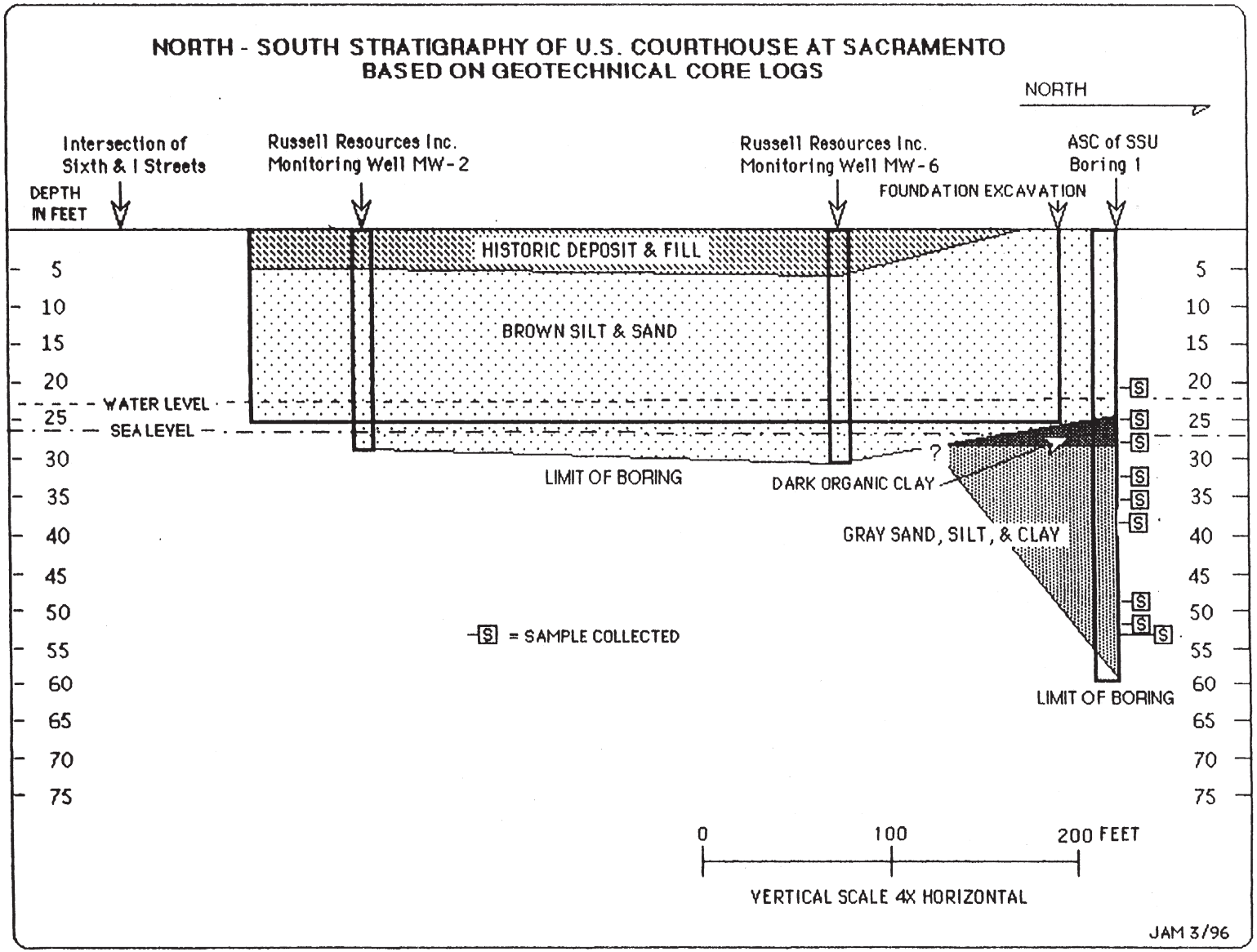


Figure 69. Pollen sample collection locations, HI56 Block Sacramento

Table 68. Modern Surface Pollen Rain of the Sacramento-San Joaquin Drainage Major Pollen Types by Percent (from West 1977)

	Browns Island FW Marsh	Princeton Riparian	Stone Lake #1 FW Marsh	Stone Lake #2 FW Marsh	Hamilton Range Grassland	Cosumnes River Oak Woodland
Pinus	9.7	14.6	3.7	23.6	5.8	10.6
Abies	*	*	0	*	0	*
TCT	0.9	*	0	.1.3	*	0.8
Quercus	8.8	7.4	6.2	5	3.2	29.9
Populus	0	6	*	0	0	0
Juglans	*	3.3	0	*	*	*
Platanus	0	1.1	0	0	0	0
Fraxinus	*	1.1	0	0	0.9	4.1
Alnus	2.9	4.6	0.7	1	1.6	4.7
Salix	2	4.4	20	*	0	2.3
Comp Hi	12.9	2.7	2.4	3.3	27.7	
Comp Lo	3.6	9	3.9	2	29	1.5
Gramineae	8.8	7.9	3.27	14.5	12	32.5
Chenopod	4.5	3	4.7	4.3	2.9	1.9
Polygonaceae	2.4	1.1	1.9	3.7	0	*
Cyperaceae	28.3	3	36	18.5	*	*

