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Title: **Forge and Falseworks: An Archaeological Investigation of the Russian American Company's Industrial Complex at Colony Ross**

Author(s): **James McGhie Allan III**

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by

James McGhie Allan III

B.S. (Saint Mary's College of California) 1966
M.A. (University of California, Berkeley) 1990
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Committee in charge:

Professor Kent G. Lightfoot, Chair
Professor Laurie Wilkie
Professor Richard A. Walker

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Chair Date

Date

Date

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Abstract

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In 1812, the Russian American Company established their southernmost outpost on a windswept marine terrace, some 60 miles north of the Spanish settlement in Alta California. Intended as a base of operations for the Company's fur hunting trade, and as a source agricultural and pastoral produce, the colony of Ross soon turned to industrial pursuits to support itself when the fur bearing sea mammals were hunted to extirpation, and the colony's agricultural efforts returned only limited success. Until the colony was abandoned in 1842, its craftsmen manufactured bricks in the small cove below the colony's stockade. There they also tanned leather, made barrels, produced iron tools and implements, and built the first ships to be launched from the west coast of what would later become the continental United States.

Today, the erosional effects of Fort Ross Creek, which flows through the site, and the tidal action of the nearby ocean, have combined to eradicate all but a vestige of the original landmass on which the complex once stood. In 1996, archaeological investigations began in the small strip of land that today is all that remains of the colony's industrial enterprise.

The archaeological research was an attempt to determine from those fragmentary remains how the industrial complex was organized, both spatially and culturally, and how the artisans of the colony conducted their industrial pursuits in the rigorous, spare environment of the colonial frontier. Although most of the evidence necessary for such an investigation has washed away, enough remained to provide some insight into how at least a portion of the complex was organized. Two features in particular illustrate how the craftsmen of the colony adapted to both the environmental constraints of their location, and the economic deprivations associated with life on the edge of the frontier. These, and the bits and pieces of cultural material recovered throughout the project's excavations, have provided unambiguous testimony to the skill and creativity of the entrepreneurs who plied their skills in the small cove nestled at the foot of the colony's stockade.

Chair	Date

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During the course of the project, well over 50 cubic meters of soil and sediment were excavated and screened. This could not have been accomplished without the assistance of the numerous volunteers who carefully dug and mapped the units, muscled the heavy buckets of back dirt, and patiently screened all of it, recovering the bulk of the thousands of artifacts that eventually found their way into the project's catalog. For this vital and oftentimes backbreaking work, my deep appreciation and thanks go to Julie Bernard, Kira Blaisdell-Sloan, Lucky Carillo, Jason Claiborne, Jason Coleman, Erin Donnelly, Laura Eklund and Eric McFarland, Rick Fitzgerald, Ian Flaherty, Tim Fortenberry, Dave Gadsby, Gina George, Susie Goddard, Anthony Graesch, Dorian Hanson, Ginger Helloman, Jennifer Herrett, Brian Hillesheim, Michael Hilton, Lucelle Hoefngels, Dr. Sandy Holloman, Patricia Hunt-Jones, Neil Lane, Dave Lewis, Alejandro Luna, Nicole McMahon, Steve Moore, Rose Mota, Mike Newland, Gabe Olson, Sara Palmer, Vanessa Pickerel, Dr. Heather Price and her students from the College of Marin, Laura Privett, Caitey Quigley, Heather Reed, John Sharp, Don Sheets, Tanya Stellini, Scott Trimble, Bill Turner, Daniel Venegas, Nicole Vialletti, Damon White, Carrie D. Wills, Brad Wolf, Elena Worley, Beth Woodie, and Elizabeth Wren. Thanks for everything -- your contributions were invaluable. To April Van Wycke, many thanks for the care you took in mapping the units. The information you recorded proved to be particularly valuable in interpreting some of the excavation units. To Chris Logan, Chris Ward, and John Edwards, special thanks for your great work on the excavation of the beach feature. John, your map has been especially helpful.

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Chapter 1: Introduction and Research Issues

The concept of the world as a "global village" derives from the technological triumphs of the late 20th century, particularly those involving the acquisition, processing, and dissemination of information. The contemporary idea that electronic mass communication has created an interconnected global community in which the economic and political policies, cultural norms, and moral posture of its members affect and influence those of the others is predicated on the recognition of almost universal access to modern technology (McLuhan 1962:31). However, the genesis of the relationships defined in the modern concept of a "global village" is actually found in the late 15th century, at the dawning of the Age of Discovery.

European contact with the New World extended the threads of communication previously established between Europe, Africa, and Asia. The "discovery of the sea," as Parry (1981:xii) describes the prerequisite of European expansion, eradicated the geophysical barriers of the oceans and continents to the global transmission and receipt of information. As Europe incorporated the New World into its sphere of influence, the nature of communication that was established, while not exactly as described by McLuhan, was nonetheless sufficient to forge a link between two formerly unknown worlds that forever changed the concept of the word "global." As ripples expand across the surface of a pond, the cultural spheres that comprised European exploration and expansion radiated through the Western Hemisphere, enveloping formerly isolated cultural entities and linking them into the expanding global network—while simultaneously being altered by the experience. The intersections where the expanding

European cultural spheres collided with extant native cultures, and with each other, were the frontiers, both geographical and cultural.

> We all know that a frontier . . . is a space between two worlds. . . . Whenever two cultures, or two events, or two ideas are set in proximity to one other, an interplay takes place. . . . The more unlike the interface, the greater the tension of the interchange (McLuhan and Powers 1989:4).

The Russians and Spanish in Alta California

In the late 18th and early 19th centuries, such an interplay occurred between four vastly different cultures in the frontier region then known as Alta California. The frontier there was the space between the worlds of the Native Californians, the Europeans of monarchial Spain and czarist Russia, and the Native Alaskans drawn into the California frontier by the Russians. The "great tension" referred to by McLuhan and Powers was clearly evident in the interface of the Native Californian and Spanish cultural spheres, but that specific relationship is better examined elsewhere (see, for example, Baker and Kealhofer 1996; Hurtado 1988; Milliken 1995; Weber 1992). A distinctly different type of tension existed between the four cultures that intersected on a small parcel of land situated in the homeland of the Native Californian, where the European frontier intersected that of the Russian empire that was then expanding south from Alaska. For it was at the Russian colony of Ross, situated on land acquired from the Native Californians but claimed by the Spanish, that the commercial ambitions of Russia encountered the colonial policies of Imperial Spain. Certainly the intersection on a distant frontier of these two European powers, each a proponent of distinctly different economic and political systems, with the radically dissimilar Native Californian and Native Alaskan cultures generated the tensions described by McLulan and Powers. These, however, were not the "great tensions" one would expect to derive from the intersections of such vastly different cultures. The pragmatic requirements of surviving on the fringes of their respective empires forced the Spanish and Russians, and by association the Native Californians and Native Alaskans, into a tempered co-existence remarkable for the diminished nature of the tension that did exist. It is this relationship that might serve to characterize the nascent global village as it existed on the frontier of Alta California in the late 18th and early 19th centuries.

Wallerstein (1989) provides a convenient model with which to examine the commercial ambitions that brought Russia to the shores of Alta California, and to contrast those ambitions with the colonial policies of Spain. Briefly, Wallerstein argues that in an expanding, capitalistic, global economic system, previously isolated economic "zones" are incorporated into the world order when a significant production process of that zone becomes integral to the commodity chains of the larger global economy. Integration is achieved when those who control the factors of production (the capitalists) begin to vary output of the production process in response to changes in market conditions. To enable the production process to respond to such changes in the world economy, four conditions must be present:

> 1) The capitalistic enterprise must be large enough to control production - specifically, the merchant, or capitalist, must be able to control the "petty producers."
>
> 2) Labor must be coercible. Expansion and contraction of production is controlled through acquisition and discard of the factors of production -- particularly labor, which is the easiest factor to control.
>
> 3) The political institutions that possess the relevant power and authority must "permit, abet, and subsidize such responses" on the part of the capitalist to the changing market conditions.

> 4) Those same political institutions must provide an "infrastructure of reasonable security and appropriate currency arrangements" (Wallerstein 1989:129-131).

The development and organization of the Russian-American Company, the vehicle through which Russia attempted to gain a foothold in Alta California, is considered below in some detail. However, use of Wallerstein's model in this discussion requires a brief overview of the Company's structure and methods of operation.

At the turn of the 19^{th} century, the demand for furs in the markets of Canton, while somewhat volatile (Gibson 1992:201), prompted Czar Paul I to oversee and ultimately approve the merger of several formerly independent, competitive Russian hunting companies into a single commercial enterprise. Named the Russian-American Company, the enterprise enjoyed government patronage and monopolistic control over the acquisition of furs on lands under Russian dominion. Russian nobles and officers from the Russian Navy comprised the company's administration, native Alaskan hunters comprised its pool of skilled labor, and emigrants from the serf class of Siberia, along with the offspring of Russian and native marriages (creoles) formed the Company's staff.

Consolidation of the competitive hunting companies under a single monopolistic administration provided control of the acquisition and distribution of furs - the production process - and the control of the "petty producers," stipulated by Wallerstein as the first requirement for incorporation into the world economy. The second requirement was perhaps the most easily met. Initially through coercion, and later through a form of unredeemable indenture, the Company compelled the subjugated native Alutiit and Aleut fur hunters of the Alaskan "zone" to ply their skills on the Company's behalf. Driven by the lust for profit, the Russians brutally controlled the acquisition of this labor, an approach that was later partially mitigated by a politically inspired desire to convert the natives to the ways of Christianity (Okun 1951; Tikhmenev 1978 [1888]; Wheeler 1965).

Fulfillment of the third and fourth of Wallerstein's conditions may be found in the relationship that evolved between the Company and the successive rulers who occupied the Russian throne. Because of anti-monopolistic leanings in Russia, the authority of the government was at first only begrudgingly granted to the Company. However, once the Company's value as an instrument of imperial expansion was recognized, it was accorded wholehearted government support. Such support included, among other things, state-level negotiations with the Company's trading partners, and the right to issue company currency as a means of employee compensation (Dmytryshyn 1989; Tikhmenev 1978 [1888]). The level of government support was further reflected in the fact that the Czar and his family were shareholders of the Company.

All of the elements necessary for incorporation of the Alaskan "zone" into the larger global economy arose as a result of the market demand for the furs of many of the indigenous animals of the region. That demand was also one of the principal elements that prompted the expansion of the Company's operations into Alta California, a move that tied the sleepy backwater of Spain's northern frontier to the same global economy that had snared the denizens of the northern Pacific.

In sharp contrast to the economic and political organization of the Russian commercial enterprise stand the conservative and virtually self-defeating commercial strictures imposed by the Spanish crown on its colonies through the *Recopilación de las reyes de los reinos de Indias* - the Laws of the Indies. Spain's economic posture, manifest in the portion of the *Recopilación* dealing with commerce and trade, was an attempt to protect its Iberian industries. The Laws intentionally discouraged colonial manufacturing, and limited colonial trading to that conducted by Spanish merchants, trading in Spanish goods, and carried in Spanish ships. Commercial trading vessels from foreign ports were forbidden access to all but a few key ports in the Spanish New World. The colonies were essentially viewed as closed markets for Spanish mercantile and agricultural products, and the source of cotton, dyes, hides, sugar, cacao, tobacco, and precious metals for the mother country (Bancroft 1886a: 217; Haring 1963: 293; Weber 1992:175).

Prohibition of commerce, and therefore contact, with representatives of foreign powers was also an attempt by Spain to protect her largely indefensible colonial empire from the incursions of her enemies (Golovnin 1979:155-156[1818]). These isolationist policies theoretically served to both insulate the colonies from interaction with the larger global economy and to discourage the English, French, Russian, and, later, the Americans from exploring the vast territory claimed by the Spanish crown.

> . . . if such foreigners be admitted and allowed to mix, troubles might develop in the Kingdom [of Spain], intelligence and discovery of its forces and secrets, or perversion and corruption of its faith, religion and in good ways of living" (Solórzano y Pereyra 1776:np).

In comparison to Russia's active cultivation of and participation in the global economy, Spain pointedly avoided such incorporation of her far-flung colonies. Although some of the factors of production necessary for incorporation were readily available -- notably a coercible labor force and an abundance of raw materials -- neither the capital, the will, nor an adequate political support structure existed to manipulate them. The economic policies of Spain's global colonial system ultimately resulted in chronic shortages of all mercantile and agricultural products in the colonies, a situation that inevitably led to widespread abuses of the trading strictures imposed in the *Recopilación* (Haring 1963:301).

In the early 19th century, the endemic shortage of material goods in Alta California, coupled with the region's agricultural bounty and its wealth of fur-bearing sea mammals, attracted the trading interests of the Russians in the north. Their arrival in Alta California ultimately drew the long-neglected Spanish colony into a tenuous, and illegal, commercial relationship with the Russians. To the extent that the trade supported the Russian commercial enterprise, it served to unwittingly incorporate an unwilling Alta California into the larger global economy, and circumvented the imperial Spanish government's attempts to isolate and protect its northernmost colonial region. Because of the benefits derived by all parties, the trade also serendipitously served to create a relationship between the differing cultures that significantly lessened the "great tension" that would otherwise have ensued on that frontier.

Colony Ross as a Multi-Ethnic Enterprise

The Russian incursion into Alta California was prompted both by the availability of fur-bearing sea mammals and a desire to establish an agricultural outpost that would supply the larders of the colonies in the North Pacific (Essig et al. 1991:5; Khlebnikov 1976:106 [1861]; Tikhmenev 1978:132 [1888]). In a fashion typical of the Company's organization and administration, the Ross colony comprised a pluralistic community of ethnic Russians, Creoles, native Alaskans, Hawaiians, Kashaya Pomo, Southern Pomo, and Coast Miwok. Although the presence of this diverse body in the Ross colony is well documented (Federova 1973:203; Istomin 1992:9-12; Lightfoot et al. 1991:3), the specific economic contribution of its component members is not as well understood. Given the economic incentives that underlay the establishment of the colony, it is doubtful that any individuals were included who could not, in some way, contribute to its operation. However, the nature of those contributions has largely been lost to the historical record.

The Alaskan fur hunter provided the fundamental skilled labor upon which the initial success of the colony, and indeed the very survival of the Company, depended. Because of the fur hunters' importance in the success of the Russian adventure in America, their role in the operation of the Company is well documented (Ogden 1991:36; Gibson 1976:32-34; Golovnin 1979:153-154 [1818]; Khlebnikov 1976:35 [1871]). Less understood, however, are the roles the other non-Russian members played in the colony's various economic enterprises. Likewise, the contributions of the native Alaskans to the colony following the decimation of the sea otter population in California, and the consequent dissolution of the hunters' primary economic role, are poorly understood.

Although many aspects of the Company's administration and operation are recorded in admirable detail (see in particular Khlebnikov 1835, 1976 [1861], 1990 [1820-1824]), much of the information about the specific operation of the Ross colony was either not recorded or has been lost. The contributions of the colony's polyethnic community, the technology and methodology employed in its economic industries, and the nature of the social interaction between its odd mix of ethnicities is not discussed in the available historical documents. What is available, however, are portions of the material record created as by-products of the mundane, day-to-day activities that occurred over the span of the colony's 30-year existence. It is in this, the archaeological record, that the nature of the participation of those disenfranchised from the extant written record perhaps may be reflected. This record may also provide some indication of how the colony's various economic enterprises were organized, the level of technological sophistication employed therein, and the degree to which the pluralistic community was utilized in the undertakings.

Research Framework

Little is known about the location or spatial arrangement of the industrial complex that the Russians created at Ross. Likewise, the technological approaches utilized in the colony's various industrial enterprises, and any vernacular modifications to contemporary or traditional manufacturing technologies, have been lost to the historic record. Visitors to the outpost frequently recorded their observations about the colony but, like so much of recorded history, the mundane was overlooked and much that was accepted as commonplace was not noted.

Fortunately, a great deal of archaeological research has been conducted in modern-day Fort Ross State Historic Park and the surrounding environs. Very little of it has focused on the area of Sandy Cove, however -- known historically as the location of the Ross colony's industrial complex. Excavations conducted by Lightfoot *et al*. (1989, 1991) and surveys and testing conducted by Allan (1990, 1996) comprise the only substantive research focused directly on the cove. Consequently, in comparison to the rich archaeological data base that has been developed regarding the fort and its surroundings, very little is known about the buildings that stood within the confines of the cove during the era of its occupation by the Russian-American Company.

The locations of those buildings, their configuration and style of construction, the nature of the activities that occurred within them, and the ethnic composition of those who worked in them, are but a few examples of the data that are not found in the extant historical record. Locating and analyzing the subsurface archaeological remains of the buildings and structures that once stood in the cove, and recovering the surviving material culture associated with them, may provide pertinent information on these subjects.

Questions regarding the operation of the colony's industrial complex, the nature and quality of its products, and the reasons for the success of some industries and the failure of others may be addressed through recovery of the surviving archaeological record.

Research undertaken as part of this dissertation was designed to explore these questions, and to develop archaeological data sufficient to begin answering them. The research program specifically focused on trying to determine how the Russian America Company's industrial infrastructure was established, how it was supported, and how the Company operated it in such a remote frontier environment.

Cultural Property Types

Both prehistoric and historic cultural materials are located within the area of Fort Ross State Historic Park, although the possibility of encountering the former in archaeological investigations of Sandy Cove was considered remote. Subsurface investigation of the cove's archaeological record was limited in scope and focused on the exposure of cultural material from the historic period, which typically lies above any cultural material surviving from either the prehistoric or protohistoric periods, although it was understood that some mixing of the deposits might have occurred. Although some prehistoric cultural material was recovered during earlier excavations associated with the Fort Ross Beach Site (Lightfoot and Schiff 1989, Lightfoot et al. 1997: 24-39), those deposits were sporadic. Nevertheless, in preparation for such an encounter, specific research questions were developed and are included below in the discussion of prehistoric research issues.

Historical cultural material expected to be encountered in the investigation of the Ross colony's industrial area comprised, among other things, building foundations, structural remains, privies, disposal sites, slag heaps, broken or lost iron fasteners, nails, copper tacks, treenails, discarded and lost tools, barrel staves, and concentrations of industrial waste products (slag, clinker, iron fragments, miscellaneous industrial wasters, etc.). The recovery of cultural material of a more personal nature (buttons, jewelry, coins, charms, etc.) that could reflect both personal preferences and cultural affiliation was also anticipated.

Research Issues: Prehistoric

Prior to the arrival of the Russian-American Company, the Southwestern Pomo, speakers of one of seven distinct and mutually unintelligible languages that 19^{th}-century anthropologists grouped together under the rubric Pomo, occupied the Fort Ross region. Of the seven language groups, only that designated as "Southwestern Pomo" had a name, referring to themselves as "Kashaya."

The Kashaya occupied approximately 48 km of today's northwest Sonoma County coast. Their territory encompassed Stewart's Point to the north and Duncan's Point to the south and extended inland approximately 24 km (McLendon and Oswalt 1978:278). This area comprises the coast-redwood and valley-foothill ecozones, which provided a diverse and abundant subsistence base (Bean and Theodoratus 1978:289).

Acorns, buckeye nuts, berries, grass seeds, roots and bulbs supplemented a diet of deer, elk, antelope, rabbits, squirrels, and birds that were hunted in the valley-foothill ecozone. Exploitation of the coastal littoral produced fish, shellfish, snails, kelp, and sea lions. Local rivers and streams produced mussels and fish. At the time of European contact, the larger mammalian food sources were hunted with bow and arrow, spears, and clubs. Small animals and birds were captured with snares, basket traps, bola, and nets. Fish were caught in traps or weirs, and with lines (Bean and Theodoratus 1978:290).

The Kashaya house form in the coast-redwood region was constructed of slabs of redwood bark, leaned together to form a conical-shaped structure 10-15 ft. in diameter and 6-8 ft. in height. Each sheltered a single family. The Kashaya Pomo occupying the Russian River area tended to favor slightly more elaborate thatched structures fabricated from a framework of poles bent and joined at the top. These structures were usually round, but sometimes rectangular, and sheltered several families (Kroeber 1976:241). Seasonal campsites on the coast were constructed of simple brush shelters, which sufficed in the more temperate summer months.

The Pomo excelled in two handcrafts that distinguished them from other native Californian groups: basketry and the manufacture of money. The baskets of the Pomo people, from flat plates to almost-perfect spheres, are considered to have been the finest made in California, if not the world (Bean and Theodoratus 1978:291; Kroeber 1976:244). The Pomo were also the principal purveyors of money in central California. Fine disc beads manufactured from clamshell, and long, cylindrical beads made from magnesite were specialties of the Pomo, who used the highly prized beads as currency throughout their trading region (Kroeber 1976:249).

The following questions were designed to address the possibility that Kashaya material culture of the latter period would be encountered, since the native Californians are known to have been an integral part of the Russian colony's operation:

- Can the recovered material culture be placed in a chronological context based on typological variation or chronometric dating techniques?
- Can the recovered cultural material be associated with what is known of the Kashaya lifeways?
- Do the recovered materials provide data useful in illustrating a continuation of the prehistoric or protohistoric Kashaya subsistence strategies?

Research Issues: Historic

Unlike the other native Californians, the Kashaya's first direct, sustained contact with Europeans was probably not with the Spanish, but with the Russians. Ivan Kuskov of the Russian-American Company purchased the property on which the Ross counter was constructed from the leaders of the Kashaya Pomo in 1811.[1] This arrangement offered the Kashaya protection from Spanish oppression and, with the relative freedom from forced acculturation offered by the Russians, served somewhat to insulate the

[1] Research suggests the purchase may have been made as early as 1810 by a fur hunter who had led Native Alaskan hunting parties to California on at least three previous occasions (Farris 1993 7-9).

Kashaya from the decimation that occurred with almost all other aboriginal cultures touched by Spanish missionization (McLendon and Oswalt 1978:277).[2] The Kashaya were, in fact, incorporated into the agricultural and economic activities of the colony. Identification of archaeological evidence suggesting their presence and involvement in the industrial complex situated in the cove is one of the principal goals of this archaeological investigation.

Examination of the archaeological remains of the Ross colony's industrial complex may provide data on the enterprises conducted there that are not available through the historic record. The nature of the manufacturing activities that occurred in the complex, the ethnic composition of its workforce, the nature and source of the raw materials used there, and the competence of its craftsmen are some of the research issues that will be addressed through locating, exposing, and analyzing the surviving archaeological record. Specific research questions have been developed to guide this analysis. Among these are the following:

- Will the archaeological record in any way reflect the interactions of the multiethnic workforce of Russian aristocrat, Russian peasant, native Alaskan, and native Californian that comprised the colony's labor force?
- Given the technologically unsophisticated environment typically found in a frontier outpost, what was the nature of the industrial activity that occurred in the cove and what were the skill levels necessary to make it successful?

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[2] Although their treatment under the Russian was different from what they would have endured from the Spanish, the Kashaya did not completely escape European oppression. Some historic accounts of their treatment suggest the Russians could be brutal in forcing local Indians to work, a belief shared today by contemporary Kashaya (Gibson 1969:211).

- Can the location and configuration of the Ross industrial facilities and the colony's shipyard be determined through examination of their sub-surface remains?
- Will the archaeological resources encountered provide any evidence of previously undocumented or poorly documented industrial or technological processes?
- Were modifications of 19th century shipbuilding techniques made in the construction of the vessels built at Ross as a result of the available technology? If so, are such modifications manifest in the extant shipyard remains?
- Can the archaeological evidence of the industrial facilities at Ross be used to develop data that may be used in a comparison with the design and construction of similar facilities in the Russian-American Company outposts at Sitka and Kodiak?

Implementation of Research

To obtain data sufficient to address such broad-based questions, a multi-phased archaeological survey and excavation strategy was developed. The research strategy comprised archival research, pedestrian and remote sensing surveys, and the use of test augers and controlled excavation units. As discussed below, the implementation of this approach unfolded in a methodical and reflexive manner. Data from the pedestrian survey, preliminary surface mapping, and magnetometer surveys were used to determine the location of test excavation units. In turn, the nature of the features and material culture recovered from the individual excavation units determined the necessity and location for the excavation of additional units as the project progressed, and the need for additional data, or data of a different type, developed.

In the field seasons of 1990, 1991, and 1992, three areas of Sandy Cove were surveyed with a magnetometer to locate anomalies indicative of the presence of subsurface cultural materials. Analysis of the signatures of such magnetic anomalies can, among other things, point to the presence of ferrous materials, such as iron fasteners, anchors, chain, cannon, etc. The presence of cultural materials that have been altered by high temperatures, such as fire-cracked rock, kilns, forges, etc., are also detectable through their anomalous magnetic signatures. Using a proton precession magnetometer, project staff surveyed the near-shore waters of the cove, the cove's beach, and the inland area of the cove, separated from the beach by the channel of Fort Ross Creek. No anomalies were identified in the near-shore waters of the Cove but several were observed on the beach and in the inland areas. As discussed below, these anomalies were examined along with others identified during remote sensing surveys conducted in 1997.

In the winters of 1995 and 1996, runoff from the heavy, wet seasonal storms caused the normally tranquil Fort Ross Creek to swell and alter its course across the beach of Sandy Cove. In 1995, the new course carried swiftly moving water along the base of the cove's access road, causing significant erosion to the embankment and exposing what appeared to be remnants of a stone foundation. The storms of 1996 exacerbated the erosion, exposing more of the foundation and carrying portions of it away. Numerous fragments of burned wood that appeared to be associated with the stone foundation were also exposed in the embankment. A glass bottle, tentatively dated to the early 19th century, was recovered in association with the alignment of stones. The location of the newly-exposed stone alignment was the same as that in which copper sheathing nails, undoubtedly associated with the Russian shipyard, frequently have been recovered after winter rains (Bill Walton and Dan Murley, pers. comm. 1991).

In July 1996, three preliminary test units were installed to locate the foundation that would have been parallel to that exposed in the eroding embankment. Remnants of hewn wooden beams that may be associated with such a foundation were uncovered in two of the three test units.

Following these exposures, a series 1 x 1 meter and 1 x 2 meter test units were opened immediately above the exposed stone and wood foundation in the eroding embankment. Test units were also opened at the location of some of the magnetic anomalies, and in other locations selected on the basis of data derived from ongoing excavations.

A magnetometer, configured for gradiometer surveying, was deployed for additional, more intensive remote sensing surveys and to relocate two significant anomalies discovered in the remote sensing surveys conducted in 1991 and 1992. A large-scale investigation was also conducted at the location of a large wood feature exposed on the beach in the winter of 1996.

The feature was briefly uncovered by fluvial erosion that resulted when the stream course of Fort Ross Creek was altered to redirect water flow away from the embankment that contains the stone and wood foundation. The erosion exposed a series of roughly hewn boards, arranged in the fashion of railroad ties, embedded in the clay substrate of the beach. Their location and configuration was strongly suggestive of the launching ways that would have been used in the Ross shipyard.

In order to provide both an historic context for the Russian American Company's industrial enterprise, and a framework within which its operation may be understood, a brief history of the Company and its expansion into Alta California is presented in Chapter 2. Because the focus of the research in Sandy Cove was directed at the Company's industrial operations, Chapter 3 provides an overview of typical 19th century industrial technology as it was practiced in Europe and the eastern United States during the period of the Russian American Company's operations in Alta California. In particular, the technology employed in tanneries, brickyards, iron foundries and forges, and shipyards is discussed in anticipation of encountering some evidence of these activities in the archaeological record as found in the Company's industrial complex.

The rationale for and a detailed discussion of the specific methodology used in the archaeological investigation of the Fort Ross industrial complex may be found in Chapter 4. Included in that discussion are descriptions of the individual test units excavated during the course of the project, the arrangement and nature of the artifacts recovered from them, and a description of the features that were exposed in several of the units.

Results of the excavations, and an interpretation of the data and features recovered from them are presented in Chapter 5. This interpretation incorporates aspects of the historic record discussed previously in Chapter 2 in an effort to integrate the project's findings into a coherent and, hopefully, enriched view of the activities that occurred in the industrial complex.

Finally, in Chapter 6 the data recovered through project excavations and the interpretations that have been developed from them are applied to the research questions that stem from the prehistoric and historic research issues presented above.

Chapter 2: Historical Background

Formation of the Russian-American Company

The Russian-American Company operated in the ocean waters of the northern Pacific during the seventy-year period from 1799 to 1867, but the roots of its history reach back nearly 800 years to the beginning of imperialist Russia's remarkable expansion across the 4000 miles of Siberia. The motivating force behind this eastward expansion was the insatiable demand for furs, the government revenues they would produce, and the possibility that Russia would gain a strong foothold in, if not control over, the Asiatic market (Okun 1951:10).

Through the *promylshenniki* (fur traders and hunters - literally "enterprisers"), the government collected an annual *yasak* (tribute tax) from the natives who had been brought under Russian domination, and an additional tax from the hunters themselves by selecting ten percent of the best furs returned from each expedition. The crown also reserved the right of first refusal in purchasing the remaining ninety percent of the pelts. By the 17th century, the amount of revenue generated from these sources was a very important factor in State income -- without it, Russia would have been a very poor country (Kerner 1948).

The discovery of sea otter in the northern Pacific Ocean in the early 18th century added a new and powerful emphasis to the relentless search for furs, and drew increasing numbers of hunters and merchants. The rich, thick pelt of the otter quickly proved to be far more valuable than the skins of the fox, beaver, and sable that had previously dominated the trade. As more and more hunters, Cossacks, serfs, and merchants moved eastward, agents of the crown followed them to collect the state's ten- percent tax, as well as the *yasak* from the natives. The administrative system they brought quickly created a bond between the outposts at the eastern frontier and the capital at St. Petersburg.

The exploration of these lands, and the charts and maps that were related to them, were kept from the rest of the world because of the immense wealth of furs that could be found there. Despite this effort at secrecy, the British Captains Cook and Vancouver, the French Captain La Pérouse, and several Spanish explorers made voyages of exploration into the northern Pacific. These intrusions into what the Russians perceived to be their territory created enough anxiety in the later 18th century that the Empress Catherine II ordered the Russian Navy into the area to assert Russian authority and enforce their claims there. War with Turkey, and later with Sweden, broke out before this could occur, so it fell to the commercial interests in the fur trade to establish and maintain Russian sovereignty over the lands in the northern Pacific (Okun 1951; Tikhmenev 1978[1861-63]).

The Cossacks, soldiers, and *promylshenniki* who pushed the Russian borders eastward were motivated primarily by furs. Pelts were obtained from the natives in trade and by hunting on the part of the *promylshenniki* themselves. In the latter approach, the brutal, uncontrolled collection of the furs left in its wake a decimated population of animals that forced the hunters to continually move eastward into new hunting grounds. By 1750, voyages to the North Pacific islands in the Aleutian and Kurile chains had returned tremendous wealth, both to the merchants involved and to the crown, but soon the islands closer to the continent's edge were bereft of fox, sable and fur seals, and what otter were left deserted for the safety of the more remote islands. Subsequent expeditions to the outlying islands required more men, larger ships and more time, making it too costly for all but a very few of the merchants to operate independently (Wheeler 1965, 1979).

The need for large amounts of capital to support these ventures brought about a new form of business arrangement - partnerships between four or five merchants that lasted for the length of a particular expedition. Hunting practices, however, remained the same. As the distances to the more abundant and increasingly more remote areas increased, so too did both the costs and the risks. Capital invested in both ships and men was tied up for the long period of the voyages, and greater distances increased the possibility of shipwreck, starvation, and scurvy. The *promylshenniki*'s cruel suppression of the natives encountered in the new lands was met with bitter resistance and bloody reprisal -- sometimes to the destruction of entire companies.

By 1770, due to over hunting in the waters near Siberia, the *promylshenniki* had moved eastward in search of sea otter. In the process, they discovered all of the Aleutian Islands, in addition to Kodiak, which lies south and a little east of the Alaskan Peninsula. During this decade, the merchants moved their base of operations from the Kamchatka Peninsula to Okhotsk, where it was both more convenient to build the larger vessels they now required, and less expensive to import supplies from European Russia (Wheeler 1965).

In 1773, a man arrived in Irkutsk from European Russia who was to affect both the fur trade and the course of Russia's eastward expansion profoundly. Grigorii

Ivanovich Shelikhov spent four years learning the business of fur trading in Irkutsk as an apprentice to the merchant Ivan Golikov (Tikhmenev 1978:12[1861-63]). Satisfied with his training, he moved to Okhotsk in 1777 and entered the fur trade on his own. Rather than compete with other merchants in the pursuit of the sea otter, he invested in several voyages to the islands closer to the continent that, although stripped of the more valuable animals, still had populations of fur seals. He correctly realized that by eliminating the risks and reducing the capital required of the longer voyages to the Aleutian Islands, he could turn a profit on large cargoes of the lower-valued fur seals (Wheeler 1965). His success in these ventures was such that by 1781 he was able to implement another business strategy that differed significantly from the traditions of the time.

Shelikhov understood that the traditional approach to capitalizing expeditions, in which partnerships were joined to raise capital, equipment, and men for specific voyages, was too costly, inefficient, and risky (Wheeler 1965). He also recognized that the predatory hunting methods used by the unsupervised expeditions, and the ruthless treatment of the natives in the island chains, would eventually destroy the industry. The additional threat of encroaching competition from the British, French, and Yankees served to further fuel his ambitions. To his former employer Golikov, Shelikhov proposed forming a permanent company to build and outfit ships for the hunting and trading of furs. The company would establish permanent trading posts on the American islands, as the outlying islands had come to be known, in order to establish Russian dominion in the area. These outposts would be the stations from which otter and other fur-bearing animals could be hunted. They would also serve as agricultural and scientific research stations, and as religious bases from which the gospel of Christianity could be preached to the natives. Shelikhov brought new definition to the concept of "shares" with his idea of a permanent company. No longer would the term refer to a portion of a particular voyage's cargo, but instead would represent an amount of ownership in a permanent company equal to the amount of capital contributed by each investor (Tikhmenev 1978[1861-63]; Wheeler 1979).

The Shelikhov-Golikov Company was officially organized in 1781. Its first undertaking was to build and provision three ships at Okhotsk, the *Three Saints*, *St. Simeon the God Receiver and Anna the Prophetess,* and the *St. Mikhail*. In August 1783, with Shelikhov and his family in the *Three Saints,* a small expedition set sail for Kad'iak Island (Kodiak) to establish a colonial headquarters for the new company (Crowell 1997). This location provided a convenient operating base from which the other islands could be colonized. It was far enough east to provide abundant sources of otter fur and was familiar enough to the Russian navigators that transit from the Russian mainland would not pose major difficulties.

In a surprisingly swift and brutal conquest, Shelikhov established a foothold on Kad'iak Island, and within three years, he had established outposts on nearby Afognak Island and the Kenai Peninsula (Black 1988:75). Prior to his return to Irkutsk in 1786, Shelikhov placed Konstantin Alekseevich Samoilov, the foreman in charge of the hunters, in the position of temporary manager of all the settlements on Kad'iak Island (Tikhmenev 1978:17[1861-63]). Samoilov was left with specific instructions about how the colony was to be administered -- instructions that encompassed everything from the direction each vessel was to sail in exploration, to how the natives were to be pacified and treated (Shelikhov 1786). After an arduous journey, Shelikhov arrived back in Irkutsk in the spring of 1787. There he hired Evstrat Ivanovich Delarov as permanent manager of the Kad'iak enterprises, a position Delarov held until July 1791. Delarov is credited with establishing the first permanent Russian settlement on mainland Alaska, at Kenai Inlet in 1789 (Tikhmenev 1978:24-25[1861-63]).

In order to consolidate the Company's position, and in an effort to recapture some of the capital invested in the young enterprise's ambitious undertakings, Shelikhov and Golikov petitioned the Empress Catherine II for governmental support in 1787. The boldness of their commercial venture is reflected in the substance of this letter to Catherine. In it, the entrepreneurs described in some detail their activities and accomplishments before launching into their request, beginning with the hope that the Company be placed under the direction of the Governor-General of Irkutsk. This was an attempt to avoid any interference from the authorities at Okhotsk or on the Kamchatka Peninsula. They also requested the right to correspond directly with the Empress, an apparent attempt to eliminate any future interference from a governor who might not be favorably disposed towards the Company. They requested 100 government men -- armorers, cannoneers, shipwrights, priests and deacons -- all to be transported and maintained by the Company. They next sought the right to trade with Japan, China, the Philippines, Korea, the Spanish and the Americans (Eskimos and Indians). Two of their petitions were particularly brazen. The first was for a twenty-year loan of 200,000 rubles, requested because the Company's capital was locked in furs that were not salable at that time because of the suspension of trade at Kiakhta. The second requested the Empress:

> . . . to protect us and our property from those who would wish to profit by our discoveries, so that they would not cause violence and oppression to our business, and would not disrupt and destroy that which has already been and shall be organized by us (Shelikhov and Golikov 1788).

This last request was especially brash in view of Catherine's concerted efforts to do away with those special privileges that had traditionally been accorded the ruling class. Her belief in an anti-monopoly, free-trade economy was especially strong.

The petition was sent to the Empress by way of Governor-General Iakobi of Kamchatka. He recommended the requests be granted and passed the petition onto the Commission of Commerce in St. Petersburg. The Commission approved the request and added that an official commendation, sword, and medal be awarded to the Company's principals. With this, the petition was passed for final review onto the Permanent Council, which also approved it and sent it to the Empress in April 1788. During this period, Shelikhov and Golikov had been busy in the capital, lobbying for their cause. As Catherine's secretary, Aleksandr Khrapovitskii, put it, "It was noted how all took care of Shelikhov so that he could get the monopoly. He had bribed them all" (Khrapovitskii 1901).

Despite these efforts, Catherine responded to Shelikhov's proposals by denying all but one of his requests. The petition for manpower was denied because of the shortage of personnel in Siberia. The loan was denied, but no reason was offered. Catherine's anti-monopoly philosophy was cited as the reason for denial of the request for exclusive privileges. Catherine did agree to reward the entrepreneurs, and ordered that they each receive silver swords and gold medals inscribed with her picture.

It is possible that the entrepreneur's lobbying efforts in the capital may have been too fruitful. The effusive, laudatory tone of the various commissions' reports apparently aroused Catherine's suspicions, especially since none of the commissioners had personally inspected any of the claims the Company had set forth (Wheeler 1965).

Despite this setback, Shelikhov continued to send ships and supplies to the northern Pacific, strengthening his colonial outposts and founding new ones while simultaneously cultivating his political contacts at the Empress' court. His fortitude and perseverance in the face of this rejection would ultimately be rewarded.

With publication of the accounts of Cook's 1778 voyage to America, Catherine's apparent lack of interest in the eastern colonies changed. Her concern that the British, through the British East India Company, were trying to establish a claim to the fur territories in the northern Pacific prompted her to implement measures that had been proposed by her Board of Trade. These consisted of a statement made to the maritime powers that the American coast from 55°21' North latitude belonged to Russia. Included in this was a claim to the Aleutian, Kurile, and Fox Islands as well as all those islands situated near the mainland and Alaska. To reinforce this statement, the Navy was ordered to send a squadron from the Baltic to the northern Pacific. In conjunction with this, Governor Iakobi of Irkutsk sent a secret missive to Shelikhov's headquarters on Kad'iak, instructing the manager there to raise the Russian standard in all their territories to enforce the Russian claim to the land. He instructed that on all lands under their jurisdiction, iron plates be buried "with the image of a copper cross superimposed and the following words in copper letters: 'Land under Russian Domain.'" These were to be buried so that "not only were the native inhabitants not to see them, but they were also to be hidden from every one of our Russian workers so that, by keeping this secret, the inhabitants might be prevented from guessing that the tablets were placed there in the present time" (Iakobi 1787; Tikhmenev 1863).

Wars with Turkey and Sweden prevented the dispatch of the naval squadron, a fact that would ultimately work in Shelikhov's favor. To cement the Russian claim to the eastern territory, the crown began to consider forming a powerful, monopolistic organization, similar to the East India Company that would be able to resist the encroaching competition of foreign merchants and the efforts of foreign governments to gain a foothold.

In 1790, Shelikhov sent another letter to Catherine by way of Governor-General Pils, who had replaced Iakobi in 1789. This letter outlined the Company's plans for further exploration, for the establishment of permanent settlements on the Kurile Islands in order to attempt trade with Japan, Formosa and Macao, and explained plans to introduce agriculture and cattle breeding to the American colonies. Although no mention of a loan was made in this letter, permission was sought for the Company to purchase serfs, and for the right to bestow rank. Catherine did not respond to this letter.

Later in 1790, with the death of Mikhail Golikov, nephew of Ivan and a junior partner in the Shelikhov-Golikov Company, the company was reorganized. The new company was named the Northeastern-American Company and took in as partners several individual traders who were no longer competing. In 1790 and 1791, two temporary companies were also founded, the Baptist Company, which sailed for the Fox and Pribylov Islands, and the Unalaska Company, which sailed for the island of that name. Fearing that his rapidly expanding enterprise would falter without proper management, Shelikhov convinced Aleksandr Andreevich Baranov, a successful merchant of Kargopol, to become Chief Manager of the Company's colonies. In 1790, Baranov departed Okhotsk to assume his new position on Kad'iak Island. He arrived in July 1791 and replaced Delarov, who returned to Irkutsk with the furs obtained during his tenure as manager at Kad'iak (Tikhmenev 1978:25[1861-63]). Baranov was to guide the Company's colonial outposts for the next 28 years.

In April 1792 the Chinese re-opened their border at Kiakhta, after a seven-year closure sparked by grievances against the Russians. Its closure had interrupted trade and, while this had damaged the Northeastern-American Company, it destroyed virtually all of its competitors. Only the companies owned by Pavel Sergievich Lebedev-Lastochkin and the Kiselev brothers were still engaged in the fur trade by 1795 (Okun 1951:23). The competition between these companies was fierce, despite the fact that Shelikhov personally invested in a number of the Lebedev-Lastochkin voyages.

In 1793 Shelikhov wrote the Empress again, reporting on the company's success in building a shipyard at Resurrection Bay on Chugatsk Sound and argued that, in order for their agricultural projects in the colonies to be successful, they required agricultural and artisan serf families in the colonies. In December, Catherine ordered that 20 artisan and 10 agricultural serf families be granted to the Company from those in Siberian exile.

This was in direct conflict with two of her earlier decrees, which reserved only to the *dvoriane* (nobility) the right to own serfs (Dmytryshyn 1989; Tikhmenev 1978[1861-63]).

In their petition of 1787 to the Empress, Shelikhov and Golikov had stressed the need for a complement of priests in the colonies, to be sent and maintained at Company expense. The Company's purpose in this was more to impress Catherine than to propagate the faith. In 1793, the Metropolitan of Novgorod was ordered by the Empress to begin formulating plans for the establishment of a mission in America. Shelikhov interpreted this to mean that his request for a monopoly would soon be granted, and he began reorganizing his companies once more.

The Baptist Company and the Unalaska Company were incorporated into a new, permanent company called the North-American Company, which was organized under the same rules as the Northeastern-American Company (Tikhmenev 1978:26[1861-63]). These two companies worked together closely, exchanging ships and crews. By 1794, the Northeastern-American Company had received the privilege of paying customs duties by promissory note in European Russia, instead of by cash in Kamchatka. As further evidence of her growing support, while the Company's ships were employed elsewhere, the Empress permitted the use of government vessels to transport the members, provisions, and equipment of the Kurile Company to the Kurile Islands where they were to establish a permanent colony (Tikhmenev 1978 [1861-63]; Wheeler 1979).

In July 1795, Grigorii Ivanovich Shelikhov died, leaving his widow, Natal'ia Alkseeva, to assume control of the Northeastern, North-American, and Kurile Companies. Competitors immediately began challenging the preeminent position the

Shelikhov companies held in the fur trade but Shelikhova, with the help of her son-in-law, Nikolai Petrovich Rezanov, fought off the challenges.

In 1797 merchants at Irkutsk, under the direction of Prokop'evich Myl'nikov, formed a joint stock company similar to that of the Shelikhov-Golikov companies with the intention of driving Shelikhova out of business. The charter granted by the government to the Irkutsk Trading Company of Myl'nikov and Associates specified that the operations of this new company could in no way harm those of the Shelikhova companies. By the time this charter was granted, the Irkutsk Trading Company, having been undercapitalized at the beginning, was facing bankruptcy. The principals approached Golikov, who had withdrawn from active participation in the renamed American-North, Northeastern, Kurile Company, with a proposal for merger. Under threat of having Golikov withdraw his capital from the firm, Shelikhova agreed to the merger and in July 1797, the United American Company was founded (Wheeler 1979; Tikhmenev 1978[1861-63]).

The company's charter was forwarded to St. Petersburg for approval. There, it was amended with an instruction to the Irkutsk governor to insure that all merchants in the north Pacific fur trade be included in the company. This proviso obviated any discussion about a monopoly. Despite this, much opposition to the charter was voiced by some of the merchants, Lebedev-Lastochkin and the Kiselev brothers in particular.

The Commerce College, 18th century precursor to the Ministry of Commerce (Riasanovsky 1984:231), was overseeing the charter's development and eventually realized the futility in trying to achieve a unanimous agreement among all the parties.

The collegiate administration consequently ordered preparation of a final report about the charter. This report stipulated that the charter must allow other merchants to join in the future, that those who chose not to join only be allowed to trade until their present voyages ended, and that stockholders be prohibited from individually competing in areas where the company was operating. It also required that all loyal subjects, not just those participating in the trade, would be able to purchase the company's stock. The report further suggested that the company be named the Russian-American Company.

On July 8, 1799, Czar Paul I, who had assumed the throne on Catherine's death in 1796, signed the charter granting imperial protection and patronage to the first Russian joint stock company. For a period of twenty years, this company was granted the exclusive rights to:

> . . . profit from all hunting and other ventures presently established along the coast of America to the northeast . . . from . . . 55° to the Bering Strait and beyond and likewise on the Aleutian, Kurile, and other islands located in the North Pacific Ocean. . . . to make new discoveries, not only above 55° northern latitude but to the south as well . . . [to] utilize, without any claims from others, everything above and below ground in places it has already discovered or may in the future discover. . . . [to] build settlements and fortified places wherever necessary for the safety of its employees. . . . [to] sail to all nearby nations and enter into trade with all adjacent powers . . . . (Dmytryshyn et al. 1989:18-19).

Though he missed living to see it by a scant four years, Shelikhov's dream of obtaining a monopoly of the Russian fur trade had finally been realized.

Expansion into California

The Russian-American Company's expansion into the northern region of Alta California was motivated by several factors. The abundance of sea otters in the Pacific's southerly waters was a powerful attraction, especially in view of their declining numbers in the hunting grounds of the north Pacific. The monarchy's imperialist interest in extending Russia's influence to the west coast of North America was also a factor, as were the opportunities for conducting trade with the Spanish colonists who resided there. More important, however, was the prospect of establishing a local agricultural base from which the Russian colonies in the north Pacific could be supplied. The Company's northeastern outposts on the Kamchatka Peninsula were supplied overland from mother Russia. A reliable extension of that supply line to the northwestern colonies was impossible, however, both from a cost standpoint and because the supplies received at Kamchatka were barely enough to sustain those colonies (Gibson 1976:60-68; Okun 1951:119). To address the perpetual shortages of supplies and provisions in the northwest colonies, and at New Arkhangel in particular, Baranov established trading relationships with several Yankee captains who bartered goods, supplies, and armaments in return for the Company's furs. While these exchanges alleviated the colonies' shortages, they also served to encourage a "foreign" presence on the northwest coast, a situation looked upon unfavorably by the Company administration. ". . .we are now taking measures to drive these gentlemen off, but the innumerable sounds and straits in our waters prevent us from being very efficient in that" (Rezanov 1806a:218).

Consequently, a sustainable and dependable "granary" was required for the colonies, and efforts to develop such a resource in Kad'iak, Kenai Bay, Yakutat, and on Sitkha had all met with failure (Tikhmenev 1978:83 [1861-63]). Establishment of the

Company's southernmost colony of Ross in Alta California was another attempt to address this need.

Prior to establishing Ross, however, the Company, in conjunction with the imperial government, authorized the first round-the-world voyage of supply for the colonies in the north Pacific. The expedition departed St. Petersburg's harbor of Kronshtadt in July 1803 under the command of Nikolai Petrovich Rezanov, Shelikhov's son-in-law, Chamberlain of the Imperial Court, and Plenipotentiary in America. On his mission, Rezanov represented both the crown and the company in his numerous diplomatic and commercial dealings. He was charged with the responsibility of determining the needs of the colonies and was empowered to provide for them to the extent it was possible (Tikhmenev 1978:72 [1861-63]). After a failed attempt to establish commercial and diplomatic relations with Japan, and after sending the supply ships ahead to Sitkha, Rezanov traveled through the Company outposts at Kamchatka, Unalaska Island, the Pribylov Islands, and Kad'iak Island, finally arriving in New Arkhangel in August 1805.

By February 1806 the colonies' supplies were low and the wreck of a supply ship from Kad'iak, plus the delayed arrival of a second supply ship from Okhotsk, had created a desperate state of affairs at New Arkhangel. Scurvy was beginning to take its toll and starvation was imminent. On February 15, 1806, in a secret letter to the Board of Directors, Rezanov wrote:

> We gave wheat only to the sick and at that only three pounds per man, the rest lived on iukola [dried fish]. . . . There is very little iukola left and it is not a pleasant prospect to be entirely without food. . . .We gathered snails and clams during full moon, when they are edible, at other times we have shot eagles and

> crows; in fact we have been eating everything we could get. . . . To get supplies for this country I must sail to California. I hope to leave about the 20th of this month. The equinox threatens storms but staying here means famine. Finding myself in such a critical situation, I prefer to face storms rather than hunger (Rezanov 1806b: 176).

With a scurvy-ridden crew, Rezanov sailed for Alta California on February 25, 1806, arriving at San Francisco Bay on March 24 "ashen and half-dead" (Rezanov 1806c: 113).

Despite Spain's strictures on colonial foreign trade, Rezanov convinced the Spanish provincial governor to allow the missions at San Francisco and Monterey to supply him with desperately needed grain, tallow, butter, salt, and other foodstuffs in exchange for the trade goods carried in the Russian ship. After six weeks, during which he unsuccessfully attempted to establish a permanent trading relationship with the Spanish, Rezanov returned to New Arkhangel, where he found that scurvy had decimated a large portion of the populations of Sitkha and Kad'iak. With the provisions obtained in California, health improved for the colonists and Rezanov began preparations to return to St. Petersburg. Prior to departing, he dispatched a detailed report on California to the Russian Minister of Commerce, Nikolai P. Rumiantsev. In this report, Rezanov first suggested his plan to gain a foothold in California, with the long-term intention of establishing Russian dominion over the entire territory (Okun 1951):

> ...if [we] could obtain permission to develop trade with California, the Company could build granaries in conjunction with it, . . .we could also develop agriculture and livestock production. . . . With no great expense from the Treasury this entire region could be brought permanently under Russian control. . . . A part of the territory is still unoccupied, which could be so beneficial and vital to us" (Rezanov 1806c: 130).

Rezanov sailed from New Arkhangel in July 1806, but before departing he left precise instructions for Baranov regarding the conditions he had observed in the colonies. One of these instructions addressed Rezanov's interest in establishing a presence in California:

> . . . the most reliable source [of foodstuffs] are the coasts of New Albion to which I shall endeavor to attract the attention of the Government to the end that through the establishment of our settlements there, by sending Jesuits and missions, we could utilize the innumerable Indian aborigines for the establishment of agriculture which, because of the fertility of the land, will prove as successful as in California (Rezanov 1806d).

In 1809, the Company's directors requested and received permission from the emperor to establish a settlement on the coast of Alta California. Anticipating this authorization, the directors had previously instructed Baranov to dispatch an advance party to investigate suitable locations for establishing such a settlement. Following this directive, in 1808 Baranov ordered his assistant, Ivan Aleksandrovich Kuskov, to sail to New Albion, as Francis Drake had named the coast, to survey for prospective sites. This voyage met with mixed success. One of the two dispatched vessels was lost while exploring the mouth of the Columbia River, but Kuskov returned with a large quantity of sea otter furs. A suitable location for a settlement had been identified but a shortage of building materials and discontent among the crew forced Kuskov to return to New Arkhangel before he could formally establish the new outpost (Tikhmenev 1978:133 [1861-63]). Kuskov attempted to return to the coast of New Albion again in 1810, but was attacked near the Queen Charlotte Islands by well-armed natives and had to return to New Arkhangel. In 1812, however, Kuskov succeeded in founding a settlement in

California on a small inlet some 20 miles north of present-day Bodega Bay, then called Count Rumiantzoff Bay by the Russians. Although the inlet would quickly prove unsuitable as a landing for ships and cargo, the location offered “vast forests to furnish building materials, fertile soil and large pastures for the raising of cattle, besides a good supply of most delicious water and water-power. All these advantages were wanting in Count Rumiantzoff Bay" (Khlebnikoff 1835:128).

Kuskov formalized the Company's ownership of the location by exchanging gifts, Russian medals, and assurances of friendship and protection with the local native California leaders in return for title to the area he needed for the settlement (Khlebnikov 1976; Tikhmenev 1978 [1861-63]). After obtaining title, Kuskov returned to New Arkhangel to plan the settlement's construction with Baranov. In November 1811, he returned to the site in New Albion with 25 Russian laborers and commenced building the fort:

> In the beginning of 1812, Kuskoff [sic] had got out all his timber and in June finished the village Ross, lat 38° 33' N., long 123° 15' W (Greenwich), at the foot of some mountains, but still at a height of more than 120 feet above the sea-level. A fort was constructed 49 fathoms long by 42 wide. In quick succession a Governor's residence, barracks, storehouses, etc. were erected (Khlebnikoff 1835:128).

It was the officially-stated intention of the company to introduce farming at the Ross colony, in addition to developing cattle breeding and raising hemp, and:

> with its mills and other economies . . . [to] provide, in time, not only a sufficient quantity of our own supplies for the subsistence of the people and the rigging of ships, but to send a large surplus of them to Kamchatka and Okhotsk, and thereby save these regions from the expensive importation of the many required things from Russian and Siberia" (Council of the Russian-American Company 1814).

The Spanish colonial government opposed the Russian presence, insisting on numerous occasions that the fort be dismantled and the Russians leave the coast of New Albion (Bancroft 1886b: 303; Gibson 1976:181; Tikhmenev 1978:137-138 [1861-63]). Refuting Spain's claim to the coast of New Albion, the Russians cited testimony of the native Californians as to their independence of the Spanish and the consequent legitimacy of their sale of the site to the Company. They also argued that Spanish authority had never actually extended further north than the port of San Francisco, and that the Spanish territorial claims in general were questionable. As evidence, the Company pointed to the occupation of the mouth of the Columbia River by the United States government, and the determination that the “southern [sic] border of [France's] Louisiana was declared to lie at the 42nd parallel, that is, a full five degrees south of the straits of Juan de Fuca” -- territory to which the Spanish had previously laid claim (Khlebnikov 1976:130).

Despite the official demands that the Russians leave the coast of New Albion, unofficial trade between the Spanish at San Francisco and Monterey and the Russians at Ross occurred regularly. "The missionaries and other inhabitants became acquainted with their new neighbors and supplied them with livestock, grain, and poultry, in defiance of their own government's prohibition of this very thing" (Khlebnikov 1976:114).

To preclude further Russian expansion, two new missions were established in lands north of San Francisco Bay. In 1817 Alta California's Governor Don Pablo Vicente de Sola founded Mission San Rafael, and in 1823 Sola’s successor, Don Luis Argüello, established Mission San Francisco de Solano in the Sonoma Valley:

> The missionaries needed various materials and tools to construct these buildings, and had constant intercourse with Fort Ross. The travel distance in good weather

> was only one day, so there were uninterrupted relations. Kuskov received livestock from them as well as various supplies which were transported from the missions in baidarkas" (Khlebnikov 1976:115).

Despite this trade relationship and the continual efforts of Kuskov to obtain permission to hunt in Spanish waters, the Russians were never officially allowed to hunt sea otter in San Francisco Bay, but continued their poaching anyway. Elsewhere on the coast, their rapacious hunting strategies soon decimated the populations of fur-bearing sea mammals and by 1817, the sea otter had become virtually extinct in the waters from Ross to San Francisco Bay, and the fur seal from the Farallon Islands (Tikhmenev 1978 [1861-63]).

The agricultural effort at the Ross colony did not fare well, either. The Aleuts, Russian creoles, and native Californians apparently did not willingly embrace the agricultural lifestyle. In a report to the Board of Directors, dated November 6, 1818, Ludwig von Hagemeister, who had replaced Baranov as Chief Manager on February 1, 1818 (Pierce 1986), discussed this situation:

> Concerning the agriculture (in the colony of Ross), I am obliged to destroy the agreeable idea which, judging by the quality of the climate has been formed and cosoled [sic] in the distance. The first inconquerable impediment at the present time consists in not having sufficient hands. The workmen sent from Sitkha, excluding a few, are the <u>worst</u> of the <u>worst</u>, not accustomed in Russia to work or labor, . . . the Aleutians for this kind of work are also unqualified, and constant and long examples are necessary to incline them to these new occupations . . . (Zavalishin 1866:np).

The location of the compound itself added to the difficulties. The moist sea air, frequent fogs, and intermittent sunshine typical of California's north coast retarded the growth of grain. What grew near the shore was covered with rust. Gophers, mice, and squirrels were formidable pests and the tillable soil adjacent to the fort was quickly exhausted. "Besides [this], there was another reason for agricultural failure in the stupidity and ignorance of both Russians and Aleuts, who were perhaps the worst farmers in the world" (Bancroft 1886b: 638). The vast and fertile lands in the interior could have been used to produce bountiful crops, and in fact, three small farms were eventually built between Ross and Bodega, but a large Russian incursion into the rich interior would have further jeopardized the already-tenuous relations with their Spanish neighbors. Penned in by the new Spanish missions in the north, the presidio and mission at San Francisco to the south, and the ocean to the west, the Russians were forced to capitalize on the agricultural and pastoral lands that were then available to them. Although never achieving the success originally envisioned, the agricultural effort eventually began to yield an adequate return. By 1826, the agricultural and pastoral industries were producing enough grain, fruits, vegetables, cattle, and sheep to supply some of the needs of the colonies in the north Pacific (Bancroft 1886b: 638; Tikhmenev 1978:224 [1861-63]). In addition, a small industrial complex at the colony became the source of bricks, iron products, leather goods, wooden barrels, pine resin, and a variety of other products that not only served the needs of the far flung colonial outposts of the Company, but also provided goods that were highly desired by the Spanish and could be traded to Alta California for additional supplies of food. The modest success of the Ross agricultural effort and the variety of products produced in its industrial complex all added to the economic viability of the enterprise as its primary function, the procurement of furs, began to decline.

In an attempt to develop an enterprise to replace that of hunting fur-bearing sea mammals, Baranov suggested the colony establish a shipyard and begin capitalizing on the proximity of the abundant forests that surrounded the fort (Khlebnikov 1976). Kuskov took the recommendation to heart and in 1816 he established the first shipyard on the west coast of what would later become the continental United States. Over the next eleven years, a polyethnic labor force comprising Russians, native Alaskans, Hawaiians, and native Californians built at least seven sailing vessels for use by the Company or sale to the missions. Like the agricultural effort, however, this enterprise met with only limited success and was abandoned in 1827.

The Industrial Enterprise at Colony Ross

As mentioned above, very little is known about the location of the industrial complex that the Russians created at Ross, its spatial arrangement, or the technological approaches employed in the colony's various industrial enterprises. With the outpost being situated on the fringes of the colonial frontier, it is likely that some modifications to contemporary or traditional manufacturing technologies were necessary, but these adaptations have been lost to the historic record. Visitors to the outpost frequently recorded their observations about the colony but much of what was recorded focused on the construction and arrangement of the stockade, and the defensive capabilities of the colony. Like so much of recorded history, the mundane was overlooked and much that was accepted as commonplace was not noted.

In 1822, for example, Father Mariano Payeras, last Franciscan prelate of the Spanish missions in California (Cutter 1995:2), visited the Ross colony. In writing of the visit, Payeras noted in some detail the compound's configuration and described many of its architectural details. The industrial area, however, was accorded only a brief mention:

> . . . in a deep ravine to the southeast [of the stockade] there is a creek of little water, which gathered together serves them for making lumber; nearby is the arsenal, and a large workshop where they fashion and square their lumber for the vessels that they build here and launch into the sea. . . . On the arroyo's bank and at the foot of the wall, they have a forge and a sweathouse, in two houses also of wood . . . (Payeras 1995 [1822]:332)

In describing his visit to the colony in 1828, the Frenchman Duhaut-Cilly simply stated that the buildings of the compound were made of wood, and gave scant attention to their configuration or location. No mention was made of any structures or facilities in the cove except for a "landing place to the boats belonging to the colony [sic]" (Duhaut-Cilly 1834:325).

On his voyage around the world, the English surveyor Sir Edward Belcher visited the Ross colony in 1839. Although his description of the colony is much more detailed than Duhaut-Cilly's, it too merely mentions the presence of an industrial complex in the cove. " . . . in a deep ravine which partly forms the bay, are three large tiled buildings, containing forges, carpenter's shops, and storehouses for boats and fishing craft" (Belcher 1979:77).

Tikhmenev made only brief mention of the industrial complex at the Ross colony in his history of the Russian American Company:

> The landing was located in a small bay south of the fort. At the landing were built a dockyard (where in 1818 and 1819 Kuskov built the brigantine *Rumiantsov* and the brig *Buldakov*) and a large shed for storing baidaras and building ships in bad weather. The smithy was a short distance away (Tikhmenev 1978:134[1861-63]).

Bancroft gives a slightly more detailed representation of the industrial complex in his description of the Russian enterprise in California:

> Down at the foot of the cliff on the beach, at the mouth of the southern barranca was a small wharf and boat-landing, a shed for the protection of the skin boats, another for storing lumber and for work connected with the building of vessels, a blacksmith's shop, and finally a bathhouse . . . (Bancroft 1886b:630).

The most informative description of the industrial complex is found in the inventory and bill of sale that itemized the capital improvements and equipment purchased by John Sutter when the Russians abandoned the Ross colony in 1841. The "Inventory of Structures and Chattels," drawn up for the sale listed the following structures in a category entitled "outside the fort":

> Outside the fort there are the following structures: A forge and blacksmith shop, built of planks, 5 1/3 sazhens[1] long by 3 2/3 arch. [arshins][2] wide, with 4 partitions. A tannery, 5 sazhens long by 3 wide. The public bath, 5 sazhens long by 2 ½ wide. A cooperage, 10 sazhens long by 5 wide. A shed for the baidarkas, on beams, 10 sazhens long by 5 wide (Dmytryshyn et al. 1989:432).

The inclusion of the boat shed in this list suggests these structures stood in the cove area. Substantiating this assumption is a separate category of the Inventory entitled "around the fort" which describes other buildings and structures know historically to have been on the bluff top, above the cove.

The 1879 History of Sonoma County confirms the presence in the cove of at least one of the buildings identified above:

[1] A sazhen is seven feet (Farris 1983:95).

[2] An arshin is equivalent to 28 inches. 3 2/3 arshins would be approximately 8.5 feet. The dimensions of this building would then be approximately 37 feet X 8.5 feet, suggesting "arch." does not refer to arshins, but may instead be an error in translation.

> To the south of the stockade, and in a deep gulch at the debouchure of a small stream into the ocean, there stood a very large building, probably eighty by a hundred feet in size. The rear half of it was used for the purposes of tanning leather. . . . The front half, or that fronting the ocean, was used as a work-shop for the construction of ships. Ways were constructed on a sand beach at this point leading into the deep water of the cove, and upon them were built a number of staunch sea-going vessels (Munro-Fraser 1880:367).

In addition to serving as the industrial nexus of the Ross colony, the cove was the location of California's first shipyard. There, between 1816 and 1827, the Russians built four ships for the Company's use, and one each for the Spanish missions at San Francisco and San Jose (Bancroft 1886; Bunje 1937; Golovnin 1819; Khlebnikov 1861; Lutke 1989[1818]; Tikhmenev 1888).

Perhaps because of the scale of its operation, the shipbuilding enterprise was more thoroughly documented by the colony's historians and visitors than was any other. Bancroft (1886b), Khlebnikov (1835; 1976; 1990, and Lutke 1989[1818]), in particular, devote a great deal of attention to the shipbuilding effort. As will be discussed in Chapter 3, the historic record sheds much light on the organization of the enterprise and its output, but little on its physical location or its actual operation.

Conclusion

Given the lack of specific information on the Ross industrial enterprise, it falls to the archaeological record to provide some insight into the spatial arrangement, technological sophistication, and social organization of the colony's industrial complex. Although substantially different in nature from the refuse and detritus of residential spaces that typically comprise the archaeological record, the waste products and by-products of industry are equally capable of reflecting the broad cultural developments of society (Hudson 1979:4). The study of such material has, in fact, evolved into a specialized sub field of archaeology known as Industrial Archaeology.

In addition to providing a glimpse of how the industrial efforts of the Ross colony were conducted, perhaps the cultural material created through the industrial processes employed there, and left behind as refuse, may also illuminate the ties that linked the multi-ethnic frontier outpost to the larger economies that comprised the first global village.

Chapter 3: Industrial Technology in the 19th Century

In order to understand how the remnant cultural material that comprises the archaeological record might reflect either the spatial arrangement of the Ross colony's industrial enterprise, the technological approaches that may have been employed there, or the social interactions and relationships of its workers, some appreciation of typical 19th century production methodology is necessary. By examining the accepted contemporary manufacturing approaches used in the industries attempted at Ross, a comparative baseline can be established against which variations in those techniques, prompted by adaptations to the frontier environment, may become evident. This chapter presents an overview of 19th century manufacturing processes that were typically employed in Europe and the United States in the industries conducted in the Ross industrial complex. Included are discussions of what is known from the historic record about how those processes were employed by the craftsmen and workers in the Russian colony.

The four principal industrial enterprises of the Ross colony -- leather tanning, brick making, iron working, and shipbuilding -- were well suited to the frontier environment of the 19th century Russian outpost. The necessary raw materials for the industries were relatively easy to obtain, the manufacturing techniques employed in each enterprise did not require much capital equipment, and production, although in some cases labor-intensive, was accomplished with a relatively stable, inexpensive work force -- although sporadic labor shortages were a frequent problem (Okun 1951:142). The industries themselves were conservative in nature (DAH 1976:127; Davis 1897:529; Prynne 1973), and had the technological impacts of the Industrial Revolution even been available to the colony, they would have evinced little change in the manufacturing approaches used in the tiny factory perched on the ragged edge of Russia's colonial frontier. This conservatism was particularly true for the shipbuilding industry. Given the enormous quantity of capital invested in a ship, and its indispensable role in binding the far-flung outposts of a colonial empire together, changes in design, materials, workmanship, and operational methods occurred very slowly from the 16^{th} to the mid-19^{th} centuries.