*present less than 1%

Lake, a Freshwater Marsh near the Sacramento and Cosumnes rivers. Historic-age samples from Sacramento IJ89 site did not exceed 18% (West 1989). The highest pine value observed in Holocene-age sediments from the Sacramento-San Joaquin Delta, dated between 2,850 and 3,940 years B.P., is 32% for a single sample below a widespread silty clay layer (West 1977) that may be Neoglacial in age. Pine values comparable to those from Samples 4 and 6 are found today above 3,000-3,500 feet in the Sierra (Adam 1967; Anderson and Davis 1988). Anderson and Davis (1988) note that, for the Sierra, pine was not present with values below 24%. Even taking into consideration the effects of long-distance transport, it would appear that pines were growing in the area of the lower American River at the time the gray sand, silt, and clay unit was deposited.

Also striking are the relatively high values for fir (*Abies*) in Samples 4 (5.1) and 6 (6.6). Two species most likely are represented—white (*A. concolor*) and red (*A. magnifica*) fir. Today, white fir is found above 3,000 feet and red fir above 5,000 feet in the Sierra. In the Sierra, fir trees are absent when fir-pollen percentages are less than 2 to 4% (Anderson and Davis 1988). Fir has a large, relatively heavy pollen grain that while resembling pine, has a smaller dispersal range. It is unlikely that fir values this high can be explained solely by long-distance transport. While fir pollen is present in four of the modern surface samples of the Sacramento-San Joaquin drainage, in no instance does it reach 1% of the pollen spectrum (Table 68). Like pine, fir must have been growing in the vicinity of the lower American River.

Alder (*Alnus* spp.) pollen, most likely derived from white alder (*A. rhombifolia*) although mountain alder (*A. tenuifolia*) could also be a contributor, ranges in value from 8 to 10%, reflecting its importance as a riparian tree. Highest values for alder are found in the Sierra between 1,500 and 3,000 feet. In addition to alder, Sample 6 pollen values indicate that sedges and willows were present, possibly growing on the margins of a nearby water course or pond.

Oak (*Quercus* spp.) is present in Samples 4 and 6 (ca. 5%) and Sample 7 (9.5%) but does not approach the values that are found in the Cosumnes River Oak Woodland today (30%; see Table 68), and in the Sierra Oak Woodland and chaparral communities (between 35 and 58%; Anderson and Davis 1988). Five of the six Sierran species are arboreal and most abundant below 3,000 feet. Thus, while oaks were present during the time of deposition of Samples 4, 6, and 7, they were far less prominent than today.

Age and Environment of Gray Sand, Silt, and Clay Unit

Minimally, this unit was deposited during a time of lower sea levels. Post-glacial sea level rise slowed significantly after 8,000 years ago and essentially reached modern levels by about 6,000 years ago (Atwater, Hedel, and Helley 1977). Based on this line of reasoning, and assuming that tectonic subsidence has been minimal, the upper part of the unit should date to the late Pleistocene or early Holocene. There is no evidence of Holocene tectonism that could account for the below sea-level elevation of the unit (Shlemon and Begg 1972).

The composition and condition of the sedimentary unit samples suggests rapid deposition with little alteration after deposition. The composition is compatible with those found in the lower reaches of glacial outwash deposits.

Comparable pollen spectra with high pine and fir values from nonglaciated low-elevation sites occur at Clear Lake (Adam 1988) and Laguna de las Trancas (Adam, Byrne, and Luther 1981). Such samples have been assigned to the coolest part of the last full glacial cycle of approximately 21,000 to 24,000 years ago. An independent date should be obtained to test this assumption for the Sacramento samples. Temperatures at this time were estimated to be 6-8 degrees cooler than today (Adam and West 1983). A significant climatic factor in the American River drainage would have been cold air drainage, which could have allowed more cold-tolerant taxa to expand down slope. Summers were probably shorter and cooler and sea level was greater than 50 meters (164 feet) lower than today (Atwater, Hedel and Helley 1977).

CONCLUSIONS

While poor pollen preservation precluded the examination of the transition of vegetation from the prehistoric period to the historic, the prehistoric samples provide important new information on the age of the sedimentary unit and local Pleistocene environments. Based on comparative pollen data, the unit is Pleistocene in age, specifically the last full glacial (approximately 21,000-24,000 years ago). The composition of the vegetation was significantly different than today, with the elevational ranges of some taxa occurring possibly as much as 3,000 feet lower. Within the lower American River drainage, pine and fir trees were common, alder was the dominant riparian tree, and oaks were restricted to protected areas where they could survive the colder temperatures.