Although visitors to the colony made passing references in their writing to the industrial activities of the Ross enterprise, they provided little in the way of detailed information. In the absence of primary information regarding the specific manufacturing techniques and approaches employed in the Ross colony's industrial enterprise, the conservatism found in these industries provides an opportunity to examine how the colony's craftsmen may have accomplished their work. Although not pertaining directly to the Ross colony, there is a substantial body of information describing the 18^{th} and 19^{th} century manufacturing techniques employed in each of the industries that were prosecuted at the Ross colony. These descriptions may serve as an analog through which the specific approaches to manufacturing in the Ross enterprise might be observed. They may also provide an opportunity to compare and contrast how these approaches were adapted to meet the special requirements of conducting such an enterprise on the frontier and, perhaps most importantly, may provide some insight into the archaeological record as it exists in the remains of the Ross industrial complex.

Leather Tanning

In the 19th century, the unprecedented technological innovations that defined the Industrial Revolution greatly affected the practices, costs, and production levels of the tanning industries of both Europe and the United States. The invention of new machinery, the improvement of existing equipment, and the application of scientific research methods into the physical and chemical reactions of the tanning process led to many new developments in the transformation of animal skins into leather (see, for example Davis 1897; de Fontenelle 1852; Schultz 1876). Despite the many economies realized with the introduction of mechanization to the process, the fundamental principles of tanning hides and skins remained unaltered. The same sequence of basic treatments and procedures that had been used for centuries were still employed, although the burden of their execution was greatly alleviated with the substitution of machinery for physical labor (see Austin 1922; Bennett 1909; Davis 1897; Flemming 1910; de Fontenelle 1852; Schultz 1876).

> Conducted originally in the most simple and primitive manner, the expenditure both of time and labor is now materially reduced by new processes and modes of treatment, which owe their beginning to various improvements which commenced in the year 1803 in Massachusetts (de Fontenelle 1852:22).

Although the small tanning operation at the Ross colony would not benefit from either the mechanical or chemical improvements in the tanning process that were occurring in Europe and the United States, the raw materials and traditional procedures and equipment employed there produced an excellent quality of leather -- both during the Russian tenure and during the ranching period that followed their departure (Bancroft 1886b:639; Munro-Fraser 1880:366). This was due in large part to the conservative nature of the industry in the 19th century. Although mechanical advances in industrialized Europe and America alleviated some of the burden of the process, change occurred very slowly in the methodology of tanning (DAH 1976:127). "It does not seem strange, therefore that the theory and practice of . . . [the] preparation of hides and skins should have remained practically unchanged for centuries" (Davis 1897:153). This situation fostered the development of highly skilled tanners who produced high quality leather by using techniques perfected over generations.

Fundamentals of the Tanning Process

The discovery of a means to prevent putrefaction of skin and make it suitable for use as a protective covering, ornament, or defensive weapon by making it soft and flexible was probably one of the first great steps forward on the path of progress and civilization (Austin 1922:32). To accomplish this conversion, skins or hides[1] were tanned in a series of processes that changed the readily putrescible skin into an insoluble, durable material that possessed both strength and pliability (Bennett 1909:3). The sequence of these processes served to clean the hide and prepare it to accept the chemical transformation wrought by the tanning process. To understand how this transformation occurred, it is necessary to have a basic understanding of the composition of the raw material.

[1] The difference between a "skin" and a "hide" is a commercial distinction based on the type of leather for which they will be used, and the size and age of the animal from which they came. Hides are taken from large, adult animals (ox, bull, heifer, cow, horse, etc.) and are used for heavy leather and shoe soles. Skins are used for lighter, fancier leathers, and are taken from smaller animals, such as sheep, goats, seals, pigs, deer, etc. (Bennett 1909:27)

In general, two distinct layers comprise the typical hide, the thin outer layer, or epidermis, from which the hair of the animal evolves, and the corium, which lies beneath the epidermis and forms the bulk of the skin (Figure 3-1). The root bulbs of the individual hairs of the animal reside within the corium but are not a part of it, as they are surrounded by epidermally constructed sheaths that provide an opening for the hair through the epidermis. As discussed below, it is the penetration of the hair root in its sheath into the surrounding corium that makes its removal so difficult prior to tanning.

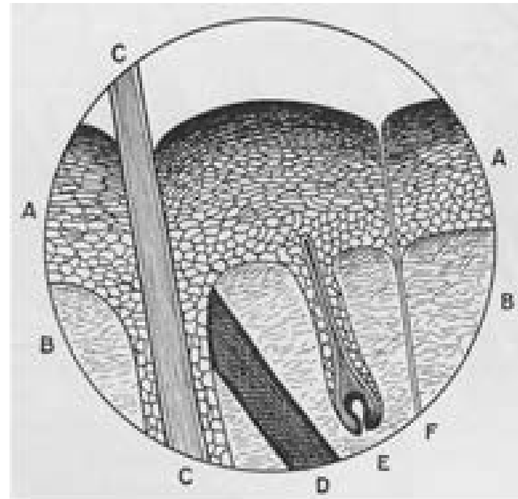

Figure 3-1: Structure of epidermis
A: epidermis; B: corium; C: hair with epidermal sheathD: arrector; E: development of new hair; F: duct of sudoriferous gland
(Bennett 1909:8)

The corium, which forms the greater part of the skin, is chiefly composed of fibrous, interlaced connective tissue, the minute fibrils of which are cemented together with a gelatinous substance. It is this gelatinous substance that combines with tannin in the tanning process to form the basic characteristics of leather (de Fontenelle 1852:143; Schultz 1876:xv). The connective tissue fibers of the corium are closely interwoven near the epidermis, forming a dense structure that surrounds the hair and its epidermal sheath. The connective tissue fibers are least compact in the central part of the corium, and increase in density again nearest the flesh, where the corium and flesh are joined by a loose network of adipose tissue, composed of hide fibers that embrace large quantities of fatty matter (Bennett 1909:6-9).

In the tanning process, the skins were subjected to the following basic processes: soaking, depilation, deliming, tanning, and drying.

Soaking

In order to prevent staining of the leather during the tanning process, the hide had to be free of all extraneous material, such as blood, dirt, dung, etc. In addition, subjecting the hides to prolonged periods of soaking helped to soften them, since in many cases they had been dried or salted as a preliminary cure to prevent putrefaction during transportation or storage. Because the washing/soaking period normally required a half-day or more, whenever possible tanneries were located near a source of fresh water, preferably a stream or creek wherein the friction of the running water could be used to loosen the dirt and other matter. Water temperature was an issue, since in high temperatures the gelatinous raw material within the hides became soluble and would be removed in the cleaning process. Consequently cold, fresh water was the preferred medium. The skins were periodically removed from the water, and in a process called "fulling" or "beating," were stretched, and scraped continuously until all animal matter subject to putrefaction was removed. After the skins were thoroughly washed and softened, they were returned to the water source to soak for several more hours (deFontenelle 1852; Bennett 1909).

Depilation

Because of the density of the corium surrounding the hair root bulbs, removal of the hair from the epidermis was not easily accomplished. Dehairing was achieved through either a process of "sweating" or "liming." In the former, the hides or skins were hung in a "sweat pit" in which temperature and humidity were controlled to induce a level of putrefaction in the corium sufficient to loosen the hair. When that state was achieved, the process was halted and the hair removed, as discussed below (Bennett 1909:58; Schultz 1876:31). Since this approach was not widely used in the early 19th century, and was definitely not used by the tanners of the Russian American Company (Khlebnikov 1976:128), it will not be considered further.

Liming is the oldest method known to dehair hides (de Fontenelle 1852: 162; Schultz 1876:31) and served the dual purpose of “plumping” or swelling the hides, a side effect that split the skin’s fibers into fine fibrils that accepted tannin more readily. Lime is a common and cheap material, one easily obtained from natural limestone, or from marble, chalk, and seashells by calcination in a properly constructed lime kiln (Davis 1897:86). The product of calcining is calcium oxide, or quicklime, - a white, amorphous, infusible solid with a tremendous affinity for water (Bennett 1909:59). When mixed with small quantities of water, quicklime swells, evolves a great deal of heat, and crumbles into a dry powder. This process, known as “slaking,” creates calcium hydrate, which was mixed with large quantities of water to form “milk of lime,” the substance used to depilate the hair of the hides and skins (Bennett 1909:59; Schultz 1876:32).

The first step in “unhairing” the hides or skins was to immerse them in a bath of milk of lime for a period of from 3 to 18 months. Specifically constructed lime vats were used for this purpose. Typically, the vats were sunk into the ground and were made of either masonry or wood, and were approximately 5 feet square and 5 feet deep (deFontenelle 1852:162; Davis 1897:91). The action of the lime over this period dissolved the hair bulbs buried in the skin’s corium, but did not damage either the hair itself or the gelatinous material surrounding the hide’s fiber. Absorption of the milk of lime swelled the corium tissue, causing the hides to "plump," making soft and flaccid hides firm and elastic. As mentioned, liming also separated the finer tissue fibrils, making them more receptive to the tannin in which they were next immersed. Liming also transformed the fatty, oily components of the hide into soluble calcium soaps that were readily removed in the rinsing process (Bennett 1909:60; Davis 1897:87; Schultz 1876:32).

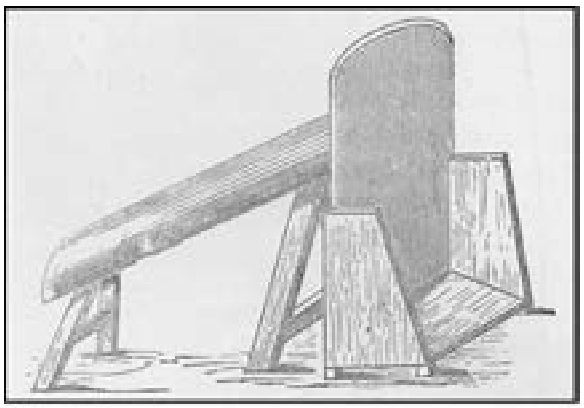

Figure 3-2: Beam
(Davis 1897:12)

After removal from the lime bath, the hides were "unhaired" on a convex, wood board, usually about 5 feet in length, called a "beam" (Figure 3-2). The beam was supported at both ends and angled to the ground at approximately 45°. After removal from the lime bath, a hide was draped over the beam and the "unhairer" or "flesher" began removing the hair. While standing behind the upper end of the beam, the workman scraped the loosened hair from the hide with the "unhairing knife" – a dull-sided, double-handled blade with a convex curvature that matched that of the beam (Figure 3-3). By scraping the hide down the length of the beam with the knife, the worker removed the hair, and any remaining flesh and fatty material. One by-product of "plumping" the hides in the lime bath was to swell the flesh still clinging to the hide, making it easier to remove in this process. By using a combination of the dull unhairing knife, and sharper fleshing knives, the "flesher"

Figure 3-3 Unhairing knife
(Bennett 1909:67)

removed all traces of hair, fatty tissue, and flesh on the hide. The process required a great deal of strength to work-off the hair, and a great deal of skill, so the hide was not cut, bruised, or damaged in the process. To compound the difficulty, the hide had to be frequently immersed in fresh water to protect it from the carbonation of the remaining lime when that residue was exposed to atmospheric carbon dioxide (Bennett 1909; Davis 1897; deFontenelle 1852; Schultz 1876).

Despite the effectiveness of the lime in softening the hair roots for removal during the "unhairing" process, its (generally) ready availability, and its relatively inexpensive cost, lime was considered a very objectionable material for use in depilation (de Fontenelle 1852:162). Not only was its use in the lime vats labor-intensive, requiring that the hides frequently be turned and shuffled within their vats but, more importantly, it was extremely difficult to rinse all traces of the lime from the hides prior to their tanning.

Deliming

Following dehairing, all lime residues had to be removed prior to introducing the hides to the tanning vats. When put through the tanning process, hides still containing lime tended to produce hard, brittle, and discolored leather (Bennett 1909:92; Davis 1897:153). Two steps used to remove the residual lime were "puering" (or "bating") and "drenching."

Puering consisted in treating the dehaired, rinsed hides with a warm, fermented infusion of dog dung[2] for several hours. The fermentation of the dung produced several weak, organic acids which, together with the ammoniacal salts present in the manure,

[2] "In common with the excrements of other carnivorous animals, that of the dog contains an acid which . . . has the property of 'cutting' the grease and fat adhering to fresh skins . . . first quality dog pure is valued

Footnote continued on next page

combined with the lime, forming soluble lime salts that were removed from the skins by subsequent washing and further working on the beam. Bating is similar in principle to puering, but the dung of pigeons or hens was used to make the infusion, which was applied cold and allowed to penetrate over a period of several days. Bating was a much more moderate treatment and was used on harness and belting leather, and leather intended for use in shoe or boot uppers. For sole and heavy leather, a heavier weight and greater firmness was required, so neither puering nor bating was applied. Instead, the lime was neutralized in a bath of weak acid, or sugar, or molasses, and then the hide was moved into the tanning vats (Bennett 1909:92; Davis 1897:154).

Drenching usually followed the puering or bating process. It consisted of steeping the hides in a fermented infusion of bran and hot water, which aided in cleaning the skins and completed the neutralization of the lime (Bennett 1909:92).

Tanning

The actual conversion of the hides or skins into leather occurred in the tanning vats. These receptacles were usually sunk in the ground and were either pits lined with masonry, or were cylindrical, open, ironbound oak vats, lined with pitch (deFontenelle 1852:204). In them, tannin (or tannic acid) dissolved in water or other aqueous solutions, - referred to as the "tanning liquor" - was allowed to penetrate to the corium fibers of the hides, where the tannin would bind with the gelatinous substance that surrounds the corium's minute fibrils. Over a period of several months, the gradual combination of the

above all other dung for the reason that the acid it contains is just powerful enough to produce these results without injuring the delicate fiber of the skin." (Davis 1897:163).

tannin and gelatinous matter converted the hide or skin into the insoluble, imputrescible, permanent, but pliable material known as leather.

When the hides were introduced to the tanning liquor, the conversion first occurred in the exterior portion of the hide. To facilitate complete penetration of the tanning liquor into the hide's interior, the hides were moved through a series of vats, each containing progressively stronger solutions of the tanning liquor, the strongest of which were gradually able to penetrate into the interior portion of the corium. Regulation of the strength of the liquor in the sequential tanning vats was a factor in determining the type of leather that would be produced. Hides moved through rapidly increasing concentrations of liquor would produce rough or harsh leathers, while hides moved through a more numerous series of weaker solutions would produce smoother leathers, but take longer to achieve the conversion.

The nature of the tannin source was also a factor in determining the type of leather that would be produced. Highly astringent tannins raised the grain of the leather if the liquor were too strong. In weaker solutions, the astringent tannin penetrated the hide quickly, but not uniformly. Less astringent tannins were used to make solutions that increased in strength from one vat to the next. Their penetration into the hide was much more even than the highly astringent tannin, but progressed at a slower rate. Typically, combinations of tannin materials were used in the different vats to address the advantages and shortcomings of each type.

Tannin

Tannins are a group of organic compounds that can be extracted by water from a number of vegetable materials (Bennett 1909:113). Davis (1897:29) lists more than thirty plant species with tannin levels that are suitable for use in leather production. However, in his exhaustive study of the many 19th century variations employed in converting animal skins into leather, de Fontenelles states:

> Skins may be converted into leather more or less perfectly, by the action of any of the vegetable substances which contain tannin; but the small quantity of it existing in most of them, and the costliness and rarity of those of which it is a principal constituent, together with the injurious effects upon the leather which often attend their use, have restricted the substitution of other substances for oak-bark, which tanners have employed from the earliest times, and which, when ground, seems to present the tannin to the skins exactly in the proportion and under the circumstances best calculated to effect their conversion into superior leather (de Fontenelles 1852:95).

The proportion of tannin within oak bark varies with the part of the tree from which the bark is taken, and the local and geographical situation of the tree (Graves 1911:14). The oak tan bark (*Quercus densiflora*) of Mendocino and Sonoma Counties was widely known as possibly the finest in the world for tanning purposes (Bancroft 1890:91; Bauer 1948:25; Davis 1897:35; Graves 1911:7).

Harvesting began when the tree's sap began to run in mid-May, and continued through mid-August. The bark was considered ripe when it had formed three distinct layers, the rough outer "ross," a central "meat," and an inner "fiber" (Bauer 1948:27; Graves 1911:14). Tannin content of the bark is highest when the bark has thus divided, with the tannin concentrated in the meat and fiber (Schultz 1876:142).

To free the tannin, the bark was broken up so the tannin-cells could be dissolved by water (Davis 1897:64). Numerous patents for various types of bark mills were issued in the 19th century (Schultz 1876:46), the earliest being awarded in 1826 (Davis 1897:63). Prior to the invention of the bark mill, bark was crushed between stones in mills powered by wind, horses, water, or steam (deFontenelle 1852:113). Once the bark was reduced to fragments and its cellular structure compromised, it was ready to be used in the tanning vats.

As mentioned, the tanning process required moving the skins through a series of vats, each of which contained progressively stronger concentrations of tannin. Typically, the bottom of the first vat was lined with previously used bark that had already given up some, if not most, of its tannin ("spent bark"). Moistened, fresh bark was then laid down, on top of which the first layer of hides was placed, followed by another layer of moistened fresh bark. Alternating layers of bark and hides continued until the vat was full. Once in place, the last layer was covered with a thicker stratum of bark (the "hatting") that was firmly pressed down and covered with boards. Water sufficient to saturate each hide was then added carefully so that none of the bark in the intervening layers was dislodged. The hides remained in the first vat for a period of at least three months, after which they were re-stacked into a second vat.

As the infusion of water descended through the alternating layers of bark in the first vat, it obtained increasingly higher concentrations of tannin. With the pressure of the superincumbent hide and bark layers and that of the water column, the highly concentrated liquor that reached the bottom layers of hides tended to impregnate them with tannin more rapidly than the hides above. Consequently, it was necessary to rotate the hides as they were moved from one vat to the next, so that those that had been at the top of the first vat were laid down in the bottom of the second. As the hides had already been partially tanned in the first vat, a stronger liquor was required in the second to insure penetration of the tannin into the interior portion of the skin. This was obtained by using thicker deposits of bark in the intervening layers, and by increasing the ratio of the bark's meat and fiber portions to its ross. Hides remained in the second vat, with its stronger liquor, for at least four months, after which they were transferred to a third vat.

There, the alternating arrangement of bark and hide was repeated with even thicker strata of bark, and higher percentages of meat and fiber. The hides remained in the liquor of the third vat for at least five months, after which they were normally judged to be completely tanned (Davis 1897:180-184; deFontenelle 1852:209-213; Schultz 1876:86-89).

Drying

Once taken from the tanning vats, excess moisture in the hides was removed through a process of carefully controlled evaporation. If allowed to dry too slowly, the hides tended to mould, if dried too quickly, they became hard and brittle (deFontenelle 1852:219). In order to prevent either of these from happening, the hides were stretched and hung in drying rooms that allowed the passage of fresh air but protected the hides from direct exposure to the sun.

While in the drying room, the skins were beaten frequently with a wood mallet to impart firmness. When nearly dry, the hides were scoured with water and the residue of spent tan that still clung to them, stretched out on a clean surface, then beaten and trod upon until the irregularities and protuberances in their surface disappeared[3]. When smooth, the skins were allowed to partially dry, whereupon they were again beaten, this time with an iron mallet to compress their tissue and render them smooth, compact, and

[3] In industrialized Europe, this process was achieved by putting the hides through a rolling machine, the design of which varied greatly from one tannery to another.

impervious to moisture (deFontenelle 1852:220-221). When completely dry, the hides - now fully transformed into leather - were lightly oiled, then stacked for shipment to market (Bauer 1948:39).

Although many of these processes were accomplished with the aid of machinery in industrialized Europe and the United States, in the frontier environment of the Ross colony the tannery was largely operated without benefit of such mechanization. Contemporary descriptions of the industry, limited as they are, suggest the tannery functioned in much the same manner as described above. In the absence of mechanized assistance, the process of producing leather thus became a very labor intensive, time intensive – and therefore expensive – industry.

The Tannery at Ross

Skins of every description were prepared in the Ross tannery, the first in California[4] (Bauer 1948:2; Hittell 1897:175). Contemporary reports of the spatial arrangement of the industrial complex are scarce, but mention is made that the tanning facility was located in a very large building at the mouth of the creek, " . . . the rear half of it was used for tanning leather" (Munro-Fraser 1880:366). As will be discussed below, accounts of the building's size vary, ranging from 100 feet by 80 feet (Munro-Fraser 1880:366) to 37 feet by 21 feet (Dmytryshyn et al. 1989:432).

Andrei Chechul'ka, an Aleut from Kad'iak, learned the art of tanning from the Russians, and in 1820 was the chief tanner for the Ross colony. He was skilled in

[4] The Russian tannery was established in 1814. The Spanish had not at that time made any attempt to utilize the local tanbark or the hides from their cattle to produce leather (Bauer 1948:2).

producing leather shoe soles from cattle hides, rawhide for the shoes uppers, and suede from deer, elk, and goat skins that was used in the production of workers' undergarments. During its period of operation, the tannery was quite prolific, producing enough shoe and boot soles that over 230 were shipped to Sitka in the three-year period 1827-29. Twenty "uppers" of fine grain leather were also shipped during that period, and a quantity of both the uppers and soles were traded with the Spanish in Yerba Buena (Bauer 1948:2).

> The extract produced here from real oak bark is excellent for tanning. Lime is produced from shells, shoe soles are made of cow hide, Russian leather from deer, black leather from young sea lions, and suede from deer. . . . The promyshlenniks use it [suede] to make their hats and trousers. (Khlebnikov 1990:59; 1976:128).

Chechul'ka was also the colony's sole cooper, and an apprentice metalsmith who worked occasionally as a coppersmith and a blacksmith (Khlebnikov 1990:64). In 1822 Khlebnikov listed Chechul'ka as the cooper who produced the barrels for the construction of the ship *Buldakov,* and identified a worker named Tuteg as the colony's tanner.

As mentioned, the lime necessary in the preparatory stages of leather production was likely obtained from calcining marine shell, since there were no limestone deposits in the immediate vicinity of the colony.

> . . . lime can be obtained from shellfish. Hopefully someone will discover limestone deposits if an attempt is made to do so. There is an abundance of it near by in the missions of San Francisco de Solano and San Rafael (Khlebnikov 1976:128).

Tanbark oak for use in the tannery was plentiful and easily obtained. "Chestnut [sic] oak is abundant in the redwood forests of Sonoma. The bark is rich in tannin, the trees are stripped and large quantities are shipped for tanning purposes" (Munro-Fraser

1880:366). Once harvested, the bark was ground with a stamping machine, located on a hill north of the stockade and powered by the same windmill used to grind the colony's wheat.

> . . . situated on an eminence was a windmill, which was the motor for driving a single set of burrs, and also for a stamping machine used for grinding tanbark. . . . The stamp for crushing tanbark was made of solid iron and was about four inches square. It was hung upon a crank, upon the main shaft of the wind wheel, and the motion was thus given to it. It was a simple and very effective device, but required the constant attention of an operator to turn the bark and stir it up (Munro-Fraser 1880:366).

Major Ernest Rufus, who occupied the Ross property with his partner William Benitz in 1845 -- after the Russian's departure -- utilized the tannery and the materials the Russians left behind. He described the tannery as having six vats fabricated from heavy redwood slabs, each with a capacity of 50 barrels. "They [also] had all the usual appliances necessary to conduct a tannery, such as scrapers, mullers, etc. but these implements were large and rough in their make." Nevertheless, Rufus made quantities of leather in the Russian tannery sufficient to conduct a lively trade with customers in Monterey for some years (Munro-Fraser 1880:366).

19th Century Brick Making

The use of brick as a building material can be traced to the earliest days of recorded history. The Bible describes burnt brick being used in the construction of the Tower of Babel (Genesis 11:3) and the Greek historian Herodotus' account of the construction of Babylon describes the city's walls as being built of burnt bricks (Dobson 1893:2). From biblical times, through the classical Greek and Roman ages and through the Medieval period, brick was used as a fundamental building material (Davis 1895:1-12; Dobson 1893:2-5; Lloyd 1928:1-9).

Although specific processes of production differed from one place to another, the basic manufacturing methodology employed in producing bricks changed little over this vast period of time. By the mid-15th century, largely as a result of the commercial intercourse associated with the Hanseatic League, these techniques had become fairly standardized throughout Europe (Lynch 1994:6).

In the beginning of the 19th century, as the rippling impact of the Industrial Revolution spread, the demand for factory-worker housing created a massive demand for bricks, particularly in Great Britain. This demand led to the introduction of over 100 different types of brick making machines between 1830 and 1850 (Davis 1895:21; Lynch 1994:14). In the United States, Nathaniel Adams invented the first powered brick-making machine in 1840 (Davis 1895:20). Designed to harness the power of the steam engine, these machines were naturally viewed with some trepidation by the societies of hand brick makers. As use of the machines spread and threatened the livelihood of the brickmakers, they frequently were destroyed or sabotaged (Davis 1895:20; Lynch 1994:15). Despite this opposition, however, power-driven brick making machines were the norm by the 1860s (Lynch 1994:15) and bricks that were handmade became a niche product of skilled craftsmen.

Since the Russian-American Company's brick industry in general, and that of the Ross colony in particular, largely predated the invention of the power brick making machines, the 19th century methodology employed in making bricks by hand is what will be considered further.

Fundamentals of the Brickmaking Process

Five processes comprise the basic brick making operation: preparation of the brick earth, tempering, moulding, drying, and burning (Dobson 1893:12). The quality of the finished product is dependent on how carefully the brick maker accomplishes each of these steps.

Preparation of the Brick Earth: There are three classes of argillaceous earth that are considered suitable for use in making bricks: (1) pure clay, composed chiefly of alumina and silica – the constituents that give the material its plasticity and when combined are known as Kaolin; (2) loams, which are pure clays with considerable quantities of sand intermixed; and (3) marls, or calcareous clays, which are pure clays containing large quantities of carbonate of lime (Davis 1895:30; Dobson 1892:14; Lynch 1994:72). When mixed with water, pure clay will form a thick, plastic paste that is readily moulded into any shape. While drying, however, it shrinks and cracks and when fired, it warps and breaks apart. By adding non-hygroscopic, non-elastic materials to pure clay, such as sand or lime, this defect is largely remedied (Dobson 1892:14). The sand content in most loams is such that the material is too loose to make a proper brick, so lime is added to act as a binder. Lime, however, can also be a problem. "Carbonate of lime, diffused limestone, and lime pebbles, when they are present in brick clays, are a decided hindrance to the production of even a passable quality of building brick . . ." (Davis 1895:33). These forms of lime, when contained in a brick formed from marl or one formed from loam to which too much lime has been added, are converted into caustic lime in the kiln when the brick is fired. The brick then becomes useless, since the lime will swell when the brick is moistened causing the brick to burst and break to pieces (Davis 1895:32).

"As a general rule, a clay fit for the manufacture of a first-class quality of building-brick is not met with in nature" (Davis 1895:30). Rather, to make a clay suitable for use as a brick, a tempering process of several months' duration was necessary, typically followed by blending different types of clay to achieve one mass of acceptable qualities.

The season for "winning" clay from the earth was the fall, a time chosen so that the heap dug during that time could temper in the ensuing winter months. The clay was left exposed to the frosts of that season so that lumps in the clay could be reduced through exposure to the elements. In the early spring, the clay mass was turned repeatedly with spades, and trod upon by horses and men to expose any stones and pebbles, that were then removed by hand. If the clay were sufficiently free of lime and other impurities, this process was often enough to prepare the clay. In most cases, however, gravels, small pieces of limestone, and other contaminants present in the clay, usually required that the mass be ground or crushed. In the latter part of the 19th century, this was accomplished by passing the raw clay through cast iron rollers. In earlier times, grinding the clay, and blending it with different clays that possessed other desirable qualities, was accomplished with the pugmill (Davis 1895:88; Dobson 1892:26).

Tempering: The pugmill was a tub, usually wood but sometimes made of cast iron, with an upright revolving shaft passing through its center (Figure 3-4). Attached to the shaft and extending from it in four directions, were a series of blades, set so that none were placed directly under another. Attached at the bottom of the shaft, and set at the same level, were four broad, curved blades called “sweeps.” A horse was used to turn the shaft while clay was being introduced at the top of the mill along with a stream of water. As the shaft turned, the blades cut and kneaded the clay. The angle of the blades forced the clay toward the bottom of the mill until it reached the “sweeps,” which forced the mixed clay from the mill through a hole near the bottom of the tub. The same clay was run through the several times before it achieved the proper blend and plasticity for moulding (Davis 1895:105; Dobson 1892:27).

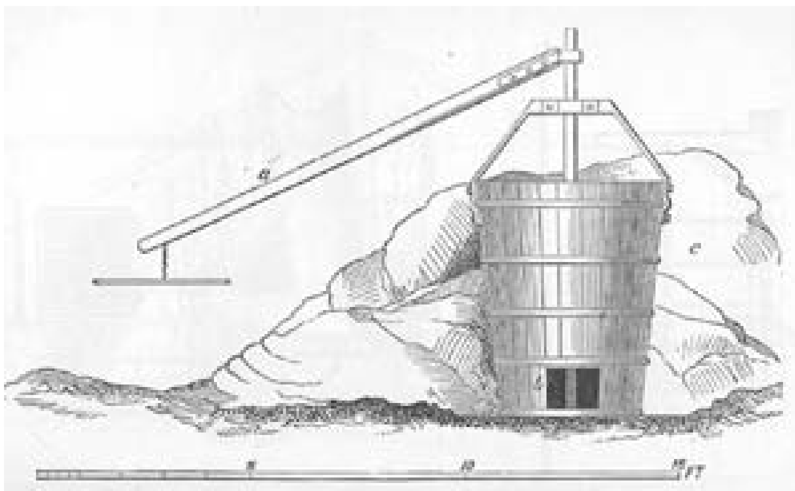

Figure 3-4: Pugmill
(Dobson 1893: 132)

Moulding: A brick mould was a four-sided frame, without top or bottom, in which the pugged clay was shaped into a brick. The mould’s interior dimensions were a function of the type of clay being moulded – brick earth with a higher percentage of pure clay will shrink more than that with a higher percentage of loam or marl, and so it required slightly larger moulds than the latter (Davis 1895:90). Bricks were usually moulded one at a time, but could also be gang-moulded in groups of four, five or six.

The moulder worked on a table to which was attached a wood cleat or "stock." The four-sided mould fit over the stock, which prevented it from moving while the brick was being formed (Figure 3-5). The mould itself could be fabricated from wood, but because of the wear to which it was subjected, it was often made from more durable materials. Cast iron was commonly used to make an entire mould, or was used to line the edges of a wood mould. Moulds were also made from brass cast in four pieces and riveted together. Regardless of the material type, the essential characteristics of a mould were that it not "spring" when the clay was thrust into it, that its edges not wear, which would gradually change the shape and size of the bricks being moulded, and that it not be too heavy, since it had to be carried with the brick to the drying floor (Davis 1895:90; Dobson 1893:30).

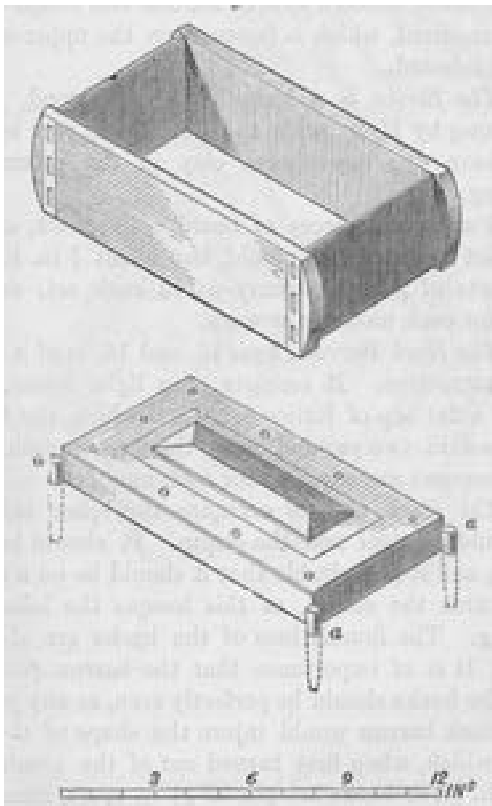
Figure 3-5 Brick mold and stockboard (Dobson 1893: 135)

To make a brick, the moulder took a portion of the tempered clay, sprinkled a handful of moulding sand over it, and formed it into a "waulk" or "clot." This he then forcefully dashed into the mould, which had been positioned over the stock. The moulder forced the clot into the corners of the mould with his thumbs, then smoothed the excess clay from the top of the mould with a flat wood stick called a "strike." The mould was then lifted from the table, and the brick was either turned out onto a flat, thin board called a "pallet," or taken away in the mould to dry (Lynch 1994:6).

In order to prevent the clay from adhering to it, the mould was dipped in either water or sand before it was placed over the strike. If water was used, the process was referred to as "slop moulding," and if sand was used, it was known as "pallet moulding." "These differences may, at first sight, appear trivial, but they affect the whole economy of a brickwork" (Dobson 1893:28).

Drying: In slop moulding, the freshly moulded bricks were wet and soft, and were kept in the mould while being carried from the moulding table to the drying floor. While the brick was being moved, a second mould was placed over the strike and another brick formed. If the yard were not laid out properly, and the size of the drying floor and its distance from the moulder not arranged efficiently, "the distance to which the bricks must be carried would be too great to allow the [carrier's] returning in time with the empty mould" (Dobson 1893:29). In pallet moulding, because the newly-moulded brick is not as wet, it was turned out from the mould onto a pallet and loaded onto a "hack-barrow" which, when full, was wheeled to the "hack-ground" where the bricks were stacked to dry in low walls called "hacks." "When placed on the barrow, it is of little consequence whether the bricks have to be wheeled 5 yards or 50" (Dobson 1893:29).

Slop-moulded bricks were sprinkled with sand while on the drying floor and left for a period of from one to five days to form a "leather" skin. Once firm enough to handle, the bricks were built into "hacks" and allowed to dry further before being moved into the kiln (Dobson 1893:36; Lynch 1994:6).

Burning: When subjected to a sufficiently high temperature, for a controlled period of time, a moulded brick (known as a "green" brick until fired) undergoes chemical changes that transform it into a harder, more durable product. The softness necessary for moulding is lost, the clay shrinks, the mechanical strength of the material is increased, becoming more durable and weather resistant, and the color of the clay changes (Lynch 1994:75).

Until the invention of the Hoffman continuous kiln in 1858, bricks were burned in one of two different types of structures -- intermittent kilns or clamps (Lynch 1994:78). The former is a dedicated chamber or structure in which the green bricks are "set" in such a way that the heat within the kiln passes around them uniformly. In some designs, the heat is generated from fires placed in arched furnaces under the floor of the kiln, in others, the heat is from fires maintained in holes built into the kiln's sidewalls. In either case, the kiln itself is a permanent structure that is used repeatedly to burn the green bricks produced in the yard.

A clamp, on the other hand, is a centuries-old approach to burning bricks in which the structure itself is built of the green bricks that are to be fired. These are set very close together in rows interspersed with layers of fuel. As discussed below, the peculiarity of the clamp is that the fuel necessary to vitrify the bricks is found in the bricks themselves (Dobson 1893:88; Handisyde 1974:52; Lynch 1994:78).

The Russian-American Company's brickyard at Kodiak apparently employed an intermittent kiln, since several archaeological investigations conducted there between 1979 and 1983 have exposed the sub-floor arches that contained the kiln's fire and are typical of that type of kiln (Dilliplane 1981:3; 1990:139). Although bricks were manufactured at other Company outposts, little is known about the nature of the processes they employed. At the Ross colony, it is more likely that bricks were burned in a clamp, rather than in an intermittent kiln, since no mention of a kiln structure is made in any of the historic references to the colony's spatial organization, nor in the detailed inventory of assets and capital equipment prepared when John Sutter bought the colony in 1841. Consequently, the use of a clamp to burn bricks will be the approach discussed further.

Although no two clamps were built alike (Dobson 1893:144; Lynch 1994:28), all shared certain fundamental characteristics of construction necessary to insure a successful burning. Clamps were built of dried green bricks set in walls or "necks," alongside an "upright" or center wall. Typically, the upright was about 60 bricks in length, and 30 bricks in height. Its base was six bricks wide at the bottom and tapered to a width of three bricks at the top, forming a triangular shape in cross section (Figure 3-6). Each neck was the same length and height as the upright, but was only three bricks in width and set so that its sides sloped inward along the line of the upright. Once the green bricks were properly set in their respective necks, a wall of burnt brick was put up around the clamp and over the top, then daubed over with mud to seal any possible drafts.

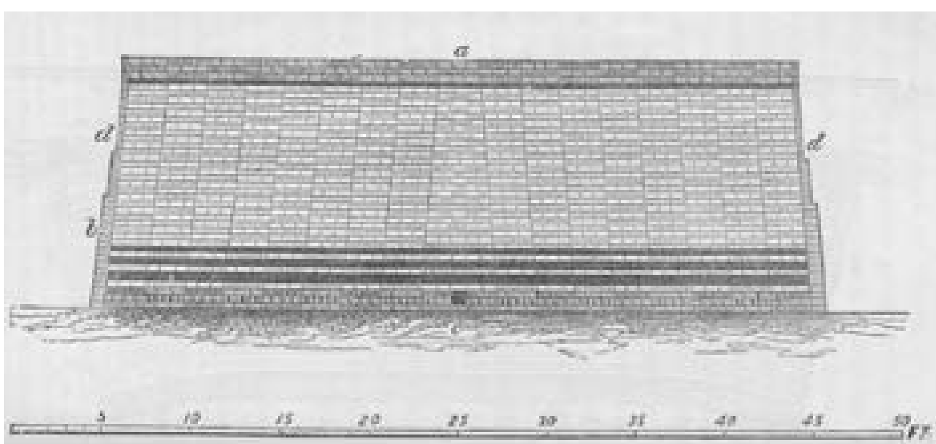

Figure 3-6 Typical structure of a clamp
(Dobson 1893: 146)

To light the clamp, a "live hole" was left along the center of the upright's length, and in several of the necks. The live holes were filled with wood and used to ignite the clamp. The essential characteristic of burning bricks in a clamp was the use of "breeze" in both the fabrication of each brick, and of the clamp as a whole.

Breeze [also known in parts of Great Britain as "Spanish" (Lloyd 1928:37)] was a mixture of cinders, small coal, and ashes similar to what would be recovered from a firebox. For bricks that were to be burnt in a clamp, breeze was thoroughly incorporated into the brick earth in the pugmill so that each brick became "a kind of fire ball, and contain[ed] in itself the fuel required for its vitrification" (Dobson 1893:19, 122). In addition, as the clamp was being set, breeze was distributed in layers along the courses of bricks.

When the clamp was fired, the fuel in the live holes was lit and allowed to burn until it ignited the breeze. Once the clamp was burning properly, the live holes were closed and the clamp was left to burn until all the breeze was consumed – a process that took from 3 to 6 weeks (Dobson 1893:144-149; Lynch 1994:29-32).

After the clamp cooled sufficiently, it was disassembled and the bricks sorted according to how they were affected by the burn. Those at the outside of the clamp tended to be underburnt and were called "burnovers," since they were used in construction of the next clamp and were reburnt. Bricks closest to the live holes tended to melt and run together, forming "clinkers," which were either discarded or used for purposes other than construction (Dobson 1893:153).

Brick Making at Ross

As with the tanning industry, little is found in the historic record that pertains specifically to the brick making operation at the Ross colony. The following is typical of the cryptic references to this particular enterprise: “The settlers made . . .bricks and leather, all of which were sent to Alaska” (Essig 1933:195) and “They [Ross] make a large amount of brick from a very fine clay, and frequently ship these to Sitka. The clay is found in various qualities” (Khlebnikov 1976:122). Several references are made to the brick making industries that operated elsewhere in Russian-America, but none shed any light on the particular manufacturing approaches they may have employed. As discussed below, it is apparent from the number of bricks produced annually at the various brickyards, including the one at Ross, that the industry was small and operated only sporadically.

Both Dobson (1893:31) and Davis (1895:92) suggest that a normal three-person work crew, comprising an assistant to prepare the “waulk,” a moulder, and an “off-bearer” to carry the moulded brick to the drying yard, could produce 10,000 to 14,000 green bricks per week. Although weather dependent, drying time could be as short as one week but three weeks was considered optimal and, as mentioned above, burning a clamp could take from three to six weeks. It is conceivable then that an entire production run of 14,000 bricks could be completed in as little as five weeks, or could take as long s two and a half months. Using those production rates, a brickyard in steady production and employing only a handful of workers could likely produce 70,000 to 140,000 finished bricks over the course of a year, depending on the weather.

The Russian-American Company operated brickyards on Kad'iak Island, Long Island, Unalaska, Atka, Nushagak, St. Michael, at Kenai Bay, and at Ross (Dilliplane1981:6; Tikhmenev 1978:416). Given the production levels possible in a fully operational yard, it appears from the output of the Company's brickyards that all but one were small industries that only operated sporadically. Some indication of the success and productivity of these yards may be found in the following:

> Ever year from three to six thousand bricks were made on Kad'iak Island, and their production might have been increased to fifteen thousand, if there had been more lime, which had to be burned from shells, and clay suitable for brickmaking . . . . Mr. Teben'kov remarks that "the seawater penetrating the clay probably makes the bricks porous. They crumble easily, and so are used only in extreme need (Tikhmenev 1978:87, 411).

By 1841 the principal brick making operation in the northern colonies was apparently located at Kenai Bay. In the brickyard near the Nikolaevsk Redoubt (Dilliplane 1990:138), "about 50,000 bricks of good quality are manufactured with the help of local natives…. Most of these are shipped to New Arkhangel, except for a small quantity which are shipped to Kad'iak" (Tikhmenev 1978:416). In comparison, 10,000 bricks were made on Kad'iak Island in the entire year of 1831 Dilliplane (1990:138). In referring to the quality of the bricks produced on Kad'iak, Khlebnikov states, "the clay is not very good, and bricks made of it are of much lower quality than the Ross ones" (Khlebnikov 1994b: 357).

Because of the high quality of the bricks produced there, the Ross yard was called upon to manufacture bricks for use in the north, but it too appears to have been a sporadic industry. In a directive dated June 7, 1824 Khlebnikov wrote:

> The Chief Manager has ordered the Ross Office to send finished bricks to Sitkha on the Kiakhta, if such bricks are available. The manager of the Ross Office has reported that they have no finished bricks at the moment but that he hopes to have a large number ready by the time the *Kiakhta* leaves. I therefore ask you to order that production should begin without delay and that, if possible, three to five thousand bricks should be made. In addition, please load several barrels of good clay onto the ship (Khlebnikov 1990:135).

At the time *Kiakhta* was still on the building slip, and Khlebnikov was exerting heavy pressure to have it completed and launched. Considering the effort underway to complete the ship, presumably only the minimum number of laborers necessary to manufacture the bricks was taken from the shipbuilding effort.

Khlebnikov, anxiously awaiting the arrival of the new ship in Monterey, wrote again five weeks later:

> Dear Mr. Schmidt,
> . . . If, God willing, the Kiakhta is safely launched, please load it with as many bricks as are needed for ballast and then send it off without delay (Khlebnikov 1990:158).

Five weeks after that, on August 22nd, the newly launched *Kiakhta* arrived in Monterey carrying 2000 bricks in ballast (Khlebnikov 1990:175, 183). It appears that Khlebnikov's relatively small order for 3000 to 5000 bricks placed on June 7 was not completely filled, but that 2000 bricks had been manufactured and stowed in the intervening 10-week period.

Although archaeological investigations of the brickyards on Kodiak Island and Long Island (an islet of Kodiak) indicate that permanent kilns were used, no such information about the production techniques employed at the other yards is available. The relatively small production of approximately 10,000 bricks per year from the Ross brick works (Gibson 1976:41), and the lack of any mention of a standing, permanent kiln structure in the historic record, suggests that the bricks fired at Ross were burned in a clamp. While this approach would leave little if any structural evidence in the archaeological record, the heat generated in such a burn would create a significant magnetic anomaly in the area in which the clamp(s) were located, particularly if the location were used repeatedly. Concentrations of brick "wasters" would also provide an indication of the clamp's location.

The source of the clay used in the Ross brickyard is also unknown. It has been suggested that the clay was mined in the vicinity of the Company's orchard, some 550 yards north of the Ross stockade (John Sperry pers. comm. 2000), but superficial pedestrian surveys of the vicinity were unsuccessful in locating any evidence of either clay deposits or the residual evidence of a clay mining operation. Whatever its source, the clay must have been reasonably plentiful, since the entire brick making operation was moved from Ross to Bodega Bay in 1832 (Gibson 1969:207).

Iron Working

Perhaps the earliest discovery of the use of iron was made accidentally, with a fire inadvertently lit upon ground where iron ore existed near the surface. In such a circumstance it is easy to imagine that some metallic iron would have been formed. The first known iron furnaces, in fact, were holes dug into the ground, usually into the sides of hills that faced the prevailing winds, and with an opening at the bottom to allow for the proper drafting of air (Boylston 1936:4). The utility of the metal produced in these primitive furnaces was so great that improvements in smelting the ore and in processing the metallic issue began almost immediately, and have continued steadily through the bulk of recorded history (Boylston 1936, Forbes 1950, Newton and Wilson 1942, Tylecote 1962.)

In both the smelting of ore and the various refining processes brought to bear on the extracted metal, a durable, impervious silicate or silicate mixture is formed that serves as a "process witness" to the production techniques employed in the metal's manufacture (Bachmann 1982:3, Gordon 1997:11, Tite 1972:10). Known collectively as "slag," these by-products of metal extraction and refinement are often the only evidence of archaeometallurgical processes that once took place. Metallurgical slags were made intentionally and their identification provides important insight into both manufacturing techniques and the nature of the metal they produced (Bachmann 1983:4). In order to understand how the analysis of metallurgical slag can provide such information, a brief explanation of the smelting and manufacturing processes that produce the slag follows.

Iron ore, from which metallic iron is extracted, is a mixture of iron oxide and other, unwanted minerals such as silica, phosphorus, manganese oxide, limestone and clays (alumino-silicates) that collectively are known as "gangue." The smelting process separates iron oxide from the gangue and reduces the iron oxide to pure iron (i.e. separates it from oxygen). Slag is the term used to describe the collection of residual impurities left after the metallic iron is separated from the ore. It is a once-molten silicate or silicate mixture that sometimes includes oxides, phosphates, borates, sulphides, carbides, and pure metal (Bachmann 1982:1, Forbes 1950:396, Percy 1861:20). Generally it is composed of the unwanted minerals that constitute the gangue, elements of the furnace lining that disintegrate in the heat of the smelting or refining process (known as “cinders” or “clinker”), and portions of the charcoal ash or coal that provide the heat in the furnace (Tite 1972:8, Percy 1861:20). The purer the ore used in smelting, the less slag will be formed (Tite 1972:8).

Iron reduces from pure iron oxide at a temperature of 800º C. and has a melting point of 1540º C., much higher than the melting points of any of the common, non-ferrous metals (Tylecote 1962:183). Smelting occurs at or above the temperature at which the gangue becomes sufficiently fluid to drain away from the iron (approximately 1150º C.), which is above the temperature at which iron oxide reduces to iron, but below the temperature at which iron melts. In this circumstance, iron is produced in a solid state known as a “sponge” or “ bloom” from which the molten slag drains away. The residual slag still adhering to the bloom is removed by hammering the bloom in subsequent refining processes, after the slag is brought back to a fluid state (Tylecote 1962:184).

To bind the silica in the ore and to lower the melting point of the oxides or minerals that comprise gangue, other compounds known as fluxes are added to the raw ore in the furnace (Forbes 1950:396). Fluxes provide the fluidity necessary to carry the non-metallic residuum of iron ore out of the furnace in the form of slag (Boylston 1936:8). Lime is the most important of the fluxing agents, since it readily aids the formation of slag (West 1902:59).

The gangue in lime-free iron ores consists mainly of fayalite, which melts at 1170º C. and will absorb the other principal compounds in the gangue, such as manganese oxide, magnesium oxide, aluminum oxide, and ferrous oxide. With the addition of up to 12% lime (CaO), the melting point of this slag will be reduced by approximately 50º C. Fluxing, however, must be carefully controlled. In using CaO as a flux, additions in excess of 15% will increase considerably the melting point of the slags. Modern blast furnace slags, for example, that contain approximately 35% lime have melting points in the region of 1400º C. (Tylecote 1962:187).

The most desirable ores for smelting are those containing a gross chemical composition of ore and gangue that is essentially self-fluxing. Hematite ores, for instance, contain only small quantities of phosphorous and larger quantities of manganese oxide, which acts as a flux and in the smelting process, makes more of the iron ore available for reduction to metallic iron. Unless the ore is self-fluxing, the addition of fluxing materials is necessary in order to achieve efficient separation of the metallic iron from the ore's impurities. The proper ratio of flux to the furnace charge (the combination of ore and fuel) will produce a good slag; one with a low melting point and sufficient viscosity to take up all of the impurities (Tite 1972:10; Tylecote 1962:176).

The main principle in iron smelting is the reduction of the metal oxide with carbon monoxide. This requires both control of the airflow into the furnace and substantial temperatures, which were typically achieved through the combustion of coal or charcoal. Because it is more readily available, charcoal was commonly used as a fuel source in the more primitive, frontier environments (Tylecote 1962:190; West 1902:146). Depending on whether the charcoal was made from wood with bark attached or not, it contained approximately 3% to 20% ash, which worked its way into the slag. The ash became an important constituent of the slag because it served to lower the slag's free-running temperature. Together with lime, some highly alkaline ashes could lower the melting point of the slag by as much as 100º C. (Tylecote 1962:190).

After the raw bloom was produced in the smelting process, further operations were required to remove whatever residual slag remained embedded in it. The re-heating of the bloom required very high temperatures in order to soften the slag enough so that it could be beaten out of the metal. For this reason, smithing furnaces would be either bowl-shaped, bellows-blown hearths, or a variation of the Catalan furnace (Figure 3-7)[5]. The chemical and physical characteristics of slag removed from the bloom in this refining process are similar to those of both smelting slag and cinders (Tylecote 1962:235).

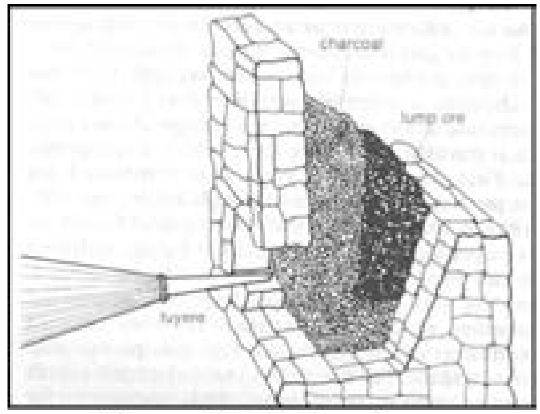

Figure 3-7 Catalan forge

Cast and Wrought Iron

The difference between wrought iron, cast iron, and steel lies in the amount of carbon imparted to the oxidizing ore as it is being smelted. If the ore is subjected to temperatures of approximately 1530º C., it is reduced to wrought iron, which is very malleable because its carbon content is quite low (Boylston 1936:5, Forbes 1950:397). If the ore is subjected to higher temperatures and kept in contact with the charcoal fuel for a longer period of time, its melting point is lowered from that of wrought iron to a minimum of 1170º C. This carburized iron liquefies more readily and flows from the smelting furnace as cast iron (Boylston 1936:8, Forbes 1950:397, West 1902:156). Steel

[5] The Catalan furnace or forge was either a round or elongated hole or hearth lined with refractory clay. A tuyere was used to direct air from a bellows to the mixture of iron and charcoal (the "charge") in the furnace (Boylston 1936:5; Tylecote 1962:232).

is iron containing much less carbon than that found in cast iron, but more than that found in wrought iron (Forbes 1950:397). Cast iron can later be converted to the more malleable wrought iron by subjecting the cast iron "pig"[6] to oxidizing conditions in a hearth, thus driving off excess carbon. This is known as fining.

The finery furnace, although similar to the bloomery hearth in its operation, was almost always square or rectangular in plan. The iron pig was melted in front of the furnace's tuyere[7]. As it melted, drips of the molten metal oxidized while falling to the bottom of the hearth. By the time they reached the bloom forming in the hearth's bottom, they would be solid, since removal of the carbon during oxidation raises the melting point of iron (see above). A covering of molten slag would form over the bloom but the solid metal drips passed through it into the bloom. At intervals, the molten slag was tapped off the bloom and drained onto the ground, forming a slag very similar in appearance to normal bloomery slag (Tylecote 1962:306).

An alternative to fining, known as dry puddling, was developed in the latter part of the 18th century. In this process, a hole was hollowed in the bottom of the hearth in which a puddle of molten pig iron would form. This was stirred vigorously to hasten oxidation. Sand lining the bottom of the hearth fused with the iron oxide formed by the partial oxidation of the pig iron to form a slag of silicate iron. A variation of this approach substituted old slag for sand as the lining in the bottom of the hearth. The latter approach, known as "wet puddling" created much larger quantities of molten slag than

---

6 Molten iron was run down a channel cut into the sand floor of a refinery. Connected to the main channel at right angles were a number of shorter channels into which the molten metal flowed. The arrangement resembled that of a sow suckling her litter, hence the name "pigs" for the iron bars formed in the short channels.

7 A tuyere is the nozzle through which air from the bellows is directed.

dry puddling, since in the latter, most of the slag-forming impurities had already been removed in the bloomery hearth (Boylston 1936:188; Tylecote 1962:307).

Final modification of the wrought iron bloom took place in the chafery hearth. There, the wrought iron bloom was reheated, cut, and hammered into the desired workable pieces. Much of the slag still embedded in the metal was removed in this process, forming a material called hammer scale. This scale forms during heating under oxidizing conditions prior to and during forging of the bloom. Together, the finery (or puddling hearth) and the chafery hearth are known as the "forge" (Tylecote 1962:254, 300, 305-7).

Slags

The composition of slag is influenced by the type of ores and gangue from which it was drawn, the types of fluxes added to the furnace charge, the nature of the material from which the furnace was fabricated, the ratio of ash to charcoal in the fuel, and the conditions under which the ore was processed. Slags created through the finery, puddling, and chafery processes are similar in appearance to bloomery slags and require close inspection if a distinction between them is to be made. A slag's physical appearance is a function of the conditions under which it cooled and the nature of the weathering to which it was subjected. Each of these influences will be represented to some degree in each piece of slag (Tite 1972:10).

In general, the main compounds found in ferrous slags are silicates and metal oxides. The most common silicates are classified according to the ratio of metal oxides to silica and usually comprise fayalite, monticellite, akermanite, or pyroxene. Next to silicates, the most important constituents of slag are the oxides, most of which are iron oxides. Wustite (FeO) is commonly found in bloomery[8] slag but is also present in many copper and lead slags. Magnetite is found in nearly all metallurgical slags containing Wustite. If iron is smelted from sulphidic ores, sulphides will be present in the slag. Metal inclusions are also found in all slags and can provide important evidence about whether the smelting involved copper or iron. Metallic iron, for example, is very common in bloomery slags and, to a lesser degree, in smithing slags, but it is not normally found in copper or lead slags (Percy 1861:20; Tite1972:15).

Identification of the compounds comprising slags can be accomplished through x-ray fluorescence or the use of a scanning electron microscope (J. Evans, R. Gronsky, pers. com. 1999). However, the problem of distinguishing smelting slags from smithing sags, and slags from furnace cinders is complex (Tylecote 1962:176,193; Unglik 1987:127), making it difficult to infer the type of metallurgical production technique from its by-products. A slag can represent a simple compound consisting of just one slag mineral after solidification, but more often, slags are complex mixtures of many constituents with a wide range of compositions (Bachmann 1982:1)

Clues do exist in the physical characteristics of the slag. The presence or absence of flow patterns on the external surfaces of slags found at iron making sites can indicate if the slag was tapped from a hearth or removed from the furnace after it solidified. Slag tapped onto the ground from bloomery or finery hearths can be recognized by the texture and material included in its contact surface (Gordon 1997:11). Slag that has cooled

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[8] Bloomery iron is iron produced in a solid condition directly as the result of the smelting of iron ore. Bloomery iron has usually not been heated above 1250º C (285ºC. below the melting point of iron) and typically has a very low carbon content (Tylecote 1962:312).

rapidly will solidify as glass, while slow cooling slag will either be crystalline, or vesicular from the evolution of gas bubbles from its interior (Bachmann 1982:4; Gordon 1997:10; Percy 1861:25). In slag that exhibits both crystalline and glassy characteristics, it is the glassy portion that has been exposed to air or other cooling surfaces (Percy 1861:25).

Slag is usually gray in color with shades of blue, green, red, brown or black. The blue color often found in slag from iron smelting furnaces is oxide of iron and is an indication of relative temperature levels in the furnace. When temperatures are not very high the oxide of iron exhibits a green color. In high temperatures, the oxide turns blue (Percy 1861:28). If the interior of a slag sample is black and very dense, the ore from which it was derived was probably high in sulphur and low in silicon and there will be a high level of metallic iron in the slag. If the interior color is light gray and porous, the opposite situation probably existed –high silicon and low sulphur levels with little metallic iron in the slag (West 1902:63).

Smithing slags tend to have a plano-convex or concave-convex shape, with low silica and high iron oxide values that make them susceptible to weathering. They are usually brittle and often coated with light to medium-brown crusts crust of iron oxides and hydroxides (Bachmann 1982:5).

<u>Iron working at Fort Ross</u>

As is true with most of the industrial enterprises of the Ross colony, little is known about the nature of the metalworking conducted by the colony's craftsmen. Passing references are made in the historic literature to the presence of a forge at the colony and the skill of the artisans who operated it, but specific information is sadly lacking.

> …down at the foot of the cliff is a small wharf and boat landing. . . . Nearby is a . . . blacksmith shop and bathhouse (Von Kotzebue 1824:12).
>
> The landing was located in a small bay south of the fort. At the landing were built a dockyard . . . and a large shed for storing baidaras and building ships in bad weather. The smithy was a short distance away (Tikhmenev 1978:134).

The inventory of structures compiled when the Company sold the colony's assets to John Sutter in 1841 describes "a forge and blacksmith shop, built of planks, 5 1/3 sazhens long by 3 2/3 arch.[9] wide, with 4 partitions" (Dmytryshyn et al. 1989:432). This suggests the forge referred to in the historic literature appears to have been directly associated with the blacksmith shop, as it was at least in the same structure, if not the same partitioned space. As discussed below, there is no direct archaeological evidence of the forge. Consequently, the nature of the metalworking conducted by the colony's craftsmen can only be inferred from evidence developed from the historic literature, and analysis of the rather large quantities of slag that have been recovered in the archaeological investigation of the industrial complex.

Iron ore is not found in the region's natural environment (Lightfoot et al. 1991:35) and there is no indication in the historic literature that ore was transported to the Ross colony from Company-controlled sources in the north, so presumably the forge was not

[9] As noted in footnotes 1 & 2 of Chapter One, a sazhen is a measurement equivalent to 7 feet. The meaning of "arch." is not clear. In the referenced source, the author has suggested it may be an abbreviation of "arshin," a Russian measurement equivalent to 28 inches. If this is correct, the building would have been 37 feet long and 8.5 feet wide. It seems more reasonable to assume the word "arch" is an error made when the inventory was translated from Russian into French, then into English, and that the 3 2/3 refers to sazhens. This would then describe a building of more logical dimensions: 37 feet by 26 feet.

used in smelting activities. Rather, it appears that the forge was used in bloomery, finery or chafery operations to convert cast iron, in the form of "pigs," into the more malleable wrought iron, and to fabricate tools and utensils.[10]:

> …there is no such thing as a smith in all California; consequently the making and repairing of all manner of iron implements here [Ross] is a great accommodation to them [the Spanish], and affords lucrative employment to the Russians (Von Kotzebue 1824:42; Essig et al 1991:8)

> There was hardly any article of wood, iron or leather which the mechanics of Ross in the early years could not make of a quality sufficiently good for the California market, and to the very last they received frequent applications from the Spaniards. (Bancroft 1886b;639).

The raw material used in this industry was provided by the Company's northern colonies that, in turn, appear to have been supplied directly from Russia. In 1817, for example, the Company's ship *Kutuzov* under the command of Leonth A. Hagemeister, arrived in the port of Callao on a voyage to New Arkhangel from Russia. Hagemeister was worried about the weight of the vessel and complained that she "was carrying too much iron, which caused her to pitch and roll heavily when we rounded Cape Horn" (Dmytryshyn et al. 1989:249). To lighten the load, Hagemeister arranged to sell or trade a portion of his cargo, including "1200 quintals of bar iron and bolt iron, 50 quintals of iron ingots, and 150 iron nails for shipbuilding" (Dmytryshyn et al. 1989:254). Presumably, this sale of over 70 tons of iron still left a sufficient quantity on board to supply the colonies in Russian America.

[10] Iron ore was typically smelted into molten iron and cast into "pigs" that were of a size, weight, and shape that was easily stored and transported.

Evidence that iron was transshipped to the Ross colony may be found in the description of the loss of the Company ship *Il'men.* In 1820, on a voyage from New Arkhangel to Ross, the *Il'men* went aground near today's Point Arena in northern California. The account of this shipwreck and its aftermath were meticulously recorded in a journal kept by Kyrill T. Khlebnikov, an accountant and administrator of the Russian-American Company. Excerpts from his description of the salvage operations he directed indicate that iron was a major component of the ship's cargo:

> First we let down the longboat and two cannon and brought them ashore and then unloaded the remaining cargo, apart from the lead, iron, pitch, anchors, and heavy lines. . . . Then we unloaded lead, sheet iron, white rosin, and pitch for the brig *Buldakov* [then on the shipways at Ross]. . . .In the mean time, Mr. Schmidt cleaned the hold with the remaining men and began unloading the iron onto the shore. . . .I tried to carry an iron bar weighing two puds [72 pounds] the whole distance and was exhausted. In the afternoon we dragged most of the iron to the place where the boats were moored and loaded it on board. . . . The following was left behind: three big anchors, two ropes, seven barrels of pitch and bar iron. (Khlebnikov 1990:45-46, 49, 50, 54).

After finally reaching the Ross colony, Khlebnikov spent the next five months inspecting the colony's facilities and operations and made trading voyages to Monterey and Santa Cruz and visited Santa Barbara (Khlebnikov 1990:26). In preparation for one of these voyages, Khlebnikov again provides some information about the importance of iron as both a trading commodity and as a raw material essential to the colony's operations. "Owing to the shortage of iron at Fort Ross for shipbuilding, I kept 150 puds[11] for trading in California and ordered the rest to be left here." In addition to the raw material, Khlebnikov also loaded "two dozen wool shears, 140 pair of iron hinges;

[11] The equivalent of 5,400 pounds (2.3 tons).

60 plowshares (made here); 94 koporulia[12] (made here); 150 blades (made here)" (Khlebnikov 1990:61-63).

The items listed in this inventory, and references made to other commodities traded by the Russians to the Spanish, provide some information about the nature of the metalwork that was conducted in the colony's industrial complex. In his history of the Company, for example, Tikhmenev mentions " . . . the demands of the missions were confined to purchasing iron and simple tools. . ."(Tikhmenev 1978:141):

> In addition to agriculture and animal husbandry the other industries of the settlement included . . . various manufactures, such as rowboats, wheels, cooking dishes, etc., ordered by the Californians. Before California was opened to free trade, such objects were manufactured very profitably at Ross settlement . . . (Tikhmenev 1978:227).

Although comments like these illustrate that metalworking was an important and on-going part of the Russian industrial enterprise at Ross, they are more enticing than they are informative. Understanding what the nature of the metalworking enterprise was and how and where it was practiced, and determining what type of equipment it employed would provide an important insight into the industrial activities conducted at the Company's remote California outpost. Unfortunately, the historic record is vague, if not silent, about this particular activity so, as is true with the other elements of the colony's industrial enterprise, it falls to the archaeological record to provide a more robust and informative glimpse of this dimension of the colony's industry.

Evidence of the metalworking industry conducted at Ross might be found in the discards of the blacksmith's shop, the structural remains of the forge itself, or perhaps in

[12] A koporulia is an iron tool used to clean the dirt from a plowshare.

a feature that would reflect specific types of metallurgical processes – casting, for example. Work on a forge creates a great deal of waste product that is typically found in the form of slag or clinker. It is ubiquitous in smithies and concentrations of it encountered in the archaeological record might give some insight into the location and spatial arrangement of the shop, and may also reflect the specific types of operations that were conducted there (see, for example, Light and Unglik 1987).

Locating the forge would, of course, be extremely valuable in determining how and where the Ross smiths operated. Although it is unlikely that the actual remains of the forge still exist, indications of the area in which it was located may still be evident. These may be found in either magnetic anomalies created through heat-induced alterations of the surrounding sediment, changes in the color and texture of the sediment and soils in the area where the forge once stood, or the identification of an excavation or pit that may have formed part of the forge itself.

Shipbuilding

The economic growth and demographic changes that occurred in Europe from the 10th to the 14th centuries led to a remarkable increase in the exchange of goods between the emerging nations. Increased contact fostered an exchange of ideas about ships and shipbuilding and shipwrights began combining the building practices and traditions of northern Europe with those used since the Roman era in southern Europe (see Kirsch 1990; Unger 1994). By the 15th century, shipbuilders were producing ships with hulls that were larger and more flexible than those that had been produced in any earlier architectural tradition. The results of these dramatic changes in ship architecture changed all aspects of life, in both Europe and the rest of the world (Unger 1994:10). From carrack, to caravel, to galleon, shipwrights expanded their technical capability, borrowing from different shipbuilding traditions, and experimenting with different designs and construction techniques until, at the dawn of the 17th century, the ship had become the most successful, expensive, productive, and impressive of human creations (Unger 1994:10).

The demands of commerce and defense, and the transmission of information on ship design and construction that resulted from trade and warfare, led to the steady development of larger and more efficient vessels between the 17th and 19th centuries. Although not radically different in form, ships increased steadily in size: by 1764, ships of 700 tons were being built; by 1780 the 800 ton mark had been reached, and by 1793 ships of 1200 tons were being built. Spanish ship architecture was at the technological forefront during this period, reflecting the Empire's need to defend the large commercial fleets that were plying the waters between Spain, the Indies, and the Caribbean, and to protect the vast coasts and many ports of the Spanish New World.

During the 18th century, Britain had become increasingly dependent on the shipyards of the American colonies for her merchant vessels and at the outbreak of the American Revolution, nearly one-third of all British ships were built in America (MacGregor 1985). The numerous wars in which Britain became engaged augmented both her naval and commercial fleet in the form of captured prizes, the most valued of which were those ships built by Spain (Harbron 1988).

During his reign, Russia's czar Peter the Great zealously studied both the Spanish and English shipbuilding traditions and in the first decade of the 18th century, he began developing Russia's first significant naval fleet and merchant marine (Riasanovsky1984: 220, 236). It was from this maritime heritage that the ships used in the Russian voyages of exploration in the Bering Sea and across the north Pacific were produced. Likewise this Russian heritage, derived from those of both Britain and Spain, also provided the means for the Russian-American Company to build and operate the fleet of vessels it required to harvest and trade the furs that formed the substance of its business.

From its very beginning, the Company began building the ships it required to prosecute its trade. In 1791, Shelikov directed Baranov to begin building ships:

> Herewith, we send you iron, rigging, and sails for one ship, which you will build with Shield's [a naval shipwright] help. Using him to advantage, you should also begin two or three other ships of various sizes, bringing them to the point where you can finish them yourselves, without a shipbuilder's aid. Everything you need for this will be sent later. Teach the natives to be sail-makers, riggers, and blacksmiths (Tikhmenev 1978:33).

In response, Baranov established a shipyard in Chugach Bay, calling it Resurrection Harbor. There he built the Company ship *Phoenix*, the first ship constructed in Russian America. Thereafter, the Company built numerous ships in the yard at Resurrection Harbor and in shipyards later established at New Arkhangel, Okhotsk, and at Ross (Khlebnikov 1976:76, 98-99; Tikhmenev 1978:33, 95). In 1806, Baranov hired an American shipwright named Lincoln [sometimes spelled "Linken"] to build ships for the company in the yard at New Arkhangel (Khlebnikov 1976:9; Tikhmenev 1978:147, 148).

During the following three years, Lincoln built three new ships and retimbered or repaired two others at the Sitkha yard. After his departure from Sitkha in 1809, no new ships were built there, although a *promylshennik*[13] named Mukin undertook the repair of several older ships (Khlebnikov 1976:9). During the period when the yard was in operation, Lincoln trained a young *promylshennik* from the Irkutsk region named Vasilii Grudinin in the art of shipbuilding. It was Grudinin who volunteered to leave Sitkha for the Ross colony in order to build ships there.

<u>Shipbuilding at Ross</u>

The depletion of Alta California's fur-bearing sea mammal population and the disappointing performance of the Ross colony's agricultural efforts led to financial losses for the Company, putting Ross in danger of becoming a financial burden. To develop an economic enterprise sufficiently prosperous to replace these losses, Kuskov ordered the establishment of a shipyard in the cove below the colony's stockade. There in 1816, the keel was laid for the first sailing vessel to be built in Alta California.

From 1816 to 1827, Grudinin directed the construction of six vessels in the Ross shipyard. In addition, prior to Grudinin's arrival and the commencement of shipbuilding activity, Kuskov himself built a small vessel referred to as either a small bark (Khlebnikov 1976: 116) or a rowboat (Kashevaroff n.d.). The first four of the vessels built by Grudinin were constructed specifically for the company's use. The last two were built for the missions, one in 1826 and the other in 1827:

> The Russians . . . built in 1826 a new boat with sails and rigging for the Mission at San Francisco for 1200 piastres; and in 1827 also built a fully equipped barge [barque?] for the Mission San Jose for 1500 piastres" (Kashevaroff n.d.).

[13] Fur traders and hunters - literally "enterprisers."

The four company vessels were constructed in the shipyard at Ross, launched, then transferred to the Russian's port at Bodega, Port Rumiantsev, for fitting-out and loading (Lutke 1818:281). The keel for the first of these vessels, christened the *Rumiantsev*, was laid in 1816. The ship was either a schooner (Bancroft 1886:640; Bunje 1970) or a brig (Khlebnikov1978: 116) or a brigantine (Golovnin 1979: 166; Tikhmenev 1978:150). Finished in 1818, *Rumiantsev* was chiefly built of oak (Bancroft 1886:640; Tikhmenev 1978:228) and was rated at 160 tons displacement by Khlebnikov (1978:116), but was described as being only 80 tons by Fedor P. Lutke during his visit to California in 1818 (Lutke 1989:281). This may be simply a difference in judgment, albeit a substantial one, or it may be attributable to the different types of tonnage used to describe a ship. Khlebnikov was citing displacement tonnage and Lutke might have been referring to tons burthen. The *Rumiantsev* was used primarily in Sitkha, under the command of a Lieutenant Livoron, until 1823, when it was abandoned (Bunje 1970). Described in 1818 as "very well built, judging from its outward appearance" and not looking "as if it had been built by a simple promyshlennik" (Lutke 1818:281), *Rumiantsev* was declared unseaworthy a mere five years after its launching because of the "open rot in all parts" (Khlebnikov 1835).

The *Buldakov* was the second ship to be built in the Ross shipyard. Its keel was laid in 1819 and the vessel was launched in 1820. Copper-sheathed, the *Buldakov* was a 200 ton brig, also primarily built of oak (Bancroft 1886:640; Tikhmenev1978: 228). The ship, whose maiden voyage was made to Santa Barbara, was in active use until 1826, when it was stripped and placed into dry-dock in Sitkha to be used as a storage facility for wheat (Bancroft 1886:640; Khlebnikov 1976:116). A slight discrepancy exists in the historical record regarding the construction dates of the *Buldakov*. During his 1818 visit to California, in addition to his comments on the *Rumiantsev,* Lutke also remarked on the *Buldakov*, which he described as "still in the building slip in Ross, but . . . already in its final stages" (Lutke 1818: 281). However, in describing the 1820 shipwreck of the *Il'men* at Cape Barro de Arena (modern Point Arena), Khlebnikov mentions some of the cargo of the wrecked vessel. "Then we unloaded lead, sheet iron, white rosin, and pitch for the brig *Buldakov*" (Khlebnikov 1990:46), indicating that the *Buldakov* was still not finished. In regard to his ability to assess ships, their size, and seaworthiness, perhaps Lutke's judgment should be called into question. He is in serious disagreement with Khlebnikov's evaluation of the size of *Rumiantsev*, he describes the vessel, out of service in five years, as being "well-built", and presents the *Buldakov* as being nearly completed two years before the vessel was actually launched.

Khlebnikov (1976:116) and Bancroft (1886:640) both state that the *Buldakov*'s keel was laid in 1819 and that the vessel was finished in 1820. Furthermore, there are many references in Khlebnikov's travel notes of 1820 regarding *Buldakov*'s fitting out at Bodega. On July sixth, for example, the crew list for the vessel was made and the men were sent to Bodega. On the ninth the ship's boat left Ross for Bodega "carrying copper sheets and craftsmen to finish the planking for the *Buldakov*" (Khlebnikov 1990:58). On July sixteenth a small baidara set out for Bodega:

> . . . with the two anchors, the large anchor cable, two small cannon, iron, glassware and hardware, and various products in barrels for the *Buldakov*. Mr. Schmidt accompanied them. Any goods that could not be loaded on the ship immediately were to be placed in the warehouse, and a guard was to be posted" (Khlebnikov 1990:64).

Three days later "Mr. Schmidt returned from Bodega and reported the *Buldakov* was ready . . . " (Khlebnikov 1990:65). This strongly suggests that Lutke erred in reporting his September 1818 observation of the *Buldakov*. His diary in which this is recorded appears to be a mixture of contemporary observation intermixed with historic background, so perhaps it was rewritten after the fact and he confused actually seeing the *Rumiantsev* in the shipways in late 1818, with what he later learned of the *Buldakov*.

In September 1820, Captain Matvei Ivanovich Murav'ev assumed the position of Chief Manager of the Russian colonies in America (Pierce 1986: 7). In an attempt to improve the durability of the ships built by the company, Murav'ev directed that all future constructions should employ pine for the ship's frames and laurel for the hull planking (Tikhmenev 1888:228), although Bancroft (1886:640) claims the directive was for pine and "cedar (redwood?)" [question mark in original].

In addition to bringing a new Chief Manager, the year 1820 also saw the retirement of Kuskov from the company. After three decades of service to the company, he departed California and returned to Russia, where he died in 1823 (Bancroft 1886:642). Karl Schmidt, a merchant seaman of "considerable enterprise and ability" (Bancroft 1886:642; Tikhmenev 1888:224) assumed the responsibilities of manager of the Ross counter and directed the agricultural and industrial enterprises of the colony for the next four years.

On September 15, 1820 the keel was laid for the third company vessel built at the Ross shipyard. Khlebnikov, who had returned from a visit to Monterey, describes the occasion thusly:

> Mr. Kuskov wanted to start building a new ship. He did not want to christen it until a new Chief Manager had been appointed [word of Murav'ev's appointment had apparently not yet reached Ross]. I suggested naming the ship in honor of RAK Director Kramer . . . . Mr. Kuskov agreed to my idea and at 11 o'clock we went to the shipyard, read a prayer, and set to work. An hour later, we raised the company flag on the sternpost of the new ship. We congratulated Mr. Kuskov, drank a glass of wine, and gave each of the workers and Aleuts a cup of rum. The ship is 60 feet long at the keel, and almost all the wood used in its construction was prepared here. (Khlebnikov 1820:86).

Sometime between its christening and its completion in 1822, the vessel was officially named the *Volga*, despite Khlebnikov's original suggestion. It was a brig of 160 tons under the command of Captain Tumanin and was used heavily, frequently traveling between company headquarters at New Arkhangel and the Ross colony. In 1827 the ship was declared unseaworthy and in 1828 was sent to the island of Atkha where it was put into use as a storage vessel for lumber (Khlebnikov 1861:117).

In 1823 construction of a fourth company vessel began at the Ross shipyard. Completed in 1824, the 200 ton brig *Kiakhta* was built of fir, with a keel and sternpost of oak (Khlebnikov 1861;117). Launched on August 9, 1824, *Kiakhta* was taken to the port of Rumiantsev the next day where it was fitted-out. Its maiden voyage was to Monterey where it arrived on August 22nd to the impatient greeting of Khlebnikov, who had been awaiting its arrival for several weeks. Although his notes of 1833 describe the vessel as having a displacement of 200 tons, Khlebnikov records it as being of 120 tons when describing his business transactions with the Spanish in Monterey, falsifying the ship's size to reduce the amount of duty he was to pay:

> Mr. Mariano [Spanish paymaster] took my word on all the items in the count. Under any other circumstances I would not have abused his trust, but here, bearing in mind the duty added for provisions purchased, I had no compunctions about leaving out numerous acquisitions or entering smaller amounts for goods

> sold. . . . I put the tonnage of the *Kiakhta* at 120 tons and that of the *Buldakov* at 160 tons. The officials argued about those figures for a long time, but finally consented (Khlebnikov 1824:183).

Subsequent references to the vessel are scarce. It apparently saw limited service along the coast with an occasional trip to the northern outposts and was abandoned after a few years.

With the launching of *Kiakhta*, Khlebnikov's dissatisfaction with the performance of Schmidt as manager of the Ross counter apparently came to a head. In a letter to Chief Manager Murav'ev, Khlebnikov itemized Schmidt's many shortcomings and promised to replace him. On November 3, 1824, the Chief Manager, through Khlebnikov, appointed Pavel Ivanovich Shelikhov as manager of the Ross colony. It was Shelikhov who oversaw the construction of the last two ships to be built at Ross.

Little is known about these two vessels that were built for the Spanish missions. Nothing in the examined Russian documentation gives any information about them. The Spanish records are equally inconclusive, possibly because the trade exemplified in the exchange with the Russians was strictly forbidden. In his numerous written instructions to the new manager of the Ross colony however, Khlebnikov states, "Once you have finished building the ship, you should focus your attention on agricultural matters" (Khlebnikov 1824:191). Since these instructions were written on November 3, 1824 and the *Kiakhta* had been launched on August 9, 1824, some three months earlier, it appears that Khlebnikov was referring to a new ship on the ways, most likely the ship that would be sold to the mission at San Francisco in 1826.

The unacceptably short lifespan of the ships built in the Ross shipyard, and the cost and difficulty of building them, led to the closure of the yard in 1827, after the sale of the barge (or barque) to the mission at San Jose:

> Generally speaking, the ships built at the settlement could only be used five years without complete retimbering. The wetness of the wood caused it to rot early. Finally, ships built at the settlement were more expensive than those purchased from the Americans or built in New Arkhangel, because of the large number of men that had to be employed to transport the timber from the remote forests to the shipyard. For this reason the company abandoned shipbuilding at Ross (Tikhmenev 1978:228).

The poor durability of the ships, and the consequent failure of the Ross shipyard to perform as a successful, long-term adjunct to the other economic enterprises of the colony is commonly attributed in the historic literature to the poor quality of the wood employed in the construction of the ships, and its improper preparation prior to its use (Bancroft 1886:639; Khlebnikov 1976:116; Potechine 1859; Tikhmenev 1863:228). Of these two arguments, the latter rightfully may be a component in the explanation for the unacceptable rate of deterioration in the vessels, but the former is almost certainly not. The same northern California forests used by the Russians also provided the timber for several prosperous north coast shipyards of the late 19th and early 20th centuries. For years those yards produced numerous successful, durable ships for use in the west coast lumber trade (McNairn et al. 1945:79). The improper preparation of the wood, on the other hand, was undoubtedly a contributing factor to the short lifespan of the Ross ships. The lack of skill in this area is exemplified in a report Schmidt made to Khlebnikov in October 1822:

> The wood prepared in the summer of 1821 by Mr. Kuskov for building a ship and which had been left outside northwest of the fort had rotted, and the shipwright said it could no longer be used (Khlebnikov 1990:96).

This gives rise to a question about the quality and the general competency of the workers involved in the ship construction, an issue intrinsic to whether or not the wood was properly treated and by extension, whether or not the ships rotted because they were simply not properly built. The stringent personnel policies of the Russian-American Company created a situation in which the company was constantly short handed and in need of both skilled craftsmen and unskilled laborers. Although considerably more enlightened in the 19th century than they had been earlier, these policies provided scant financial opportunities for the company's work force, so a reliable supply of labor from the motherland was always problematic.

Despite its comparatively benign climate, the colony at Ross shared the same labor problems as the company's outposts in the north; it,too, was constantly in need of workers. Workers at Ross were recruited from the force of contract laborers brought into the northern colonies from Russia and Siberia, and from the local native Californians (Okun 1951:142). Once at Ross, the workers from the north, being virtually bound into perpetual servitude to the company by the terms of their contracts, often deserted for the nearby foreign lands of Spanish California.

As a source of labor, the pool of Indian workers soon proved unreliable as well. The low wages paid by the Russians quickly discouraged the Indians from voluntarily reporting for work. The large numbers of workers required to keep the agricultural and industrial ventures functioning necessitated the type of action described by Baron

Ferdinand Petrovich Wrangell, Chief Manager of the American colonies from 1830 to 1835:

> . . . when there are few volunteers, then as many Indians as can be assembled - sometimes as many as 150 - are driven together by force and put to hard work in the fields for a period of about a month and a half. . . . the Indians reach in the end a state of complete exhaustion (Okun 1951:143).

By 1822, the shortage of both skilled and unskilled workers was taking its toll on the shipbuilding effort. The optimism evident in Khlebnikov's early descriptions of the abundance and suitability of the local wood for shipbuilding had evaporated. In October 1822 he wrote of the shipbuilding enterprise:

> It is virtually impossible to continue building ships. The wood needed is very far away and extremely difficult to bring back because there are not enough men available. The wood is cut in a deep ravine and must then be carried onto a road, where it is loaded onto horses that can take only one log at a time. From there it is taken to a better road and transported to the fort, but the distance is such that no more than two trips a day can be made (Khlebnikov 1822:97).

Those laborers who were available to work in the shipyard apparently lacked the requisite skills to properly build a ship. Problems in the construction of the *Volga* illustrate this point. "Mr. Schmidt deeply regretted the sudden death last year of the best carpenter, Vasilii Antipin. None of the other men had any shipbuilding skills, except Korenev, who wants to leave, and Permitin" (Khlebnikov 1990:97). The shipwright Grudinin had apparently heeded a suggestion Khlebnikov made in 1820 and trained two or three men in the rules of shipbuilding, but he was not directly involved in the construction of the *Volga* in 1822. Khlebnikov advised Schmidt "to do all within his power to build the ship, which might be the last. The shipwright Grudinin agreed to take charge of the ship's construction" (Khlebnikov1990:97). Who Grudinin used to complete the ship and how it was done are not mentioned in the extant historic accounts of the enterprise.

The blame for the short lifespans of the ships built at Ross may properly be laid at the feet of the men who built them, rather than in the materials with which they chose to work. In a backhanded compliment to the yard's chief carpenter, Khlebnikov himself indicts Grudinin as an element in the yard's failure.

> One must give credit to the common carpenter who built two ships on Sitkha and later four ships at Fort Ross. But one must also acknowledge the fact that any person boarding these ships for a stormy passage cannot have full confidence in an individual who has no understanding of the art of shipbuilding (Khlebnikov 1976:79).

The problem of obtaining skilled workers to build the ships is also mentioned obliquely by Khlebnikov, who seems to be reluctant to specifically place any blame for the poor performances of the shipyard's issue - probably because of his earlier enthusiasm for the enterprise. After discussing the cost of paying the wages of thirty workers for the eighteen months required to build a ship, he wrote:

> The consideration that the persons who live in an area must earn their living somehow was the only reason shipbuilding attempts were considered. However, when it was found that California oak soon rots and is quite unsuitable for ship construction, the decision was made to terminate this activity, and people were put to work in agricultural occupations instead (Khlebnikov 1976:80).

Since nothing of the ships built in the Ross yard remains, the only evidence that may be brought to bear on questions of the skill levels and competence of the shipyard workers is the archaeological evidence that may be extant at the site of the shipyard itself. The sketchy historic accounts of the yard's operation give little indication as to the construction methods used, but vessels of the size built at Ross surely required fairly substantial shipways, support facilities, equipment, and tools.

In building a ship, a number of factors must be considered before construction begins. First, the foundation on which the ship is built, the slip, must be solid enough to sustain the weight of the finished vessel. Second, the timbers that carry the finished vessel down the slip and into the water, the launching or shipways, must be properly inclined toward the water.

In the latter part of the 19th century, these two factors were addressed as follows: a series of piles were driven into the ground in rows. Their tops were cut off at a height sufficient to insure the proper angle inclination to the waterline (Figure 3-8). Across the piles, perpendicular to the direction of launch, a series of capping timbers were fastened to form a stage on which were mounted the shipways and support structure, which was known as the "falseworks" (Figure 3-9).

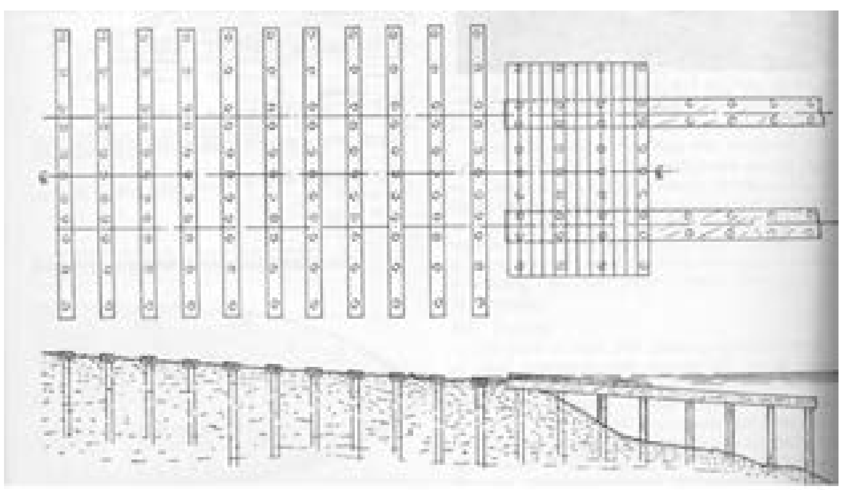

Figure 3-8 Building slip and launching ways
(Desmond 1984 [1919]: 66

Specifications typically called for a minimum of 30 inches between piles, to prevent breaking of the ground. Two to four rows of piles were positioned under the center of the slip to support the vessel's keel, with two to four rows of closely spaced piles on each side to support the shipways. The length of the slip was one and a half times the length of the ship to be built, and the slip had to be wide enough to accommodate the vessel at its widest point, with additional room to support the falseworks.

The distance between the vessel's stern to the high-water mark, and the angle of the slip to the water's surface both had to be great enough to create a velocity in the launched vessel sufficient to overcome the loss of momentum created when the stern entered the water (Desmond 1919:66-79). Although these specifications date to the latter part of the 19th century, they provide insight into the methods and considerations involved in the initial planning of the construction of a ship, regardless of the period.

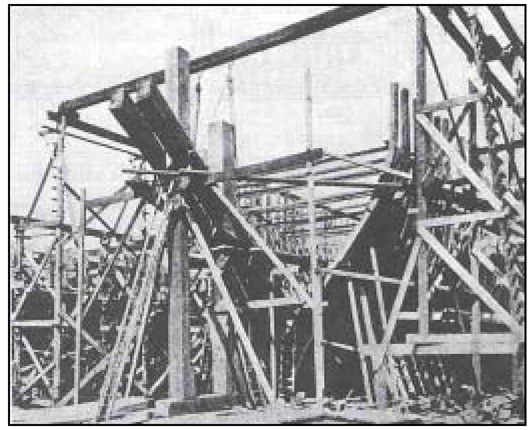

Figure 3-9:Typical falseworks, ca. 1900 (Desmond 1984 [1919]: 51)

The tonnage of the vessels built in the Ross shipyard suggest that the ships were probably 80 to 100 feet in length and 18 to 24 feet in width (see Desmond 1919; Gardiner 1993; Kirsch 1990; MacGregor 1985; Unger 1994). Using the criteria described above, this suggests the building slip at the Ross yard could have been 120 to 150 feet in length and 30 to 40 feet wide.

References are made to the structures built to accommodate both the construction activities and the launching of at least one vessel. In referring to *Kiakhta*, Khlebnikov wrote "They have begun building a launching structure and hope to launch the ship in July" (Khlebnikov 1990:156). A month later, he wrote "With regard to work on the ship, Mr. Schmidt wrote in two lines that the launching structure was ready, but that there were not enough rafts available" (Khlebnikov 1990:162). This confirmation that there were specifically built foundations and frameworks employed in the shipbuilding activity raises the possibility that perhaps something of the shipyard still exists beneath the sands of the cove at Fort Ross

In addition to the consideration given to the design, location, and arrangement of the shipways, thought had to be given to the harvesting, preparation, and storage of the timber used in shipbuilding. Manager Schmidt's letter to Khlebnikov in October 1822 describes the loss of timber prepared the previous year "for building a ship and which had been left outside northwest of the fort." This suggests that the timber was prepared and stored some distance away from the shipyard itself, since "northwest of the fort" would place the storage yard on the marine terrace, on the opposite side of the stockade from Sandy Cove. This may have been an attempt to protect the timber from the moisture it would have absorbed if it were stored on or near the beach, but the fact it was stored outside suggests it was relatively unprotected anyway. More to the point, if the timber was prepared and stored on the terrace, there may be no archaeological evidence in the shipyard for this activity. Such evidence most likely would have taken the form of a large and deep rectangular excavation created for the use of a pit saw, which would have been used to shape – at least to some degree – the timbers used in the shipyard (Figure 3-10). A smaller version of this type of saw may have also been employed in the yard itself to

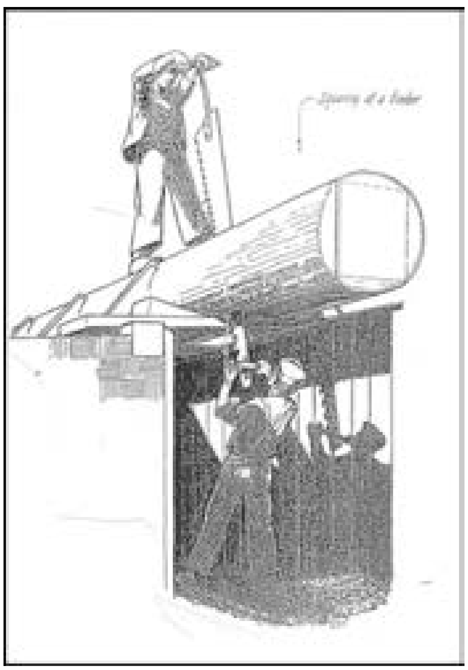

Figure 3-10: Pitsaw
(Greenhill and Manning 1988)

shape some of the smaller timbers and to prepare the hull planking, however and evidence of its use may still exist there.

Another element of 19th century ship construction that may have left some trace in the archaeological record is the method employed by the colony's shipwrights to bend the timber. Ideally, shipwrights used timber from trees that yielded naturally curved pieces. This wood, known as "compass timber" was highly prized and much sought after (Figure 3-11). It was also quickly exhausted in many parts of the world, and shipwrights turned to bending timbers in order to get them to conform to the desired shapes. Bending was preferred to cutting curved shapes for two reasons: cutting the shapes out of larger pieces of timber was very uneconomical because of the large volume of wasted wood, and – more importantly – the strength of the finished piece would be substantially diminished because the wood's fibers would have been cross cut to get the desired shape. To insure that the wood fibers remained uncut, and parallel to each other and the curve, the timber had to be bent artificially (Desmond 1984 [1919]:10). To do this, water and heat were brought to bear on the wood to soften its fibers, rendering them supple enough to bend.

Figure 3-11: Hewing a knee from a piece of 'compass timber"

In the 18th century, this was accomplished in one of three ways: charring, stoving, and steaming (Fincham 1851: 76). Charring consisted in subjecting the inner surface of a plank or timber to the flames of a fire, while keeping the exterior surface wet. However, it was only suitable for timbers of small dimensions (Fincham 1851:76; Desmond 1984 [1919]:10). Stoving was a process in which the timbers or planks were moistened, then buried in a bed of moist, hot sand until they were supple enough to bend. It was a process used in British shipyards until the late 1730s, when it was gradually replaced by the use of steam-trunks, or steam kilns (Fincham 1851:76). In a steam-trunk, planks or timbers were laid inside an airtight iron box into which steam was injected from a nearby boiler (Figure 3-12). The action of the hot steam softened the wood fibers over time, rendering the timber or plank pliant.

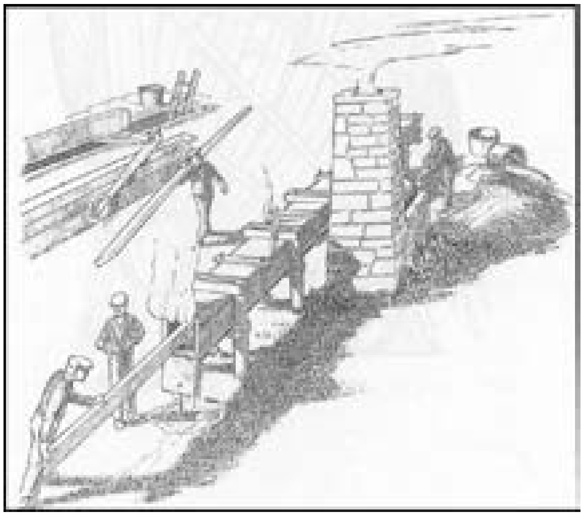

Figure 3-12: Typical steam-trunk, ca.18th century

Regardless of the method used to soften the wood and make it supple, it had to be formed into the required shape while it was still in a state of pliancy and secured so that it could cool in that form and retain the desired curvature. To achieve this in the 19th century, the softened timbers were bent on a mold having the desired contour (Figure 3-13). The simplest method of doing this involved erecting a series of stout posts along a line of the desired curvature

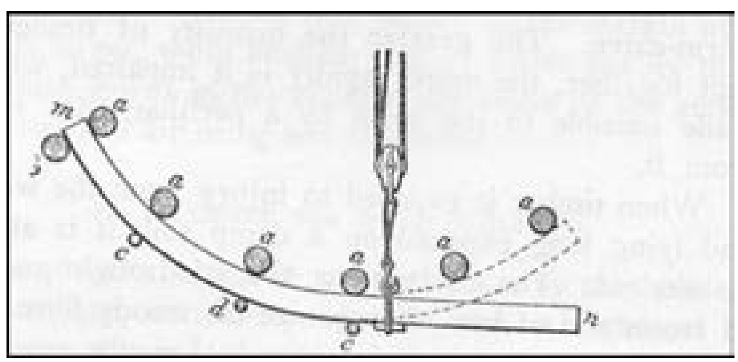

Figure 3-13: Molding the shape of a plank
(Desmond 1984 [1919]:10)

("a" in Figure 3-13). The softened plank or timber was then inserted between two posts at the point where the curve was to begin ("m") and, using a block and tackle, was brought to the next post, where it was fixed by driving a smaller post ("c") behind the plank to hold it against the second post. The tackle was then shifted from point to point along the line of curvature until the entire length of the plank or timber was brought up against the original line of posts ("a"). The wood piece was then left in place to cool and dry, after which it was removed, retaining its new shape, while a new piece – fresh from the oven or chest -- was inserted in its place. Although this technique was employed in the latter 19th century, its simplicity is such that it may be similar to the technique employed in the frontier shipyard at Ross, as it is an approach that requires very little in the way of equipment or technical skill.

Since no evidence of the ships produced in the Ross yard appears to exist, it may be only through the archaeological record that some insight may be gained about how the ships were built. Remains of the shipways, discovery of the areas used to store, cure, and prepare the ship's timbers, or identification of the procedures used to soften and shape the ship's timbers and planks, may be the only indicators of the technological approaches used in the frontier shipyard. If they still exist at the site of the colonial shipyard, these indicators may provide some insight into the quality of the craftsmanship employed in the frontier shipyard, the methods employed to build the ships, and the reason for the yard's ultimate demise.

Conclusion

With a basic understanding of some of the contemporary manufacturing approaches used in the industries attempted at Ross, identification of their archaeological remains may be more readily made. The typical 19th century manufacturing processes discussed above that were employed in Europe and the United States in and around the era in which the Russian American Company conducted its industrial enterprise at the colony may offer an analog to how the Ross craftsmen accomplished their work.

Although visitors to the colony often made reference to its industrial activities, they provided little in the way of description or detail of the enterprise. In the absence of such primary information, understanding the 18th and 19th century manufacturing techniques employed in each of the industries that were conducted at the Ross colony may help to identify the archaeological remains of the approaches to manufacturing taken by the artisans of the Ross enterprise. Such an understanding may also provide some insight into how these approaches were adapted to meet the special requirements of conducting such an enterprise on a distant, non-industrialized frontier.

Chapter 4: Field Methodology and Description of Findings

Introduction

As discussed above, neither the available historic literature on the Russian American Company, nor the descriptive accounts of the Ross colony left by the travelers who visited there provide much information on the spatial organization, industrial processes, and social relationships that existed in the colony's industrial complex. While much attention was paid to the stockade area and its defensive capabilities, the industrial enterprise of the colony was largely overlooked.

What is known is that the manufacturing activities of the Ross counter took place below the stockade, in the area now known as Sandy Cove. There, the first shipyard on the west coast of what is now the continental United States produced at least six sailing vessels -- four for the Company itself, and two for the Spanish missions. In addition, a small cooperage produced barrels for the Company's use, both at Ross and for the colonies in the north Pacific, and most likely for trade with the Spanish. A brickyard in the industrial complex, along with a tannery and an active forge and blacksmith shop also produced finished products for internal consumption, to supply the Company at large, and as trade goods for the Spanish missionaries.

Who produced these ships, bricks, barrels, leather and iron products, how they did it, and exactly where has been lost to the extant historical record. In order to gain some insight into how the complex operated, and how it was organized, an archaeological investigation was conducted in the cove, along the eroded, narrow strip of land that is all that remains of the area where the industrial complex once stood.

The research program was designed to expose, record, and recover the archaeological remains of the enterprise wherever they were encountered in the cove. The data thus acquired could then be synthesized to address the research themes and specific research questions that are discussed above in Chapter 1. It began with the investigation of two erosional features that appeared after heavy winter rains -- one in the sidewall of the remaining portion of the terrace where the complex once stood, the other beneath the sands of the cove itself. Both appeared to be architectural features that were possibly associated with the Russian American Company's use of the cove. A combination of geophysical remote sensing, pedestrian survey, test augers, and archaeological excavation was employed in the investigation, which unfolded over a two year period and grew to encompass most of the remaining footprint of the industrial complex.

Figure 4-1: Project Area, View Northeast

The area designated as the industrial complex encompasses the uplifted lower marine terrace along the edge of Sandy Cove, and a portion of the cove's beach – both of which are situated below the Ross stockade (Figure 4-1). An access road leads from the higher marine terrace on which the stockade is situated down to the beach, bisecting the relatively flat lower terrace. Remains of the industrial complex have been found on both sides of the lower portion of the road, although they are more concentrated in the narrow strip of terrace on the road's south side (Figure 4-2). As depicted in Figure 4-3 the terrace once extended substantially further to the south, but has eroded considerably due to the effects of Fort Ross Creek, which in modern times has annually cut against its southern flank, and the tidal action of seasonal high tides that batter the terrace from the southwest. When archaeological investigations began in July 1996, all but a narrow strip of the original terrace had been washed into the ocean.

Field Methodology

The archaeological investigation began on June 25, 1996 and continued through August 16, 1997. Additional data recovery took place in February, March, June and September 1998. A number of students and interested volunteers conducted the supervised fieldwork over the weekends of that period, many of which stretched over three and four days. Several weeklong field sessions were also conducted during the period.

At the beginning of the archaeological investigation, a site datum established during remote sensing surveys conducted in an earlier investigation carried out in 1990 and 1991 was found again and became the principal datum for all subsequent project measurements. Over the course of the investigation, researchers excavated 14 test units on either side of -- and in -- the lower portion of the access road (Figure 4-4). In addition, three substantially larger excavations took place on the beach. As data were recovered in the excavations, the size and configuration of most test units expanded in

Figure 4-2 line drawing of cove and terrain on Surfer topo

Figure 4-3 Photos Marine terrace 1866/1958

Figure 4-4 – unit layouts

one direction or another. On-going data recovery determined the location of the units, and simultaneous excavation took place in many of the units over the course of the 18-month investigation.

Several strategies were employed to determine the location of the excavation units. Bore holes were drilled to determine the lateral extent of the feature that had been exposed through erosion in the sidewall of the marine terrace. A hand auger was used to recover subsurface samples in 10-centimeter increments to a depth of approximately 100-centimeters in several locations opposite the feature. The first test units were excavated in the locations of the boreholes that contained either historic cultural material or material that was possibly associated with the erosional feature.

Additional test units were excavated immediately above the erosional feature, and adjacent to it as its configuration was exposed. Test units were also excavated in the projected location of a wood barn depicted in a photograph of the cove that dated to 1866. Those units were designed to expose any architectural remains of the structure so that its location and orientation could be analyzed relative to the material recovered from the surrounding excavation units. Finally, additional units were excavated on the basis of magnetic anomalies identified in remote sensing surveys conducted along the remaining portion of the marine terrace, and the beach itself.

All units were laid out and excavated in metric measurements. Except in those instances where a clearly defined feature was encountered, units were excavated in arbitrary 10 cm levels that were controlled with a line level attached to a unit subdatum. As familiarity with the depth of the modern overburden progressed, the first levels of some of the later units were excavated in thicker strata, as discussed below. In investigating features, the configuration and depth of the feature controlled the excavation levels.

Each subdatum was situated just beyond the unit's northwest corner, and elevated 10 cm above the ground surface. In the subsequent analysis of the excavated strata, all unit elevations were adjusted for uniformity.

Soils and sediment from each 10 cm excavation level were screened through 1/8" shaker screens and cultural constituents from each level were noted on a corresponding level record. Those conducting the screening placed the artifacts recovered from each level in bags numbered with the appropriate provenience information. Excavators mapped and photographed features *in situ* that were exposed as digging progressed. Where appropriate, features were pedestalled until association with other artifacts or features in lower levels could be ascertained. This procedure was followed in each of the test units excavated on the terrace, although the depth of the initial arbitrary levels changed as excavators gained familiarity with the nature of the substrate and the thickness of the modern overburden. Beach excavations were conducted in a slightly different fashion, as discussed below.

Stratigraphy: The stratification of the site was fairly uniform. From the ground surface to a depth of approximately 30 cm, the sediment was typically a sandy brown clay loam (Munsell: 10YR4/2 to 10YR5/4), sandy and slightly plastic, with rounded and subangular gravel inclusions (sandstone and shale) and a few small cobbles. At a depth of approximately 30 cm, the sediment changed in both color and consistency. At this depth across the site, the sediment was a slightly darker, yellowish-brown clayey sand that contained rounded to subangular gravels and cobbles. Interspersed in this matrix from approximately 30 to 80 cm below the surface were flecks of charred wood or charcoal, bits of glass and ceramic, iron and copper nails, and the various other artifactual materials that will be discussed below.

From depths of approximately 80 cm to the bottom of each excavation unit, which in some cases reached 180 cm, the sediments were uniformly found to be dark gray clay (Munsell: 10YR3/2) with heavy inclusions of oxidizing, decomposing sandstone. No cultural material was recovered from these levels and as the project developed, when excavation units encountered this type of matrix they were considered to have reached culturally sterile sediments.

Excavation Units

As data were recovered in the excavation units, the initial size and configuration of many of the units expanded in one direction or another. On-going data recovery was used to assist in determining the location and orientation of new units, and simultaneous excavation took place in many of the units over the course of the 18-month investigation. For the sake of clarity, however, each unit is described below as a complete, individual entity. Artifacts recovered from the excavations are mentioned in the discussion of each excavation unit. They will be more fully described in the following chapter.

As discussed previously in Chapter 1, the erosion that occurred in 1996 exposed what appeared to be the remnants of a stone foundation in the side of the remaining portion of the terrace, on the south side of the lower access road, near its termination at the beach (Figures 4-5 and 4-6). In June 1996, in conjunction with Santa Rosa Junior College's archaeological field school, students and volunteer researchers

Figure 4-5 line drawing of SRJC sidewall map

Figure 4-6 Photos of sidewall w/rene

excavated three test units on the north side of the access road, opposite the exposed stone feature. These excavations were an attempt to determine whether or not an alignment of stones parallel to those observed in the sidewall could be located at a distance consistent with the width of the buildings described in the Sutter inventory (refer to Chapter 1). As mentioned above, the locations of the test units were determined on the basis of test bores excavated along and around the projected location of such an alignment. Auger hole number one proved to be culturally sterile and was abandoned. Brick fragments were recovered in auger hole number two from depths 10-20 cm below the surface. Slag was recovered from a depth of 20-30 cm, and heavy concentrations of brick, charcoal, glass sherds, slag, and redwood were recovered from 30-55 cm. Below that level, the substrate appeared to be culturally sterile.

In auger hole number three, small quantities of glass, abalone shell, brick, slag, and redwood were recovered from similar depths. On the basis of this information, test units were opened at the locations of auger bores two and three (Figure 4-7).

<u>Test Unit 2</u>: Although it was the first of the test units, this 1-x-1 m excavation was designated as test unit number two since it was situated at the location of auger hole number two. The location of the auger hole determined the placement of the northeast corner of the unit, which was oriented to conform to the upward slope of the terrace, rather than to a cardinal direction. Excavation of the unit occurred in 10 cm levels to a depth 60 cm below the surface.[1] Brown, sandy soil (Munsell 10YR4/2 to 10YR4/4) lightly intermixed with small bits of charcoal or burned wood, glass sherds, pieces of slag, pieces of brick, mussel shell, and fragments of redwood characterized the

[1] Although each unit's excavation was controlled with an elevated unit datum, all depths refer to a measurement from the surface level.

Figure 4-7 Bore hole locations

archaeological matrix. Two ceramic sherds (one possibly creamware), an obsidian waste flake, and six chert waste flakes were recovered from the unit. The quantities of artifacts increased as the excavation deepened, with maximum concentrations of all artifact categories occurring in the depths between 20 and 50 cm. At the bottom of the fourth level 30-40cm, an iron horseshoe was exposed in the southern wall of the unit. It was pedestalled and left *in situ* until excavators could determine whether or not it was associated with other artifacts or features in lower levels. In the fifth level 40-50 cm, the edge of a redwood beam or board was exposed in the unit's northern sidewall at a depth of 47m. The auger hole from test bore number two had penetrated the edge of the wood, which proved to be a source of the redwood recovered in the test bore. At the bottom of the level, excavation exposed the surface of a heavily degraded redwood beam, 18 cm wide that extended across the width of the northern half of the unit (Figures 4-8 and 4-9).

Figure 4-8: TU2, View West

In the next level (50-60 cm), the typical assortment of cultural material (slag, brick fragments, glass sherds, iron nails, etc.) was recovered along with a small, rectangular piece of copper sheathing material and a fragment of iron bar. Excavation around the redwood beam determined it was approximately 6 cm thick. In the north

Figure 4-9 Illustrator figure TU2

sidewall, the side of the beam located there was fully exposed and determined to be 20 cm thick. In the very bottom of the level, the surface of another heavily degraded beam or plank was exposed between the beam in the north sidewall and the beam that crossed the width of the unit.

Excavation of level 7 (60-70 cm) served to further expose the third beam, which was situated 63 cm below the surface, and measured 16 cm in width and 7 cm in thickness. The auger bore had completely penetrated its eastern end (refer to Figure 4-9). As with the beam exposed in the previous level, the redwood was heavily checked. In both beams, the longitudinal center portion had the appearance of a groove, but because the wood was so heavily degraded, it was not possible to ascertain whether this was natural deterioration of the wood or an intentional recess cut into the timber.

The close proximity of the two beams to each other and to the unit's north wall limited excavation of the next level (level eight, 70-80 cm) to the southern portion of the test unit, between the south wall and the southern edge of the first beam. Although the comparatively sparse concentrations of cultural material in the previous two levels suggested level eight was below the cultural strata, the additional 10-centimeters were excavated to determine whether or not an alignment of rocks underlay the southernmost beam. Such would be the case if the beams exposed in the test unit were the disarticulated mudsills of a foundation that paralleled the stone alignment observed in the sidewall across the road. Aside from a single slag fragment and a few small pieces of charcoal however, nothing was recovered from level eight and no stones were observed beneath the redwood beam.

In order to determine whether or not a stone alignment underlay the beam to the north, the center section of the southern beam was removed to allow excavation of the sediment that lay between them. The grooves running down the centers of both beams were the impetus for this approach. They resembled longitudinal mortises and, if they were intentional modifications and not simply the product of the wood's deterioration, they would suggest the possibility that the beams had been stacked, with the grooves accepting a mating tenon projecting from the bottom of the superior beam. If that were the case, the beams exposed in the test unit may have simply fallen over. The possibility existed, then, that the northernmost beam was the lower of the two, and rested on the alignment of stones that would have been the basis of a foundation.

Excavation to the bottom of level eight determined that no such stone alignment existed, and the beam was simply resting on the dirt. Of some interest, however, was the recovery of a brass "Phoenix" button beneath the lowest portion of the wood beam at a depth of 82 cm.[2] No other artifacts were recovered from this level.

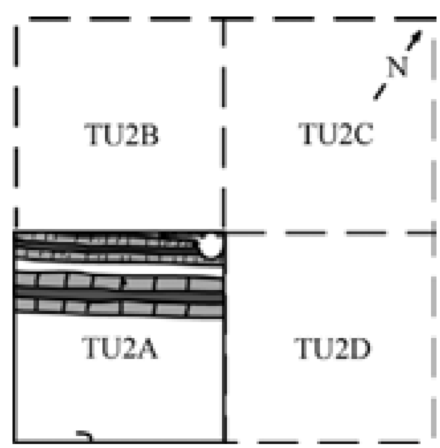

Figure 4-10: TU2A-D

In subsequent investigation of this feature, the test unit was expanded into a 2-x-2 m excavation (Figure 4-10). The four 1-meter squares comprising the expanded unit were designated as units A through D. Excavations commenced in unit D, the square immediately east of unit A.

[2] "Phoenix" buttons were produced for the uniforms of the army of King Christophe of Haiti. They were popular trade items for the Northwest- Coast Indians around 1830 and are useful temporal indicators (Strong 1975:74). The button and its significance will be discussed in detail in the next chapter.

TU2D: The same mixture of slag, glass sherds, brick, redwood fragments, bits of charcoal and marine shell observed in unit A was recovered from unit D. One notable difference was the higher occurrence of obsidian flakes throughout the strata identified as the cultural layer. The tip of a projectile point, six reduction flakes, and one chert flake were recovered in the strata between 10 and 40 cm. In addition, another small strip of copper sheathing material was recovered from the stratum between 30-40 cm.

The wood beams exposed in unit A were encountered in the northern portion of the unit in the 40-50 cm level (Figure 4-11). As in unit A, another 10 cm stratum was excavated on the southern side of the beams. Although a few pieces of slag (n=10), an iron nail, and two pieces of marine shell were recovered from the level beneath the beams, the nature and quantity of cultural material recovered from beneath the level of the beams was negligible.

TU2B: In order to determine the width of the wood beam array, attention turned to unit B, situated immediately above unit A. Slag was the predominate type of cultural material recovered in the excavation of this unit (n=48) although, as with the other two units, brick fragments, ceramic sherds, lead bird shot, glass sherds, and marine shell were also recovered. Obsidian (n=2) and chert (n=1) flakes were also recovered from the 20-30 cm and 40-50 cm levels and a small strip of copper sheet was recovered from the 20-30 cm stratum. Fragments of the redwood beams were exposed at approximately 40 cm. The nature of the matrix changed noticeably in this unit. South of the wood beams, the sediment was loosely packed, dark, organic, and friable. North of the wood, the sediment was culturally sterile and heavily laden with oxidized sandstone and rock.

Figure 4-11 TU2 with expanded units

Excavation continued into the 50-60 cm layer where large portions of the redwood beams were exposed in the northern half of the unit, beneath the sandstone/rock matrix of the previous level. Several iron spikes (n=10) were exposed in association with the redwood beams. They had not been driven into the wood, but they were grouped in a loose pile immediately south of the beams in this unit.

TU2C: In the fourth 1-m unit, designated as unit C, the redwood beams were first exposed in level three, 20-30 cm below the surface. Unlike the compact, rock matrix found in the northern portion of unit B, the sediment in unit C was much finer and more loosely packed, although it contained quantities of small, gravel-size rock. Excavation continued around the redwood beams to a depth of 60 cm. Slag was the predominant artifact recovered (n=29), 1 creamware sherd, 2 brick fragments, abalone shell, iron nail fragments, 1 iron spike head and assorted iron nail body fragments were recovered from the cultural layer.

The arrangement of redwood beams exposed in the 2-square meter unit did not appear to be the foundation elements suspected to have paralleled the alignment of stones observed across the road in the sidewall of the marine terrace. Although heavily degraded, the beams appeared to be both too wide and too thin to be mudsills. In addition, no evidence of a stone alignment, typically used to create a level foundation, was observed in the excavation. Subsequent analysis of an 1866 photograph suggests instead, that the beams are remnants of what may have been a wood retaining wall.

Confirmation of this interpretation was made while using a technique developed by Gene Prince of the Phoebe Hearst Museum of Anthropology at UC Berkeley (Prince 1988), in which the images in an historic photograph are superimposed on the modern landscape. A slide transparency of an 1866 photograph of the Ross stockade and cove was used to visually reconstruct the past configuration of the cove area. Prominent in the 1866 photo is a large, dilapidated barn and corral, situated on the beach below the stockade area (Figure 4-12).

The slide of this image was placed on the focusing screen of a 35-mm camera equipped with a zoom lens. A view through the camera lens then produced a view through the transparency. The position from which the 1866 photograph had been taken was relocated and the camera with the transparency was placed on a tripod. With the variable focal length provided by the zoom lens, a view through the camera superimposed the 1866 view onto the modern landscape. Volunteers on the beach were observed through the camera and directed by radio to the location of the beams exposed in the excavations of test unit two. Their location and alignment was exactly the same as that of a partially obscured feature in the photograph that appears to be the remains of a short retaining wall. Interpretation of this feature will be discussed in the next chapter.

<u>Test Unit 3</u>: As with test unit two, the number for this test excavation was derived from the number of the auger hole at which it was situated. Although it was the second test unit to be excavated, it was designated as test unit three since it was situated at the location of auger hole number three. The location of the borehole marked the northeast corner of the 50 cm-x-2 m unit, which was oriented to conform to the upward slope of the terrace, rather than to a cardinal direction. Excavation of the unit occurred in 10 cm levels to a depth 120 cm below the surface.

The first three excavation levels (0-30 cm) contained very small quantities of clear and green bottle glass fragments, and redwood fragments but were otherwise devoid

Figure 4-12 --1866 picture of barn

of any cultural material. In the fourth excavation level (30-40 cm) abalone shell fragments, and sherds of clear glass, (possibly windowpane) were recovered[3].

The heaviest concentrations of cultural material were recovered from the next three excavation levels (40-70 cm), although artifacts were found as deep as 120 cm below the surface. Between levels five and seven, concentrations of brick fragments (n=17), flat iron fragments (n=23), mammal bone (n=10), and abalone shell (n=14), some possibly culturally modified, were recovered. In addition, a single glass trade bead and a possible hammerstone were recovered from level seven (60-70 cm).

No evidence of the redwood beams exposed in the adjacent test unit number two were observed in test unit three, although small pieces of burned wood were recovered from levels eight (70-80 cm) and 11 (100-110 cm). In the five levels excavated below level seven (from 70-120 cm), the quantities of artifacts decreased significantly, and the nature of the recovered cultural material changed as well. Chert debitage, fire-altered rock, a ground stone tool, mammal bone, and marine shell fragments were recovered in association with small quantities of brick fragments, the head of a copper sheathing nail, a glass sherd, charcoal fragments, and fragments of redwood[4] (Figure 4-13).

<u>Test Unit 4</u>*:* In conjunction with the excavations of test units 2 and 3, a third excavation unit was opened to determine the lateral extent of the redwood beams exposed in test unit 2. Situated between test units 2 and 3, test unit 4 was a 50 cm-x-2 m rectangular exposure excavated to a final depth of 50 cm. As with the first two test units, test unit 4 was oriented to conform to the upward slope of the terrace, rather than to a cardinal direction.

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[3] Munsell color of levels 1-4: 10YR5/3
[4] Levels 5 – 12

Figure 4-13: Strat profile TU3

Due to an error in calculating its depth, level 1 was excavated as a 20 cm level. The next four levels were each excavated as 10 cm levels. Cultural material recovered from each level was similar in nature and color to that recovered from test units two and three. Brick fragments, charcoal, green, brown, and clear bottle glass, and slag were recovered from both levels 1 and 2 (0-30 cm). In addition, fragments of mammal bone, iron nails (n=8), several pieces of flat iron (n=7), a ceramic creamware sherd, and a heavier concentration of slag (n=16) were recovered from level 2. Two redwood beams that appeared to be extensions of those discovered in test unit 2 were exposed in level 2, projecting from the east side of the trench (Figure 4-14). These were in the same alignment and at the same elevation of the beams exposed in the adjacent test unit. The ends of the beams appeared to have been sawn and, although another fragment of the beams was found on the west side of the trench, it appeared that the two stubs projecting from the east wall marked the end of the feature exposed in test unit 2.

Figure 4-14: Test Unit 4. View NW

Levels 3 (30-40 cm) and 4 (40-50 cm) were excavated around the redwood beams and yielded the same type of cultural material as found in the first two levels. Notable in these strata was the recovery of several pieces of clear bottle glass from level 3 that were embossed with the same pattern as glass fragments recovered from level 1, and an obsidian flake recovered from level 4.

Foundation Test Unit 1*:* During the course of the Santa Rosa Junior College Field School, students removed all vegetation on the face of the bluff in which the stone alignment had been observed, and prepared a stratified profile. The drawing was used to guide the first excavation on the south side of the lower access road near its termination at the beach (refer to Figures 4-5 and 4-6). A 1-x-2 m excavation unit was opened directly above the stone feature. The unit was cut into the edge of the terrace and consequently comprised only three walls. Because the feature being investigated in this excavation was thought to be the remnant of a foundation alignment, the test unit was designated as Foundation Test Unit 1. In one of the most regrettable strategic decisions of the project, all subsequent test units excavated on the south side of the road were distinguished from those on the north side by the addition of the letter "F" (i.e.) FTU1 vs. TU1. The danger in relying on the inclusion of this single letter to differentiate the locations of test units that shared the same number (i.e. TU1 and FTU1) did not become apparent until the field research was well underway and at a point that was too late to make a change in the numbering system.

The configuration of FTU1 changed substantially over the course of the excavation. At the northern edge of the test unit, along the edge of the road, a large rock (perhaps 100-x-120 cm in size) initially blocked expansion of the unit in that direction (Figure 4-15).

As the investigation of the 1-x-2 m unit progressed, it became necessary to expand the excavation to the north, so a 50-x-50 cm extension of the unit was excavated

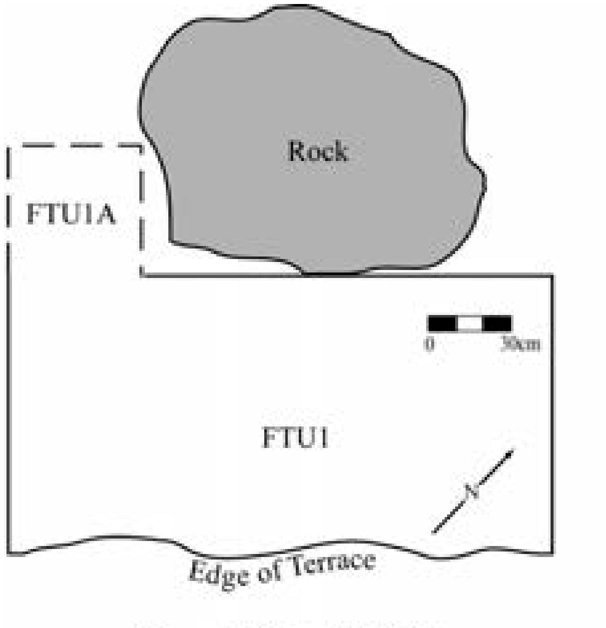

Figure 4-15: FTU1 & 1A

on the west side of the of the rock. The extension was designated FTU1A. It soon became necessary to expand FTU1A, so the rock impediment was rolled to the north and the 50 cm width of the unit was extended to the east, along the north edge of FTU1 for an additional 150 cm to match the width of the original unit. A subsequent 50 cm-x-2 m extension of FTU1A to the north, along its 2-m length was excavated and designated FTU1B (Figure 4-16).

As the investigation proceeded, the western end of FTU1, the initial 1-x-2 m unit, was extended to the west by an additional 70 cm to investigate a feature that appeared to be a vent. This was later extended to the west an additional 170 cm to accommodate the recovery of a nested set of barrel hoops. The extension was designated FTU1C and a subsequent 60-x-170 cm expansion of FTU1C to the north was designated FTU1D (Figure 4-17).

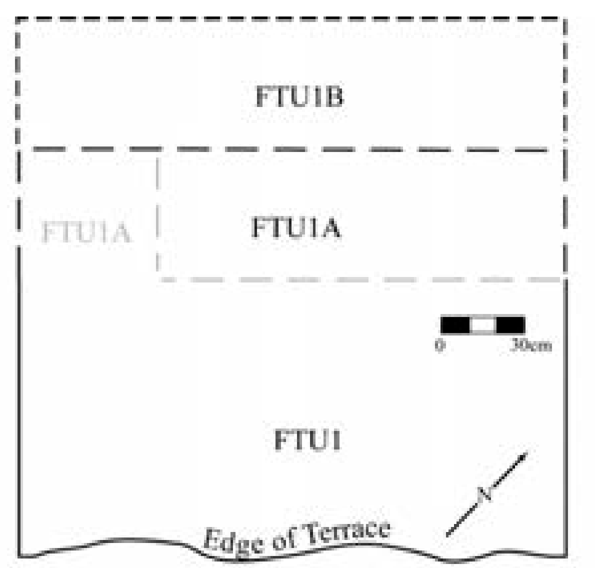

Figure 4-16: FTU1A & B, Plan View

As depicted in the pre-disturbance drawing of the bluff face (refer to Figure 4-5) and described in the

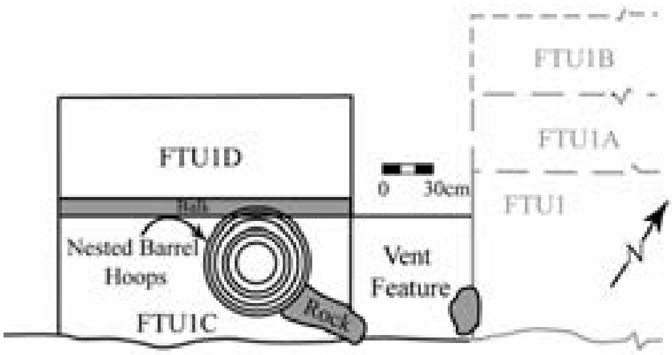

Figure 4-17: Expansion of FTU1 to FTU1C and FTU1D (Plan View)

stratigraphy section above, a stratum of light brown sediment[5] 60 to 80 cm thick lay above a stratum of dark brown or black, granular sediment[6] that varied in thickness from 10 to 160 cm. The stone alignment that was the original focus of the excavation was situated near the upper boundary of the lower stratum.

As with the test units excavated on the opposite side of the access road, FTU1 was excavated in 10 cm levels. Although the first stratum contained modern nails, bottle glass, and crown bottle caps, much of the same type of cultural material observed in the test units across the road was recovered from FTU1. Abalone shell, ceramic fragments, glass fragments, heavily oxidized iron nails, brick fragments, fragments of copper sheathing, copper nails, and mammal bone were recovered from throughout the ten excavation levels, but in greater quantities than those recovered from the test units on the northern side of the road. The greatest concentrations of this cultural assemblage were found between levels 5 and 6, 40-60 cm below surface, with chert flakes (n=9), copper sheathing nails (n=15), and brick fragments (n=14) predominating. A leather shoe sole and 5 obsidian flakes were also recovered from these two levels.

In the sixth excavation level (50-60 cm) the archaeological matrix changed from a tan, loosely packed sediment into a black, coarse, granular sand heavily laden with bits of

[5] Munsell: 10YR6/4
[6] Munsell: 10YR3/2

burned wood or charcoal and small pieces of oxidized sandstone. The matrix, which itself appeared to have been burned, was considerably more compact than the superincumbent strata and tended to clump together. This matrix continued through levels 7 and 8 (60-80 cm). In level 7, a slight depression was exposed along the southern edge of the trench. The depression, which appeared to be intrusive to the surrounding black, granular sediment, was filled with the same light colored tan sediment that formed the matrix of excavation levels 1 through 6.

Excavation at the bottom of level eight (70-80 cm) exposed the stone alignment observed in the face of the bluff – the suspected foundation wall configuration. Rather than exposing a single line of stones that could have supported the mudsill of a foundation however, the excavation uncovered a floor of rocks that appeared to extend beyond the limits of the test unit's walls (Figure 4-18). The stones had been placed on a flat, horizontal plane and appeared to have been burned, as they were all discolored and many were cracked *in situ*.

One lead shot was recovered from within the burned-sand matrix in level 7 (60-70 cm). A second lead shot, approximately 9 mm in diameter, and two obsidian flakes – one the tip of a projectile point, were recovered from between the rocks forming the floor of level 8. Other than these artifacts, no cultural material was recovered from the beginning of level 7 (60 cm) through the bottom of level 8 (80 cm) other than the numerous bits of burned wood or charcoal mixed throughout the burned sand matrix.

FTU1A: As mentioned, a large rock situated at the northern edge of the excavation unit prevented further investigation of the fire-altered stone floor to the north. In order to determine whether or not it was worth the investment of time and effort to

Figure 4-18 --Photos 4-F and 4-G

move the rock, a 50-x-50 cm unit was opened south of the rock, at the northern edge of FTU1 (refer to Figure 4-15). Excavation of the first 40 cm of the unit, designated as FTU1A, determined that the matrix and the cultural constituents were similar enough to those observed in FTU1 to justify expanding the unit -- and moving the rock -- in order to gain a broader exposure of the stone floor. Consequently, after rolling the large rock further to the north, the 50 cm width of FTU1A was expanded by an additional 150 cm along the northern edge of FTU1.

The expanded portion of FTU1A was then excavated in 10 cm levels until the elevation of the initial 50-x-50 cm unit was reached. At a depth 50 cm below surface, the decision was made to expand FTU1A an additional 50 cm to the north. The 50 cm.-x-2 m expansion was designated as FTU1B.

FTU1B: As the excavation of FTU1B proceeded, the nature of the matrix began to change from the friable, light tan sediment previously observed in the upper layers of FTU1 and FTU1A to one increasingly more laden with small gravels. Initially, the gravel appeared to be concentrated in the broad area that had underlain the large rock but as excavation proceeded, the gravel composition of the matrix came to be more localized. At a depth of 40 cm the gravel matrix had changed to one more densely laden with larger cobbles that were concentrated within a more circumscribed area. Beneath this level, at a depth of 50 cm, the excavation of FTU1B reached the previously excavated level of FTU1A. Thereafter, FTU1A and FTU1B were excavated as a single 1-x-2 m unit, although provenience for the artifacts recovered from each unit was respectively maintained.

At the 60 cm depth, the stratum of burned, charcoal-laden sand observed at the same elevation in FTU1 was again encountered. In the northeast corner of the excavation a scattered layer of fire-altered rock was exposed. Unlike the stratum of burned sand encountered in FTU1, an intrusive layer of tan colored, gravel laden sediment spread across the bottom of the excavation, in the same relative location as the concentrated cobble deposit observed in the superincumbent stratum. Seen in cross-section, the edge of the intrusive sediment appeared to be a pit (Figure 4-19). Continued excavation through this level revealed that, rather than a pit, the feature was actually an intrusive, square-sided trench that had been back-filled with the tan sediment that comprised the matrix of the previously excavated strata. The southern edge of the trench had been disturbed and had created the appearance of a pit in the sidewall of FTU1A/B (Figure 4-20).

The trench itself was excavated and proved to be sharply rectangular in cross-section. It measured 50 cm in width and was 20 cm at its deepest point, although accurate measurements of its depth were hampered by the irregularities in the surface of the black sand matrix. The trench appeared to continue into the north sidewall, and presumably under the adjacent access road.

Attention was next turned to a feature observed in the vertical face of the bluff at the western end of FTU1. The feature appeared to be a rectangular depression cut into the stratum of black, burned sand that had been encountered at approximately 60 cm below surface in FTU1 and FTU1A/B. In view of the exposure and excavation of the trench found in FTU1A/B, it appeared that the rectangular depression may have represented a second trench cut into the sand substrate, or possibly a type of vent

Figure 4-19 – line drawing of level record FTU1-B-level5 & level 6 and line drawing of sidewall --drawing bottom of level 4)

Figure 4-20 – line drawing of trench feature and Photo 4-H of trench on same sheet associated with FTU1 (refer to Figure 4-17). A small test excavation, 50-x-60 cm was excavated to determine the nature of the feature and its relationship to the larger feature exposed in FTU1. This preliminary excavation was labeled as the "vent feature."

No cultural material was recovered from the excavation, although an arrangement of fire-altered rocks, similar to those observed in the excavation of the adjacent FTU1, was observed at a depth of 50 cm. At a depth of 60 cm the stratum of black burned sand was encountered. Although inconclusive, it appeared that the rectangular feature might have been the remains of the sidewall that formed the western end of the feature observed in FTU1 and FTU1A/B. This interpretation was enhanced through a subsequent excavation immediately to the west of the "vent" feature.

Following the winter and spring rains of 1998, a portion of the bluff southwest of the FTU1 and FTU1-vent excavations had eroded, exposing the edges of several iron bands in the face of the bluff. The bands were situated approximately 40 cm below surface and 80 cm west of the vent feature (Figure 4-21).

FTU1C: In order to determine the nature of the bands and what relationship, if any, they had to the feature exposed in FTU1A/B, a new excavation unit was opened immediately above the bands. The new unit, designated FTU1C, was a 170-x-70 cm extension of the vent feature excavation (refer to Figure 4-17). Excavated in controlled, 10 cm levels, the unit was virtually sterile in terms of cultural material.

At the bottom of level 4 (30-40 cm), the top of the metal band assemblage was exposed. The arrangement comprised six circular, nested iron hoops that were highly oxidized and extremely fragile (Figure 4-22). At least one of the exterior hoops had been bent and appeared to be almost straight. The assemblage continued into the northern

Figure 4-21 – photos of barrel hoops

Figure 4-22 plan view of hoops in FTU1C&D

sidewall of the excavation. Consequently, the excavation unit was extended to the north by an additional 60 cm.

FTU1D: The new unit was designated FTU1D and was separated from FTU1C by a 10 cm wide balk, maintained to determine the significance of any visible cultural stratification in the deposit (refer to Figure 4-22). The first excavation level of the new unit was removed as a 20 cm stratum and each of the subsequent levels was excavated in 10 cm increments.

Unlike FTU1C, the new excavation yielded several artifacts. Notable among these was a single trade bead recovered in the northwest corner of the first excavation level (0-20 cm). Brick fragments (n=3) were recovered from the first and second levels, and a decorated ceramic fragment and the head of a copper sheathing nail were recovered from the second level (20-30 cm). Leather fragments (n=3) were recovered from the first three excavation levels (0-30 cm).

Because the iron hoop assemblage was lying at an angle, it was encountered at the shallower 20-30 cm depth in FTU1D. The top surface of the assemblage on the north side of the balk was exposed and the balk was removed, following an examination of its sidewall - which gave no indication of cultural stratification.

Because of the fragility of the iron hoops, it was necessary to recover them en masse, using the techniques employed by paleontologists to recover degraded, fragile skeletal elements. The top portion of the assemblage was completely exposed, then painted with a consolidating polyvinyl acetate/acetone mixture. The sides of the assemblage were then exposed and coated with the acetone mixture. Gradually, the mass of the entire assemblage was exposed, pedestalled, and coated with the consolidating acetone mixture. Strips of plaster casting material were then wrapped across and under the assemblage, which was then cut from its pedestal and removed from the excavation.

Investigation of the matrix below the position of the iron hoop assemblage revealed that the strata of black, burned sand encountered in FTU1 and FTU1A/B were not present. The close proximity of the hoop assemblage to the location of the "vent" feature, and the absence of the burned sand from the underlying matrix reinforced the interpretation of the "vent" feature as the remains of the side wall that formed the western end of the feature observed in FTU1 and FTU1A/B.

<u>Foundation Test Unit 2</u>*:* Examination of the bluff face northeast of the location of FTU1 determined that approximately 57 cm of light brown sediment lay above the stratum of black, burned sand that, in turn, extended to a depth of approximately 125 cm below the top of the embankment. The line of stones that had been observed in the face of the embankment at the location of FTU1 was not evident, since Fort Ross Creek had eroded the lower face of the bluff. However, a projected alignment of the stones placed them at the bottom of the burned sand stratum (Figure 4-23). In order to determine whether or not the floor of fire-altered stones observed in FTU1 continued to the northeast, a 1-x-1 m test unit was excavated above the portion of the bluff face that had eroded away.

Designated as FTU2, the test unit was excavated at the edge of the terrace and consequently comprised only three walls, as was the case with unit FTU1 (Figure 4-24). The first three excavation levels (0-20 cm, 20-30 cm, 30-40 cm) appeared to be culturally sterile during excavation but in screening the backdirt, an artifact assemblage similar to that observed in the others excavation units was recovered. Bottle glass, a ceramic sherd,

Figure 4-23 – Drawing of FTU2

Figure 4-24: FTU2, View Northwest

iron nail fragments, marine shell, a copper sheathing nail, and numerous fragments of charred wood comprised the bulk of the assemblage in these levels.

Beginning with the fourth excavation level (40-50 cm) mammal bone and an increasing number of marine shell fragments were exposed in the excavation. In addition, increasing quantities of culturally modified groundstone, chert and obsidian were recovered in the same levels that yielded copper and iron nail fragments, and relatively large numbers of charred wood fragments. In levels 6 through 9 (60-100 cm), for example, fragments of mammal bone (n=9), abalone shell (n=39), ceramic sherds (n=2), copper sheathing nails (n=5), iron square nails and fragments (n=17), groundstone (n=1), a groundstone *mano* (n=1), a large piece of slag (n=1), modifid chert flakes (n=9), obsidian flakes (n=2), an obsidian projectile point fragment (n=1), charred wood fragments (n=100), and non-burned wood fragments (n=94) all were recovered. In level 10 (100-110 cm), a single copper sheathing nail was recovered along with three chert flakes and 32 wood fragments, 25 of which had been burned. Obsidian and chert flakes were also recovered from levels 11 through 14 (110-150 cm), but no other non-native cultural material was recovered from these levels, suggesting the bottom of the historic cultural strata had been reached.

No evidence of the burned sand strata or fire-altered rock floor encountered in FTU1 was observed in the excavation of FTU2, although the matrix below level 5 (50-60 cm) was considerably more granular in texture than the clay-like strata encountered in the upper excavation levels.

Foundation Test Unit 3: Following the initial excavation of FTU2, a third test unit was opened further along the edge of the bluff to the northeast. Designated as FTU3, the 1-x-2 m unit was positioned above several pieces of burned wood that were visible in the face of the bluff, approximately 110 cm below the bluff top. The proximity of these burned timbers to the projected location of the barn pictured in the 1866 photograph suggested they may have been associated with the removal or destruction of the barn, the historical disposition of which is unknown.

Figure 4-25: FTU2 and FTU3, View Northwest

Like FTU1 and FTU2, this unit was located at the edge of the terrace and consequently comprised only three walls (Figure 4-25). With the familiarity of the archaeological matrix gained from the excavations of FTU1 and FTU2, the first level of FTU3 was excavated as a 20 cm stratum. It proved to be culturally sterile. Subsequent levels were excavated in 10 cm increments to a maximum excavation depth of 180 cm.

Two small pieces of lead, a small copper strip, and three iron nail fragments comprised the few artifacts recovered from the first three excavation levels (0-40 cm). In level 4 (40-50 cm) the first evidence was encountered of the burned wood fragments previously observed in the sidewall. Both burned and unburned fragments of redwood (n=15), and a champagne bottle finish[7] were recovered from this level. Beneath it, in level 5 (50-60 cm) a dense concentration of burned and unburned wood fragments (n=~100) was exposed. Mixed within it was a variety of historic and native Californian cultural material. Chert flakes (n=2) and abalone shell fragments (n=6) were recovered along with a brick fragment, ceramic and glass sherds (n=2; 6), pieces of flat iron (n=24), and iron spikes (n=10). The same type of material was recovered from level 6 (60-70 cm), with the addition of highly degraded mammal bone (n=10) and groundstone fragments (n=2). The quantity of small burned wood fragments increased to over 460 in this level.

With the addition of a copper sheathing nail, the same mixture of cultural material was again recovered in level 7 (70-80 cm), but the number of burned wood fragments increased to over 500. In level 8 (80-90 cm), the first intact pieces of wood were encountered. These comprised the ends of two charred beams that projected approximately 40 cm and 18 cm respectively from the north sidewall of the unit. Although heavily degraded, the beams measured approximately 16 cm in width and, after further excavation, proved to be approximately 20 cm thick. Excavation of level 9 (90-

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[7] The "finish" is the very top of the bottle; the portion to which the cap attaches. It is a diagnostic attribute of historic bottles that can indicate contents, age, and type of manufacture.

100 cm) fully exposed these beam fragments. The shorter of the two beams had a slight curvature along its longitudinal axis and the ends of both appeared to have been sawn. Excavations to the bottom of this level exposed another beam fragment adjacent to the end of the longer beam. It, too, had been burned and was in a more advanced state of deterioration. To the east of this arrangement of beams, the stub end of a smaller (5 cm x 11 cm) board projected vertically from the floor of the level. In the west corner of the unit, two more wood fragments were exposed. Smaller than the beams that were first encountered, these two fragments were highly deteriorated and lacked any discernable angular shape. The larger of the two projected approximately 25 cm from the sidewall and was about 20 cm long. The second fragment measured approximately 5-x-10 cm. Like the other beam fragments, both had been burned (Figure 4-26). Two copper sheathing nails, an iron spike fragment, abalone shell fragments, and three small mammal bone fragments were recovered by screening the matrix of this level.

Excavation of the next five levels (100-150 cm) consisted of pedestalling, mapping, and removing the various pieces of charred wood beams and wood fragments that were encountered in each level. The density of the wood deposit increased from levels 10 through 12 (100-130 cm), started to decrease in level 13, and ended in level 14 (140-150 cm). The beams, planks, and wood fragments recovered from these levels had all been burned, as the exteriors of each were charred, but in many of them, the fire had not affected their interior portions. All of the wood recovered from FTU3 appeared to be fragments of larger pieces, since none had any appreciable length. The pieces ranged from planks measuring approximately 20-x-80 cm, to beams of 4-x-6-x-25 cm, to smaller pieces measuring approximately 8-x-15-x-30 cm (Figure 4-27). The condition of most

Figure 4-26 Plan View of Level 9

Figure 4-27 Plan Views of levels 12 & 13 pieces made it difficult to determine whether or not the wood had ever been surfaced, although several exhibited evidence of having been shaped. One piece in particular, recovered from the east side of the unit in level 13 (130-140 cm), clearly had been shaped. Measuring approximately 13-x-15-x-20 cm, this stub-end of a beam had been split at a point where a 4 cm (1 5/8-inch) diameter hole had been bored through (Figure 4-28). Its dimensions, the curvature along its longitudinal axis, and the size of the hole suggested the timber was related to ship construction activity[8]. This interpretation will be explored more fully in the following chapter.

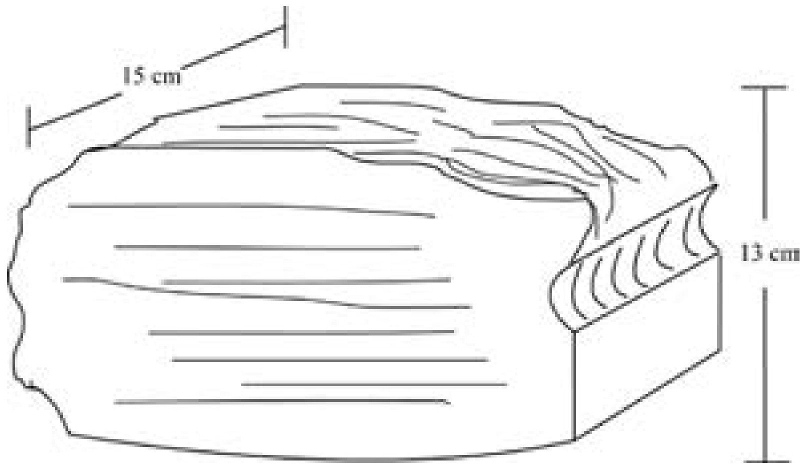

Figure 4-28: Stub end of redwood beam

As excavations progressed through the deposit of charred wood, more of the cultural material encountered in previous levels of the unit was recovered, although in smaller quantities. Mixed among the wood beam and plank fragments in levels 10 through 13 (100-140 cm) were chert flakes (n=7), copper sheathing nails and nail parts (n=5), iron nails and nail fragments (n=2), and one brown bottle glass fragment. Beneath the wood deposit, in levels 14 through 17 (140-180 cm), excavation produced two

[8] As will be discussed in Chapter 6, the dimensions are consistent with a piece of ship's framing called a "futtock."

obsidian flakes, one obsidian projectile point, two chert flakes and one copper sheathing nail, the latter recovered from level 17.

In February 1997, the rains of a heavy winter storm caused the rear and side walls of the excavation unit to collapse. Although the unit had been covered with a tarp, rainwater running across the access road had seeped beneath the covering and eventually saturated the ground to the point of failure. Fortunately, excavation of the unit had been completed so no archaeological data were lost. To the contrary, the collapse of the unit's walls exposed more of the burned wood deposit to the north, beyond what had been the unit's rear wall. The size of this newly exposed feature suggested that the remains of the burned wood deposit continue beneath the modern access road that leads to the beach.

Magnetometer Survey

In November 1996 a magnetometer survey of the entire site was conducted to collect data that would inform decisions regarding the placement of additional test units. The nature of the feature that had been exposed in FTU1 and of the deposit of burned wood uncovered in FTU3 suggested the possibility that more fire–altered materials (which in many cases have a distinctive magnetic signature) might be located in such a survey. For example, the location of the forge, or of the brickyard's clamp, or ferrous deposits associated with either the smithy or the shipyard's carpentry shop could all be identified through the anomalous magnetic disturbance their remains might produce.

Three survey blocks were laid out across the site in preparation for the survey. The survey team established a sub-datum in each of the survey blocks. Because of the broad spatial extent of the survey area on the beach and the significant difference in elevation from the location of the project's principal datum, an additional sub-datum was established at the lower beach elevation. This datum was designated as 0'/0' and was located 3.7 m and 116º from the site's principal 0/0 datum. From the 0'/0' sub-datum, a second sub-datum was established at a distance of 60 m and a bearing of 116º. Designated as subdatum $0^2/0^2$, this stake marked the corner of survey area A and the point from which the baseline for the beach survey was established. As discussed below, the magnetometer survey for Area A was conducted in June of 1997.

A third subdatum was established 11.75m and 344º from the 0/0 datum. Designated as subdatum $0^3/0^3$, this point marked the beginning of the baseline for areas B and C. From the $0^3/0^3$ subdatum, a baseline at a bearing of 47º was established that extended 60 m across the lower plateau, slightly above and parallel to the access road. The area east of the baseline was designated as survey block B, and the area to the west was designated as survey area C (Figure 4-29).

Area B was surveyed first. Transects perpendicular to the baseline were established every three meters along the baseline, and way points were marked every three meters along each transect, forming a 3-x-3 m grid. The survey was conducted with a Geometrics proton precession magnetometer, configured in gradiometer mode to filter out the diurnal variation. Readings were taken at every way point along each transect. The resulting data set was contoured using Golden Software Inc.'s Surfer software (v 6.01).

As depicted in Figure 4-30, a considerable magnetic disturbance was generated southeast of the $0^3/0^3$ subdatum that continued along the length of the 0 transect (Anomaly 1). This was caused by the permanent steel posts and steel gate situated to

Figure 4-29- – plan view of datum locations, baselines & grid).

Figure 4-30 mag contour map-mark anomalies, clip to 69 meters) control vehicular access to the beach. The anomaly was actually concentrated in the area between the 0 and (–) 12 meter mark where the gate is located. The extended linear component of the anomaly from the (–) 12 mark to (–) 21 is a product of “edge-effects” generated by the contouring software. Two other large anomalies are readily apparent in the contour map. Anomaly 2 is located at the edge of the dirt road, on a small grassy plateau used for picnicking. The anomaly was generated by two steel garbage cans housed inside a wood shelter and a metal parking sign. Anomaly 3 is located southeast of the road. A test excavation to identify its source determined that it was generated by a length of abandoned corrugated steel storm drainpipe buried some 40 cm below the surface.

A small anomaly is evident 39-meters along the baseline. A steel pole and steel traffic control sign situated at the eastern edge of the access road generated this. A smaller anomaly is apparent between transects 27 and 30, 18-meters below the baseline. As described below in the discussion on FTU 7, this proved to be a round metal bar, 90 cm long that appeared to be intrusive. The only other anomaly of note appears on transect 18 approximately 9-meters below the baseline at the south edge of the access road. Foundation Test Unit 4 was installed in this location and the source of the anomaly will be described below in the discussion of that excavation. No other anomalies suggestive of the presence of cultural material or culturally disturbed sediments were identified in the magnetometer survey for Area B.

Area C was surveyed subsequent to completion of the survey of Area B. A large anomaly was observed 21m along baseline $0^3/0^3$ and 9m north of it (Figure 4-31). This was attributed to a steel pole and traffic sign that was permanently installed at the edge of

Figure 4-31 Mag contour of Area C

the upper portion of the access road. No other anomalies suggestive of the presence of cultural material were observed in the magnetic data collected in Area C.

Beach Feature

While the gradiometer survey was being conducted, excavators were simultaneously investigating the feature exposed on the beach in 1996. As mentioned in chapter 3, in the winter of that year the swollen waters of Fort Ross Creek were running against the embankment of the access road that opens onto the beach. In an effort to protect the embankment from further erosion, park rangers, volunteers, members of the California Conservation Corps and AmeriCorp directed the flow of the creek away from the road embankment, sending the watercourse across the center of the cove's beach. By February, the volume of water flowing through the new channel had cut through more than 2.5 m of the beach sand to a clay substrate. There, two pair of parallel wood planks and two wood beams, oriented perpendicular to the planks, were found embedded in the clay (Figure 4-32). The planks were approximately 9 cm (3.5 in.) thick and ranged in width from 30 to 36 cm (12 to 14 in.) They protruded from beneath the side of the stream channel, so overall length could not be determined. The exposed portion measured approximately 82 cm (32 in.) in length before disappearing beneath the sand of the stream channel wall. The planks comprising

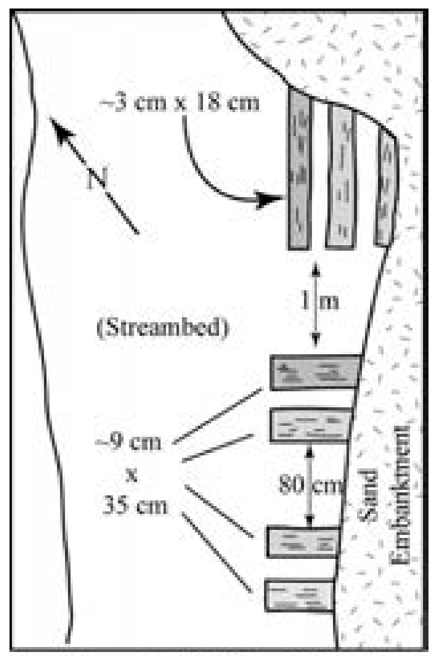

Figure 4-32: Plan View of Planks and Beams

each pair were aligned next to each other, and the pairs were separated from each other by approximately 82 cm (32 in.) Nearly 1 m to the east, and also in the streambed, were two beams of undetermined length, that measured approximately 13-x-18 cm (5-x-7 in.). The beams lay parallel to each other and were oriented perpendicular to the planks. The parallel edge of one more beam could be seen beneath the sand wall of the stream channel.

It was this feature that was investigated in November 1996, while the magnetometer surveys of Areas B and C were being conducted. Since its exposure in February, tidal and storm activity had reburied the feature under significant quantities of sand, and no parts of it remained visible. The only indication of its location was the dry, rocky bed of the stream that had cut through the sand ten months earlier. Coordinates taken in February 1996 for the location of the feature were used to define a 50 cm-x-2 m area of investigation in the streambed. The planks each measured 34 cm (13.5 in.) in width and were lying in a northwest-southeast orientation (Figure 4-33). Approximately 5 cm (2 in.) separated the planks of each pair and the pairs were separated from each other by approximately 76 cm (30 in.). Three to four-meters (10-14-ft.) of the length of each

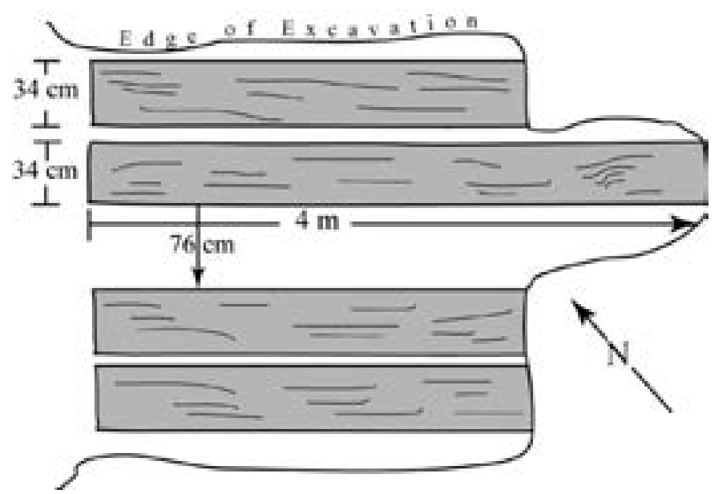

Figure 4-33: Re-exposed planks

plank were exposed before the height of the sandbank into which they disappeared became too formidable to dig.

In March 1996, the Department of Parks and Recreation provided a front-end loader and operator to remove the sand overburden lying above the beach feature. The mechanical excavation removed a considerable quantity of sand in an area approximately 8-x-5.5 m in size, exposing an extensive and intricate assemblage of wood planks (Figure 4-34).

Southeast of and perpendicular to the original exposure of the two pair of 34 cm (13.5 in.) wide wood planks lay two more planks of similar size. They were separated from each other by approximately 1.7 m (5.5 ft.), and butted against the northeast side of the eastern-most plank. Lying parallel to the perpendicular planks was a series of 13 slightly more narrow wood planks 20-23 cm (8-9 in.) wide. Six of these lay north of the first perpendicular plank, and seven lay between it and the second perpendicular plank.

With the mechanical removal of most of the sand overburden, hand excavation resumed, exposing the full length of the planks. The northern-most 34 cm (13.5 in.) wide perpendicular plank measured 4.94 m (16-ft., 2 in.) in length, while the southern plank proved to be 4.4 m (14-ft., 5-in.) long. The 13 narrower, intervening planks varied in length between 2.4 and 2.9 m (8 and 9.5 ft.) The length of the two pairs of planks that were originally exposed could not be determined, as the feature continued into the sidewall of sand that still remained.

Before arranging for further mechanical excavation to remove the remaining sand overburden, a high-pressure water pump and hydraulic probe were used to probe the overburden in an effort to determine the lateral extent of the wood feature. The original

Figure 4-34 Line Drawing of Walton's Map pairs of wood planks appeared to continue slightly further to the southeast into the sand sidewall, and the entire feature appeared to continue for some distance to the west, toward the waterline of the cove. With this in mind, the front-end loader was again used to remove the sand overburden. In combination with hand excavation, the full extent of the wood feature was eventually exposed. As depicted in Figure 4-35, the feature measured approximately 15 m (50 ft) in length. Its longitudinal axis was oriented along a near-perfect northeast-southwest alignment (50º azimuth) and ended approximately 23 m (75 ft.) above the high-water mark that was evident on the beach in April 1997.

After the front-end loader had removed the sand overburden, excavators removed by hand the thin layer of sand that remained on the feature's surface. During this process, several fragments of leather and a piece of copper sheathing were found lying on top of the wood feature. The leather fragments (n=18) varied in size but most were approximately 6 – 7.5 cm square and all appeared to be portions of shoes. The heel portion of three outer soles (one of which had wood pegs), a partial counter, the remains of a vamp, and what may be the remnant of a quarter piece were the only identifiable pieces. The remaining pieces appeared to be scraps of shoe leather.

The piece of copper sheathing measures 15-x-10 cm. It is pierced with 8 nail holes along one side of its length and three on the other. A rectangular hole measuring 1.9-x-8.25 cm (.75-x-3.25 in.) has been cut into the center of the piece, starting approximately 5 cm (2 in.) from one end (Figure 4-36). When found, the piece was folded along its longitudinal axis, along the line of the holes. The perforations indicated that the eight nails on one surface had been driven from one side, while the three on the other surface had been driven from the opposite side, suggesting that the piece of

Figure 4-35 -- full layout of beach feature

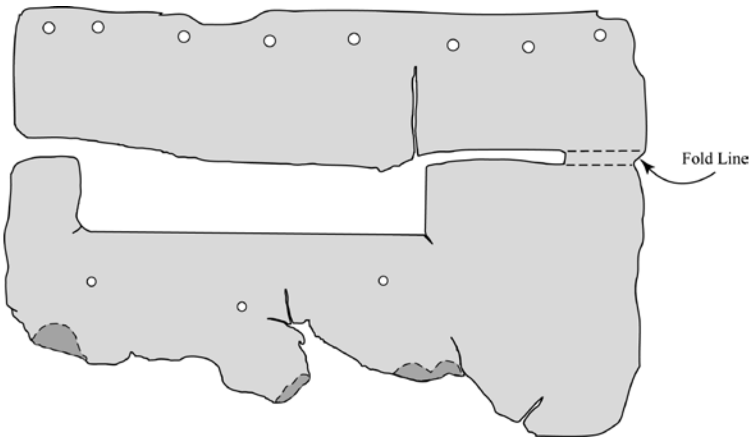

Figure 4-36: Copper Sheathing Fragment

sheathing had been fastened so that the two surfaces were perpendicular to each other along the line of the fold.

In addition to the leather fragments and copper sheathing, a number of heavily-concreted iron nails were found embedded into the edges of almost all of the beams that were oriented perpendicular to the feature's longitudinal axis (refer to Figure 4-35). Although some of these appeared to be round, they were so degraded that it was not possible to tell if their shape had once been square. No fasteners were found in any of the beams aligned parallel to the feature's longitudinal axis and no fasteners of any type were found to be holding the structure together. Rather, the entire arrangement of beams had been fitted together and was embedded into the hard-packed sand.

Two features of the structure were of particular interest. In the central portion of the wood platform, the pointed end of a single square spike protruded approximately 15 cm (6 in.) from one of the beams (refer to Figure 4-35). The spike was approximately 2 cm (.75 in.) square and had been driven from the bottom of the beam, before the beam had been set in place. This was not only the only fastener found on any portion of the structure (save the nails that had been driven into the edges of the perpendicular beams), but unlike the nails, it was not corroded in any way. The spike may have been fabricated from bronze, which would explain the lack of corrosion, but it was faintly gold in color and lacked the characteristic green patina typically found with cuprous metals that have been exposed to a marine environment.

The second item of interest was a keystone-shaped opening found in the wood platform. As depicted in Figure 4-35, the ends of two short beams that had been cut at an angle formed the opening, which measured 30-x-23 cm (12-x-9 in.). The short beams were held in place and supported on either side by two of the full-length beams comprising the platform. A rock filled the opening when it was first exposed. It appeared to be intrusive.

Once the feature was fully exposed it was mapped in detail, then photographed. Alphabetical labels were assigned to its various sections for control of provenience and the sand between the various beams was screened through 1/8-inch shaker screens in an effort to recover any cultural material that might have been associated with the structure. Aside from more concreted iron nails, no cultural material was recovered in these excavations.

The proximity of the feature on the beach to the historic location of the Russian-American Company's shipyard, and its overall configuration, which resembled a type of transportation system to or from the water, suggested that the structure might have been associated with the operation of the shipyard. The asymmetrical arrangement of its components further suggested that what was exposed on the beach formed only one-half of a larger structure. In an effort to determine whether or not other parts of the structure remained buried elsewhere on the beach, more hydraulic probing was conducted around the perimeter of the feature and in areas further away from either of its sides. The probe produced a series of hard returns to the southeast of the feature at a depth approximately equal to the elevation of the feature. The front-end loader was again used to remove the sand overburden and a trench was cut to the southeast for a distance of approximately 12 m (40 ft.) No additional subsurface components of the structure were identified either in the trench or through additional hydraulic probing. The hard returns identified to the southeast of the feature proved to be the product of a thick stratum of gravel apparently deposited when Fort Ross Creek once ran through the area.

In a serendipitous coincidence, geophysical engineers from Geometrics, Inc. of San Jose, CA (one of whom had an extensive background in archaeology) expressed interest in testing a new survey approach using the company's Cesium gradiometer. With the magnetic signature generated by the exposed wood feature as a template, the engineers offered to conduct a gradiometer survey across the beach in an effort to determine whether or not more of the feature could be located through remote sensing. Consequently, three rectangular survey grids were established around the feature, one on either side of the trench and one parallel to the alignment of the feature (Figure 4-37). The survey area on the north side of the trench was designated as beach grid B-A (to distinguish it from survey grid A on the terrace) and measured 20-x-40 m, although its southwest edge was truncated where it intersected the trench opening. Survey area B-B paralleled the southwest edge of the trench and measured 16-x-40 m, and survey area B-C paralleled the northern side of the wood feature, measuring 20-x-40 m. A fourth survey grid, designated as area B-D, was constructed directly over the feature for control purposes. It measured 12 m in width and 20 m in length.

In laying out the grids a new datum was established on the beach, adjacent to datum 0'/0', which was unusable at the time, as it was covered with the flowing water of

Figure 4-37: Plan View of Mag survey grids

Fort Ross Creek. The new datum, which was designated $0^5/0^5$, was 125º and 10 m from primary site datum 0/0.[9] It was the point from which the location and orientation of the feature was subsequently recorded.

As depicted in Figure 4-38, a number of magnetic anomalies were identified in the survey[10]. In the interest of time, only two were selected for further investigation. Both were situated in Grid C. They were considered good potential indicators of material that might be associated with the wood feature, based on their intensity, horizontal extent, predicted depth, predicted size, and their proximity to the feature.

Anomaly one was a dipole of approximately +70/-100 gammas (γ)[11] with an apparent horizontal extent of approximately 5 m. Analysis of the gradiometer data suggested there was a 92% chance that it lay approximately 108 cm below the surface.[12] Anomaly two, a 16γ dipole, was situated nearby. Immediately next to it was a monopole of 4γ. For the former, there was an 87% chance that it lay approximately 170 cm below the surface, while the latter had a 95% chance of lying at a depth of 245 cm. The horizontal extent of the closely aligned anomalies was approximately 10 m.

Given the estimated depth of the anomalies selected for investigation, the front-end loader again was used to remove the sand overburden. A trench was excavated along the longitudinal axis of the paired anomalies designated as anomaly two, an orientation that roughly paralleled the alignment of the wood feature. Several heavily concreted iron fasteners and what appeared to be small pieces of a cast iron stove were

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[9] Datum $0^4/0^4$ had already been assigned, as will be discussed below.

[10] The magnetic anomalies depicted in the survey data from area D (the wood feature) are disturbances caused by the nails that had been driven into the edges of the wood planks.

[11] A gamma is a unit of magnetic energy, also known as a nanotesla.

[12] Geometrics used a computer model to analyze the magnetic data and developed estimated size, depth and "quality of fit" data for each. The 92% figure refers to an estimate of the quality of fit of the interpretation.

Figure 4-38 Color Contour Maps

recovered from a depth of approximately 1m. They did not appear to be associated and were clearly in a secondary context. At a depth approximately 1.5 to 2 m below the surface the excavation exposed a stratum of heavy, black clay, densely laden with a fibrous organic material. At that depth the tidal water table was encountered and the excavation slowly started filling with water, prompting a change in the focus of the investigation to anomaly one, which was situated at a slightly higher elevation on the beach.

At a depth of approximately 50 cm the excavation exposed a 2.4 m (8 ft.) long length of ¾-in. galvanized steel pipe, bent in the middle to form an angle of nearly 90°. Although this was probably the source of the magnetic anomaly, it was encountered at a depth much shallower than that predicted, so excavations continued to determine whether any other contributory elements could be found. When the excavation reached a depth of approximately 90 cm, the stratum of heavy, black, organic-laden clay was again encountered (Figure 4-39). Examination of the clay with a magnifying glass suggested the fibrous material was degraded wood. The substance was so degraded that a sample could not be recovered, as simply touching the clay destroyed any evidence of the wood.

The following day, excavation resumed in the trench over anomaly two, which had dried out with the falling tide. As the trench was lengthened, the stratum of black, fibrous clay was encountered sporadically. Surrounding the isolated deposits of the black clay were heavy oxidation stains. At a depth of approximately 140 cm, a number of large rocks were exposed that appeared to underlie the stratum of black, fibrous clay. No other cultural material was recovered in the excavation, nor was any specific evidence of the source of the anomalies identified, although the excavation did not reach the depth in

Figure 4-39 – Beach Feature with test trenches which they were predicted to lie. It is possible that the rocks exposed beneath the stratum of black clay were the source of the magnetic disturbance, as they seemed to be intrusive, but this could not be determined without a magnetometer, which was unavailable at that point.

Following an *in situ* examination of the oxidation stains and the sporadic deposits of the black organic clay, the anomaly excavations were backfilled, the wood feature was photographed in detail, and the loader was used to rebury the feature and to bring the beach contour back to its pre-disturbance elevation. An interpretation of the wood feature and the materials exposed in the investigation of the magnetic anomalies will be presented in the next chapter.

Foundation Test Unit 4: When the Prince technique described above was being used to analyze the wood beam feature in Test Unit 2, the visible corners of the dilapidated wood barn and attached corral that appear in the foreground of the 1866 photograph were marked with stakes. The oblique angle at which the barn is depicted completely obscures the structure's north corner and somewhat distorts the location of the south corner (refer to Figure 4-12). In attempting to stake the east and south corners, it was discovered that the ground upon which they once rested has eroded away. The stake marking the estimated location of the west corner was situated at the very edge of the bluff. The location of the east and south corners had to be projected vertically into the empty space above the bed of the creek that formerly ran against the base of the bluff and, as mentioned, the north corner could not be staked because it is not visible in the photograph. In conjunction with this spatial information, analysis of the data collected

Figure 4-40: Shelter erected over FTU4A-D

during the magnetometer survey of Areas B and C on the terrace was used to determine the location for a new test unit along the edge of the bluff (refer to Figure 4-29).

In consideration of the time of year (December), a shelter large enough to protect the new unit from the winter rains and provide ample working space was erected over the area (Figure 4-40). All other exposed test units were covered with tarps and sandbagged.

To facilitate spatial control, a fourth subdatum – $0^4/0^4$ -was established inside the shelter. The position of this sub-datum was later surveyed and determined to be 38.5 degrees and 20 m from the 0/0 datum.

Before laying out the unit, volunteers participating in the project used a power auger to drill a series of six test holes within the shelter. Analysis of the backdirt was used to help determine the optimum location of the unit. One hole was drilled on magnetometer survey line 112 and another on magnetometer survey line 115, and four holes were drilled in random locations within the shelter (Figure 4-41). Five of the test holes were drilled to the 90 cm limit of the auger flight. Backdirt recovered from the bores was wet screened and the recovered artifacts were bagged as one level. A hand auger was then used to bore in 10 cm increments to a finished depth of 140 cm.

Figure 4-41 – Borehole locations

Sediment samples and any artifacts recovered were bagged for each of the deeper 10 cm levels. Auger bore five was drilled in 10 cm increments from the surface and sediment samples from each increment were recovered and bagged separately.

The matrix and the nature of the cultural material recovered were very similar to those observed in units FTU1, FTU2, and FTU3, and described above in the discussion on site stratigraphy. Small brick fragments, an iron nail, a single glass trade bead, mammal bone, groundstone, and ceramic sherds typified the type of artifacts recovered. The density and location of these materials was considered in determining the location of the excavation test unit.

The unit was aligned parallel to the $0^3/0^3$ baseline used in Area B and was situated 1.5 m east of the westernmost projection of the bluff face. The 1-x-4 m rectangular unit was designated as FTU4 and was positioned between magnetometer survey lines 112 and 116, approximately 6 m northeast of the edge of FTU3 (Figure 4-42). The unit was subdivided into four 1m squares, labeled from west to east as A, B, C, D, respectively.

Units FTU4A and FTU4C were excavated first. Because of the familiarity with the overall site matrix gained from the previous excavations along the bluff edge, the first 30cm of these units were excavated as a single stratum. The moisture content of the sediment was quite high making dry screening impossible, so most of the stratum was wet-screened. Only the bottom few centimeters were dry enough to run through conventional shaker screens.

FTU4A: Glass, iron, slag, abalone shell, mammal and sea mammal bone dominated the cultural material recovered from throughout FTU4A. A single glass trade bead was recovered in the first level (0-30 cm), along with ceramic sherds (n=6), glass

Figure 4-42 – Location of FTU4

fragments (n=12), iron nail fragments (n=8), and a single obsidian flake. Cultural material recovered from the second level (30-50 cm) was similar in nature and quantity, with the addition of pieces of slag (n=12), and abalone shell fragments (n=4). The third stratum (50-60 cm) was considerably less dense in terms of the cultural material it contained. Eleven pieces of slag, small pieces of burned wood (or charcoal) (n=9), glass sherds and iron nail fragments (n=2 each) were all that were recovered. A second glass trade bead and one small shell bead were recovered from level four (60-70 cm), along with glass sherds (n=3), fragments of flat iron and iron nails (n=6), abalone shell (n=50), slag (n=3), mammal bone (n=15), and sea mammal bone (n=26). Modified obsidian and chert flakes (n=7) were recovered in all strata except for level three (50-60 cm).

The densest deposit of cultural material was recovered from stratum five (70-80cm). Glass (n=2), fragments of flat iron and iron nails (n=10), iron shot (n=1), modified chert flakes (n=2), abalone shell fragments (n=40), slag (n=12), bone (n=21), brick fragments (n=6), charcoal (n=80), and a copper sheathing nail were all recovered from this level. The assemblage recovered from this stratum was found in association with a cluster of rocks and relatively flat stones, largely concentrated in the southeast corner of the unit, although some of the stones were scattered to the northwest (Figures 4-43 and 4-44). An iron spike, approximately 15 cm long, a round iron ring approximately 6 cm in diameter, a small iron shot, a fragment of mammal bone, a large piece of slag and two unidentified iron objects were found resting on top of or immediately next to the cluster of rocks. Although excavation continued into the underlying stratum for an additional 10 cm, the matrix proved to be culturally sterile and further excavation of the unit was terminated.

Figure 4-43 – plan view of FTU4A

Figure 4-44- Strat of FTU4A

The configuration of the cluster of stones, the absence of any similar material anywhere else in the unit, and the association of the artifacts exposed on and around them suggested they were purposefully placed. It appeared that they might have been the remains of a stone support for the building foundation. With the exposure of this stone assemblage, the wood stake used to mark the projected west corner of the barn was relocated. The stake was not visible during the excavation since it was situated just outside the confines of the shelter and was hidden by the vegetation that had grown during the weeks intervening between its placement and the excavation of FTU1A. The stake marking the projected west corner of the barn was found in the edge of the embankment, approximately 10-inches away from the stone assemblage.

FTU4C: The excavation of FTU4C was conducted concurrently with that of FTU4A. As with the latter unit, the first stratum was excavated in 30 cm increments. Subsequent strata were excavated in 10 cm levels to a finished depth of 100 cm. Although the nature of the cultural material recovered from this unit was similar to that found in FTU1A, the density of material was much greater. With the exception of levels two (30-40 cm) and eight (90-100 cm), fragments of mammal bone were recovered in all levels (n=1 to 5). In level four (50-60 cm), 14 fragments were recovered. Abalone shell fragments (n=1 to 5) were recovered from all levels except number six (70-80 cm), in which there were none. As with the mammal bone, the highest concentration of shell fragments (n=10) was found in stratum four (50-60 cm). Brick fragments (n=1 to 2) were found in levels two through five (30-70 cm), with a high concentration (n=10) recovered from level four (50-60 cm). Six ceramic fragments were found in level one (0-30), one fragment in level two (30-40 cm), two in level three (40-50 cm), four in level five (60-70 cm), and one in level six (70-80 cm). None were recovered from the other levels. Glass fragments (n=18) were recovered in each of the first five levels of the unit (0-70 cm). The highest concentration was found in level one (0-30 cm), with the remainder fairly evenly distributed through the next four levels.

Numerous fragments of thin, flat iron (n=~600) were recovered in FTU4C, beginning in the first excavation level and continuing through level nine (100-110 cm), although none of the material was observed in levels three and four (40-60 cm). The largest concentration of these fragments (n=~475) was recovered from levels six through eight (70-100 cm), with another high concentration (n=~60) in level two (30-40 cm). Most of the thin metal fragments exhibited a red color on one side that appeared to be the product of differential oxidation, perhaps caused by exposure of only the oxidized surface to the elements.

Pieces of slag (n=45) were recovered from levels one through six (0-80 cm), with the highest concentrations found in level two (30-40 cm) and level five (60-70 cm) (n=10 and 15, respectively). The remainder of the slag was fairly evenly distributed through the other levels, but only two examples were recovered from level four (50-60 cm).

Small pieces of charred wood or charcoal (n=48) were recovered from throughout levels one through five (0-70 cm). These were concentrated in levels two and three (30-50 cm) (n=16 and 11, respectively), with the remainder evenly distributed through the other three levels.

A single glass trade bead was recovered from level 5 (60-70 cm), modified obsidian and chert flakes were recovered from levels one (0-30 cm), five (60-70 cm), and six (70-80 cm), (n=2, 3, and 4, respectively). Two copper sheathing nails were found in level one (0-30 cm), and one was recovered from level 6 (70-80 cm). A small piece of copper sheathing material was also recovered from level one. A lead slug from a bullet and a lead bale seal were both recovered from level one (0-30 cm).

Except for the dense concentration of flat iron fragments recovered from the upper portion of level eight (90-100 cm), the density of cultural material in that level was considerably less dense than that found in the superincumbent strata. A single abalone shell fragment and a possible groundstone fragment were all that were recovered from the lower portion of the stratum. A manual auger was used to drill a 10 cm (4 in.) diameter hole to a depth 80cm below the floor of level eight. The bore was drilled in 10 cm increments and each increment was screened. No other evidence of cultural material was observed in these increments so the excavation of unit FTU4C was terminated.

As discussed below, with the completion of FTU4C attention turned to the installation of five additional test units, which were excavated over the next several months. Nearly four months elapsed before the remaining units in FTU4, squares B and D, were excavated.

FTU4B: Over the three-day period June 17-19, 1997, students from Santa Rosa Junior College excavated units FTU4B and FTU4D as part of their summer archaeological field school. As with FTU4C, a rich assemblage of cultural material was recovered from FTU4B, which was excavated in 10 cm levels from the surface to a finished depth of 70 cm. Two small pearlware sherds, one obsidian and three chert waste flakes, and six small slag fragments were recovered from level one (0-10 cm).

In level two (10-20 cm), excavation exposed a gravel lens, approximately 30 cm wide, running along the eastern edge of the unit. Excavators recovered a single creamware sherd, 10 fragments of green, clear, lavender, and black glass, and 11 iron nail body fragments, but no artifacts were observed or recovered from the gravel lens.

Level three produced a small creamware sherd; a small flattened copper cap molded with a decorative pattern of ridges; a small, triangular piece of flint; clear, green, and brown glass sherds (n=6); 2 fragments of a green bottle (one of which was embossed with the letters "OC"); 25 pieces of heavily oxided iron (one of which appears to be the tooth or point of a tool); iron nails, nail bodies, and heads (n=16); small pieces of slag (n=3); and 2 fragments of mammal tooth.

In contrast to level three, level four (30-40 cm) was virtually sterile. A single fragment of mammal bone, one small piece of (possibly) modified obsidian, and 19 pieces of slag were all that was recovered from this level. Excavation of level five (40-50 cm) exposed a small concentration of chalky, (possibly calcined) abalone shell fragments (n=27), numerous small mammal bone fragments (n=40), a sherd of thin, clear glass (possibly window pane), another sherd of green bottle glass, two small pieces of heavily oxidized flat iron, a small modified obsidian flake, and eight small pieces of slag.

A similar assemblage was recovered from level 6 (50-60 cm). Four more pieces of chalky abalone shell were recovered, as were 20 fragments of mammal bone, three small creamware sherds, one blue-on-white ceramic fragment, and one small fragment of clear, flat glass that may have been window pane.

Abalone shell fragments (n=38) dominated the cultural material recovered from level seven (60-70 cm) the deepest level of FTU4B. Two small mammal bones, the distal end of a bovid femur, a flat, rectangular piece of groundstone (9-x-10 cm), a possible hammerstone, one creamware and one pearlware ceramic sherd, sherds of black bottle glass (n=2), and five iron nail fragments were all recovered from this level. In the northeast corner at the bottom of the level, a dark, slightly circular discoloration was observed that suggested the presence of a firepit. Excavation into the next 10 cm level (70-80 cm) exposed a change in the color of the sediment across nearly half of the level's floor. No cultural material or evidence of any cultural activity was observed in this level and the discoloration observed in the superincumbent stratum was apparently the first indication of a change in the composition of the lower stratum's natural matrix. With no indication of any cultural activity, excavators assumed the sterile level had been reached and no further excavation was conducted.

FTU4D: Along with the excavation of FTU4B, students from the Santa Rosa Summer Field School also excavated unit FTU4D. They excavated the unit in 10 cm levels, but time constraints only allowed for the excavation of four levels to a maximum depth of 40 cm below surface. Unfortunately, subsequent project time constraints precluded the excavation of this unit to the sterile stratum. Despite this relatively shallow investigation, the quantity and nature of the recovered cultural material was both more numerous and more complex than that of the material found in any of the other units comprising FTU4.

As with the other units, iron nails, nail fragments, and iron slag were the predominate materials recovered. In level one (0-10 cm), iron nail fragments, concretions, and pieces of unidentified iron were recovered (n=14). In level two (10-20 cm), iron nails, nail fragments, portions of iron straps or bands (n=48), and what appeared to be iron stove parts (n=20) were recovered. Excavation of level three (20-30 cm) exposed more iron nails and nail fragments (n= 146) as well as another scattering of pieces of iron bands or straps (n=31). The deposit of iron nails continued into level four (30-40 cm), where 75 more iron nails were recovered.

Ceramic sherds, charcoal fragments, pieces of clay, copper sheathing nails, glass fragments, marine shell, and iron slag were all recovered from each of the four excavation levels. Of the 11 copper nails recovered, 6 were found in level 3 (20-30 cm), and 112 of the 151 glass bottle and clear glass fragments were recovered from levels three and 4 (30-40 cm). The highest concentrations of wood fragments (n=13), calcined shell (n=82), slag (n=28), mammal bone (n=23), bark (n=22), and leather fragments (n=34) were all recovered from level three, with level four yielding nearly as many examples. In that level, 65 fragments of calcined shell, 14 pieces of slag, and 11 fragments of mammal bone were recovered along with the iron, glass, clay, and copper artifacts mentioned above.

Other items of note were a glass trade bead recovered from level two (10-20 cm), a lead shot and three pieces of lead sprue recovered from levels two and three, and an obsidian and chert flake recovered from level one (0-10). In addition, obsidian flakes were recovered from levels two (n=1) and three (n=2) and a possible groundstone hammerstone was recovered in level three. In level two (10-20 cm) excavation exposed a flat piece of sandstone measuring 18-x-15 cm. Its isolated nature, location and orientation suggested it might have been used as a foundation stone.

During the excavation of FTU4A-D, 13 additional boreholes were drilled in randomly selected locations in the roadway and in the grassy slope between the upper and lower portions of the access road in order to further characterize the subsurface nature of the site (refer to Figure 4-4). As with the six bores drilled in the vicinity of FTU4, the test holes were drilled to the 90 cm limit of the auger flight. A hand auger was then used to bore in 10 cm increments to a finished depth of between 140 and 180 cm. Volunteers screened the backdirt recovered from the bores and bagged the recovered artifacts by levels. Only seven of the bores returned any evidence of cultural material.

Burned fragments of redwood and a small sherd of green bottle glass were recovered from the 0-100 cm level in bore 8; bore hole 10 returned a clear glass fragment, two brick fragments, two pieces of slag, and 10 pieces of wood from the 0-100 cm level. A copper sheathing nail and a piece of charred wood were found in the 120-140 cm level, and two small charcoal fragments were found at 150 cm.

Screening of the backdirt from the 0-100 cm level in bore hole 11 produced two small mammal bone fragments; small fragments of charred wood, an iron nail body fragment, and a sherd of clear glass. A brick fragment was found in the 100-120 cm level and a single chert percussion flake was recovered from the 140-160 cm level.

In the 120-140 cm level of bore 12, two small wood fragments were recovered and a small strip of copper was found in the lower 140-160 cm level. A heavy deposit of charcoal or charred wood was recovered from 70 to 120 cm in borehole 14. Because of a dense deposit of rocks, borehole 17 could only be drilled to a depth of 60 cm. Screening of the backdirt from this shallow bore returned iron fragments, and obsidian and chert flakes. Bore hole 19 produced four pieces of slag, a round clay sinker, and 11 pieces of burned wood in the 0-100 cm level. The backdirt from all other bole holes was culturally sterile.

Foundation Test Unit 5*:* As discussed above, the Prince technique was employed to determine the location of the dilapidated wood barn depicted in an 1866 photograph of the project area. The oblique angle of the barn's image and the extreme distance between the historic location of the barn and the point from which the photo had been taken made it very difficult to ascertain the exact location of the barn's corners.[13] The angle of the barn's western exposure allowed for an accurate determination of the west corner but the lack of detail in the photo made it difficult to determine the exact location of the south and east corners and, as mentioned previously, the north corner was not visible at all (refer to Figure 4-12).

The configuration of the stone assemblage in FTU4A and its nearly identical location to the projected west corner of the barn strongly suggested that the excavation had exposed the foundation stones for the barn's west corner. It then became necessary to determine the location of one additional corner so that the orientation of the barn could be established and from that, a determination made as to what in the artifact assemblage was recovered from inside the barn, and what was from outside.

As mentioned, the east and south corners had been marked but the ground on which they once stood had eroded away. The stake marking the location of the south corner had been driven into the modern creek bed at the base of the bluff, some 3m below the stake marking the west corner. The stake marking the east corner was located on the downslope of the eroded embankment. With a stadia rod, the location of the two corners was raised to that of the west corner and, using the location of the three corners, a projection made as to the position of the unseen north corner, which was marked with a stake.

[13] The location from which the photo had been taken in 1866 was found to be a high, thin, rocky precipice over 245 m south of the barn's location. The unstable ground, treacherous footing, and blustery winds encountered on the precipice made using a camera tripod problematic. This and the distance over which the superimposition had to be made somewhat degraded the accuracy of the corner locations.

Test units were laid out over the projected location of the barn's east and north corners. The unit situated over the projected north corner was designated as FTU9 and its excavation is discussed below. The unit placed over the barn's projected east corner was designated as FTU5 and, like those opened previously, was situated at the edge of the embankment. To compensate for any errors in calculating the projected location of the barn's east corner, and to allow for the loss of the archaeological matrix due to the erosion of the embankment, the unit was designed as a 2-x-2 m square to increase the likelihood of finding the corner. The following day, a reapplication of the Prince technique, using a different camera and under different light conditions, indicated that the projected locations of the south and east corners of the barn may have been incorrect, so a second projection was marked.

As discussed in chapters one and two, the inventory of structures in the industrial complex compiled in 1841 when the Russian-American Company sold the colony's assets to John Sutter describes "a forge and blacksmith shop, built of planks, 5 1/3 sazhens long by 3 2/3 arch.[14] wide, with 4 partitions" (Dmytryshyn et al. 1989:432). A conversion from Russian measurements to English feet and inches indicates this building was 26 feet wide and 37 feet long.[15] Although there were four other buildings described

[14] As noted in footnotes 1 & 2 of Chapter Two, a sazhen is a measurement equivalent to 7 feet (Farris 1983:95). The meaning of "arch." is not clear. In the referenced source, the author has suggested it may be an abbreviation of "arshin," a Russian measurement equivalent to 28 inches. If this is correct, the building would have been 37 feet long and 8.5 feet wide. It seems more reasonable to assume the word "arch" is an error made when the inventory was translated from Russian into French, then into English, and that the 3 2/3 refers to sazhens. This would then describe a building of more logical dimensions: 37 feet by 26 feet.

[15] Although the metric system was used in project excavations and has been used throughout this document to describe the sizes of various artifacts and features, English feet and inches will be used in the discussion of the barn. It is the unit of measure used in the historic descriptions of the barn, and the original Russian measurement of a sazhen is evenly divisible into 7 English feet, making the discussion more convenient.

in the inventory as being situated in the industrial area,[16] the size of the barn depicted in the 1866 photograph appears to be the closest match to the size of the forge and blacksmith shop. More importantly, the width of the barn as determined with the Prince technique, measured 25 ft. and several inches, nearly identical to the recorded width of forge and blacksmith shop (a more exact determination could not be made because of the circumstances described above).

In order to determine which of the projected positions for the east corner were correct, measuring tapes were used to lay out a right triangle with sides of 26 and 37 feet with an origin at the barn's west corner. The intersection of the 45-foot hypotenuse with the end of the 37-foot long base suggested the first projections for the east and north corners were incorrect. A new test unit was laid out over the revised location for the east corner, which lay further down the slope of the embankment. This was designated as FTU6, and it will be discussed below (Figure 4-45).

To enhance vertical and horizontal control of the 2-x-2 m unit designated as FTU5, the unit was subdivided into two segments along its east-west axis. The 1-x-2 m subdivision on the north side, closest to the road, was designated as FTU5A and the subdivision on the south side, along the slope of the embankment, was designated as FTU5B.

The nature of the cultural material recovered from the excavation of FTU5A was similar to that recovered from FTU4A. Within the first 30 cm, excavation exposed brick fragments (n=8), ceramic sherds (n=4), trade beads (n=2), a shell bead, chert percussion flakes (n=4), fragments of copper sheeting and copper nails (n=6), bottle glass and

[16] A tannery, measuring 35-feet x 21-feet, a bath measuring 35-feet x 17.5-feet, and a cooperage and a *baidara* shed, each measuring 70-feet x 35-feet.

Figure 4-45 – Plan View of Barn Orientation(s) window pane fragments (n=125), iron nails and spikes (n=65), obsidian flakes (n=4), pieces of slag (n=77), and charred wood fragments (n=72). Unlike the other excavation units, however, the sediment comprising FTU5A exhibited significant variation across the width of the unit. On the western side of the unit, the sediment was densely compacted with high clay content, while on the eastern side it was both less compacted and lighter in color. The sediment in the southern corner was yellowish in color and noticeably more sandy than elsewhere in the unit. At a depth of approximately 20 cm below the surface, excavation exposed five deposits of black, granular charcoal or burned wood along the northwest side of the excavation (Figure 4-46). Each was approximately 2 cm thick. As the excavation of the next level would show, these were associated with a feature that was exposed as the excavation continued.

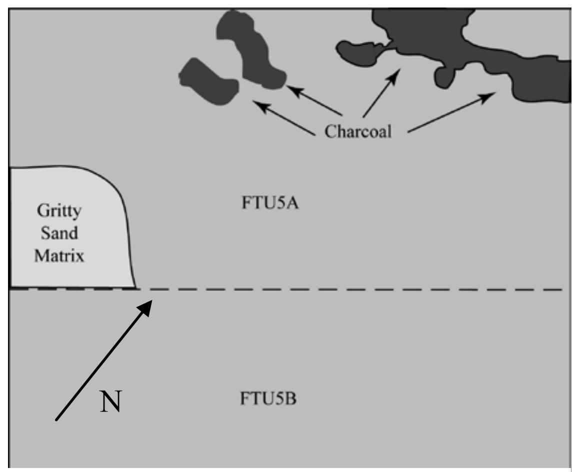

Figure 4-46: Plan View, FTU5A and 5B

The same sediment characteristics were observed through the excavation of the second level (30-50 cm), within which the recovery of the same type of cultural material continued, although in smaller quantities. Unlike the assemblage recovered in level 1, some abalone shell that had possibly been modified was recovered (n=5), along with a piece of burned mammal bone. Brick fragments (n=8), charcoal or charred wood (n=30) chert (n=1), clay pipe stem (n=1), copper sheeting and nail (n=3), glass fragments (n=6), iron fragments and nails (n=10), slag (n=44), and one piece of possible tan bark comprised the remainder of the cultural material recovered from the second excavation level. None were in any evident association.

At a depth of approximately 40 cm below the surface, a circular deposit of charcoal or burned wood was exposed in FTU5A, approximately 20 cm southeast of the unit's northwest wall. Excavation around the deposit exposed a portion of a larger, circular, clay-lined depression that underlay the charcoal deposit (Figure 4-47). The bowl shaped depression was approximately 12 cm deep at its center and appeared to continue into the northwest sidewall of the unit.

In order to expose the feature further, excavators expanded FTU5A an additional 50 cm along its northeast edge. The expanded portion of the excavation was designated as FTU5A'. At a depth of approximately 15 cm below the surface, the exposed matrix of FTU5A' became significantly more compact and was heavily laden with charcoal or charred wood. An iron spike and two iron nails were found in this matrix between 17 and 20 cm below the surface.

At approximately 30 cm below the surface (some 10 cm above the elevation of the clay-lined bowl in FTU5A) the nature of the sediment changed to loosely compacted sand. This continued through the next level (40-50 cm), where a copper nail and pieces of slag were exposed in the matrix.

When the excavation of FTU5A′ reached the level of that in FTU5A, the feature was exposed to a much greater extent. It appeared to comprise a circular clay lined pit nearly 1.8 m in diameter and 12 cm deep. The bowl of the pit was filled with a mixture of compacted sand and clay, much of which exhibited the reddish stain of oxidation. To examine the feature in cross section, smaller excavations were conducted in its center and

Figure 4-47 – Plan view and x-section of FTU5A at either side. A 1 m section in the center of the feature was excavated an additional 5 cm, and two smaller sections, approximately 40 cm square, were excavated at the southeast and southwest edges. These excavations exposed what appeared to be a second, underlying feature of similar construction, designated as feature 1B.

The underlying feature appeared to be a shallow, clay-lined depression that was also filled with a mixture of coarse sand and clay. Several areas within the bowl contained areas of burnt sand. Although only a portion of the underlying feature was exposed, it appeared to be smaller in diameter than that above (feature 1A), measuring approximately 90 cm in diameter (Figures 4-48 and 4-49).

In the northwest sidewall of FTU5A′, a thin lens of burned wood was evident at a depth of 30 cm below surface. To determine its possible relationship to the two clay-lined features, a small (50-x-50 cm) excavation unit was opened above the visible wood. No discernable relationship between the burned wood and the features could be ascertained. However, the excavation served to expose two other portions of wood planking, on top of which two iron spikes, an iron nail, a glass fragment, and pieces of burned clay were recovered.

FTU5B: Excavation of the south side of the unit, designated as FTU5B, exposed more of the silty sand and clay deposits observed in the upper unit. Because the southern portion of the unit was situated on the down slope, its upper portion had largely been eroded away. Consequently, the density of cultural material found in FTU5B was noticeably lighter. The usual slag fragments (n= 78) were recovered from throughout the excavation, which reached a finished depth of 50 cm. The highest concentration of slag (n=61) was recovered from the 0-30 cm stratum. In addition, highly degraded fragments

Figure 4-48: Plan view of fully excavated FTU5A

Figure 4-49 Photos 4-K and 4L

of mammal bone (n=4), brick fragments (n=4), small bits of charcoal (n=12), clear and colored glass sherds (n=27), iron nail fragments (n=16), an obsidian percussion flake, and two historic ceramic sherds were recovered from the 0-30 cm stratum.

Excavation of the 30-40 cm stratum recovered a single glass trade bead, more brick fragments (n=13), two ceramic sherds, and more iron nail fragments (n=6). A small quantity of charcoal (n=16), and 10 iron nail fragments were recovered from the final stratum of FTU5B, 40-50 cm below surface. Neither evidence of the barn's east corner, nor the foundation line was uncovered in the excavation of FTU5B, which was abandoned after the 50 cm depth was reached.

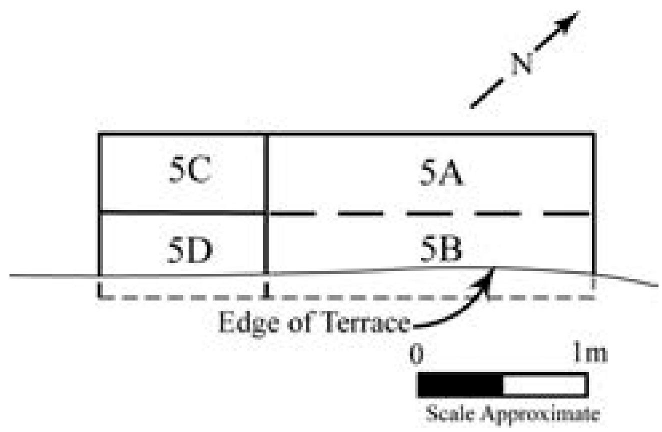

Figure 4-50: Extension of FTU5A&B into 5C and 5D

FTU5C and 5D: As the excavations of units FTU5A and B progressed, the excavation team decided to extend the western boundary of each unit by an additional 1 m in order to define a mound of clay and sand that appeared along the western edge of the two units (Figure 4-50). The extension of the west side of FTU5A was designated as FTU5C and the extension of FTU5B was designated as FTU5D. A 10 cm-wide balk separated the two units, which were both excavated simultaneously.

The first 20 cm in each unit were excavated as a single stratum but because of the sloping bluff, it was not until the excavation reached level 3 (30-40 cm) that a full 1 m exposure of FTU5D was achieved. Despite the relatively limited horizontal exposure of the first 30 cm of this unit, a substantial quantity of cultural material was recovered in the first 30 cm. Iron spikes, nails and nail body fragments (n=71), slag (n=55), and glass fragments (n=43) were the predominant artifact types recovered from both units. In addition, six trade beads, an obsidian projectile point, obsidian and chert percussion flakes (n=5), and a clay pipe stem fragment were also recovered, along with smaller quantities of the usual assortment of brick, wood, and shell fragments.

At the bottom of level 2 (20-30 cm) in FTU5D and in the upper portion of level 3 (30-40 cm) in FTU5C the deposit of clay and sand observed in the western portion of FTU5A and B was again encountered. Despite the heavy impact of bioturbation, it appeared that the feature was cultural in origin, as it was flecked with inclusions of charcoal and contained slag and nail fragments. Excavation through the feature exposed light concentrations of copper sheathing nails (n=2), slag (n=8), iron nails (n=5), and brick fragments (n=4). The feature appeared to be a stratum of mixed clay and sand approximately 10 cm thick in units FTU5C and 5D and somewhat thicker in the western portion of units FTU5A and 5B.

The stratum underlying this feature in units FTU5C and 5D (30-40 cm) contained significantly denser concentrations of slag pieces (n=65) that were larger in size (~5 cm) than that observed in the higher strata. The same was true for deposits of charcoal in that layer, which were greater in both size and frequency than that observed earlier. Underlying these deposits in level 4 (40-50 cm), both units contained notably smaller quantities of both slag (n=20) and charcoal (n=9). The nature of the matrix in both units in level 4 also changed from sandy clay to oxidized, reddish, gravel-laden sediment. Excavation in FTU5D continued for two more levels (50-60 and 60-70 cm). The matrix in both levels comprised gravel-laden, deteriorating sandstone with evidence of oxidation. Only 2 slag fragments, 5 glass sherds, 1 iron spike (recovered from a krotovina) and 5 iron nail fragments were recovered from the two levels and excavation was terminated when the bottom of level 6 was reached.

In order to determine whether any foundation remnants of the barn's northwest wall could be identified, and in consideration of the imminent impact to the archaeological record brought about by the visible, ongoing erosion of the bluff due to the previous winter's rains, the configuration of unit FTU5A-D was enlarged once again. The unit was extended an additional 4 m to the southwest toward the location of FTU4A-D. Eight 50 cm-x-1m units (FTU5E-5L) were established and numbered sequentially, continuing from unit FTU5D (Figure 4-51).

FTU5G: This unit was arbitrarily chosen as the first of the expanded units to be investigated. In level 1 (0-20 cm) a small chert core, 20 fragments of green and brown bottle glass, 5 iron nails, 1 iron spike, and 3 small pieces of slag were recovered from the compact clay matrix which was laden with dense sandstone gravels. The large, pointed end of a triangular-shaped, flat rock was encountered in level 1, protruding from and continuing into the northwest wall of the unit. The rock was approximately 30 cm wide and protruded into the unit approximately 20 cm. It was left in place and excavations continued around and below it.

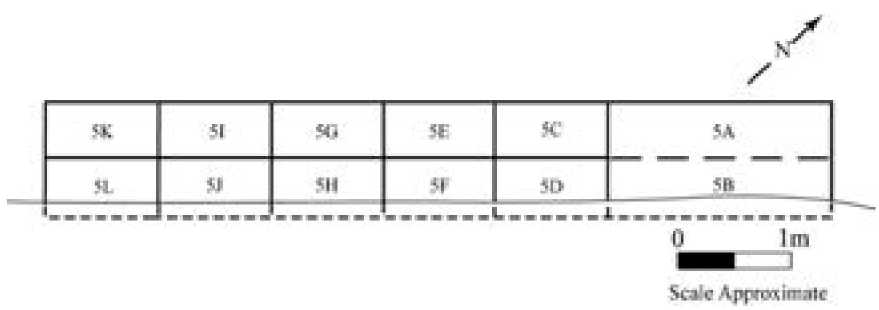

Figure 4-51: Expansion of FTU5A and B into 5K and 5L

In level 2 (20-30 cm) 1 chert and 1 obsidian flake were recovered along with a copper sheathing nail, fragments of black, clear, green, and brown bottle glass (n=63), iron nail fragments (n=19), pieces of slag (n=29) and one cow tooth. Level 3 was excavated as a 20 cm stratum and produced 4 historic ceramic fragments, another copper sheathing nail, 6 glass fragments, 5 small fragments of marine shell, pieces of slag (n=55), 2 small fragments of brick, 2 cow teeth, 2 pieces of modified chert, and 12 iron nail fragments.

FTU5K: Unit FTU5K was excavated simultaneously with FTU5G. With the familiarity gained from the previous excavations, level 1 was excavated as a 30 cm stratum. Excavations recovered 2 small abalone shell fragments, one possibly modified, 1 historic ceramic fragment, brick fragments (n=5), 3 chert flakes, 2 copper sheathing nails and 6 small pieces of copper. In addition to numerous green, clear, brown, and black bottle glass fragments (n=29), iron spike and nail fragments (n=28) and pieces of slag (n=29) were also recovered from this stratum, which was heavily laden with small fragments of charcoal. Portions of two medium-sized, flat rocks were exposed in the northwest corner of the unit at a depth of 25 cm below the ground surface. The rocks extended into the sidewall so their full size could not be determined.

The second level of unit FTU5K was also excavated as a 20 cm stratum (30-50 cm). The same assortment of cultural material recovered from the preceding stratum was encountered in this level, although with the exception of copper sheathing nails (n=10), these were recovered in slightly smaller quantities. The 20 cm excavation exposed more of the rocks situated in the northwest corner and uncovered 2 additional rocks embedded in the northwest wall. Investigation of the third stratum (50-70 cm) produced no additional cultural material and excavation of the unit was terminated.

FTU5I: The alignment and shape of the rocks exposed in FTU5G and FTU5K suggested they might be associated with the foundation or mudsill of the historic barn so the intervening unit, FTU5I, was opened to determine whether additional such "foundation stones" could be located. A 15 cm-wide balk was retained at each end of the excavation to maintain separation between the contiguous units and to provide stratigraphic control. As with unit FTU5K, the first level was excavated as a 30 cm stratum. Within it, 21 partial bricks and brick fragments were recovered, along with a horseshoe, a ceramic trade bead, 2 copper sheathing nails, 13 iron nails and spikes, an iron hinge, 42 pieces of slag, and 25 fragments of green, brown, and clear bottle glass.

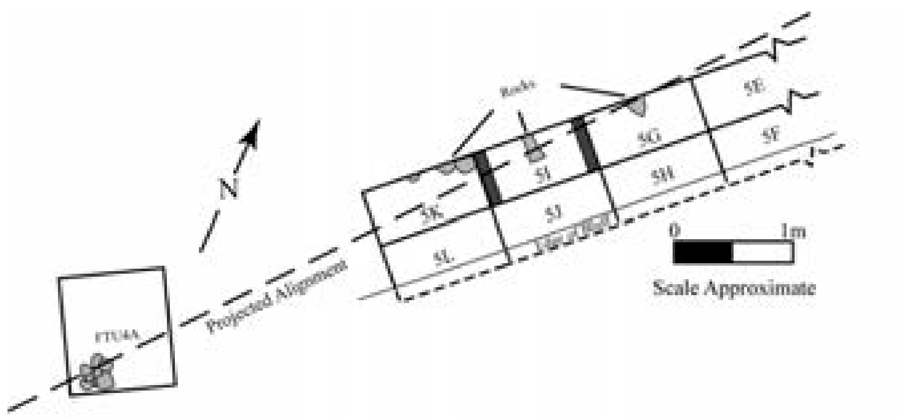

Figure 4-52:Configuration of stones in FTU5G, 5I, and 5K

At a depth of 27 cm below the surface, a flat rock was exposed that projected from the northwest sidewall (Figure 4-52). The rock was roughly triangular in shape, measured approximately 13 cm at its widest point, and extended some 30 cm into the unit. It was situated in approximate alignment with the stones exposed in units FTU5G and FTU5K, and with the stone pile exposed in unit FTU4A at the projected western corner of the barn. Three centimeters lower, at the bottom of the level, continued excavation exposed the faint outline of a wood plank in the center of the unit.

Excavators removed the underlying second layer as a 20 cm stratum (30-50 cm). Seven small pieces of charcoal or charred wood, a single copper sheathing nail, and 22 pieces of slag were recovered from the stratum. Excavation of the second level served to further expose the wood plank, which measured 35 cm in length and 20 cm in width. The nature of the sediment in the second level was markedly different on the eastern side of the unit, beginning at the eastern edge of the plank. There, the sediment changed from the hard, sandstone-laden matrix observed along the western side of the unit to a softer, more friable sediment along the eastern side (Figure 4-53).

More degraded wood was evident in the sidewall of the southeast balk. It appeared to be in alignment with the wood plank that had been pedestalled in the center of the unit. To investigate this feature further, excavators removed a 50 cm-long portion of the balk, exposing the plank fragment. A brick, iron spike and a piece of slag were also exposed at the same elevation as the plank fragment. [17]

FTU5E': Given the apparent alignment of the rocks exposed in FTU5G, 5I, 5K, and FTU4A, unit FTU5E was extended 50 cm to the west to determine whether or not more stones could be found in the alignment (Figure 4-54). The extension was designated FTU5E' and was excavated in two levels, the first as a 30 cm stratum (0-30 cm) and the second as a 20 cm stratum (30-50 cm). No additional stones were found but the same distinction in the nature of the sediment observed in FTU5I was seen in this unit as well. The sediment on the east side of the extension was soft and friable, while that on the west side was more firm, heavily laden with sandstone, and appeared to be culturally sterile. The few artifacts recovered in level 1 (an iron spike, and two small pieces of

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[17] The balk separating FTU5I from FTU5G was removed at the conclusion of field operations. The base of a relatively modern brown "shoefly" flask base was recovered from the balk.

Figure 4-53 –FTU5I plan and profile

iron) were found on or just east of the boundary line, which appeared to be in alignment with the rocks and stones exposed in FTU4A, FTU5K, 5I and 5G. A large brick fragment was recovered from the second level of FTU5E'.

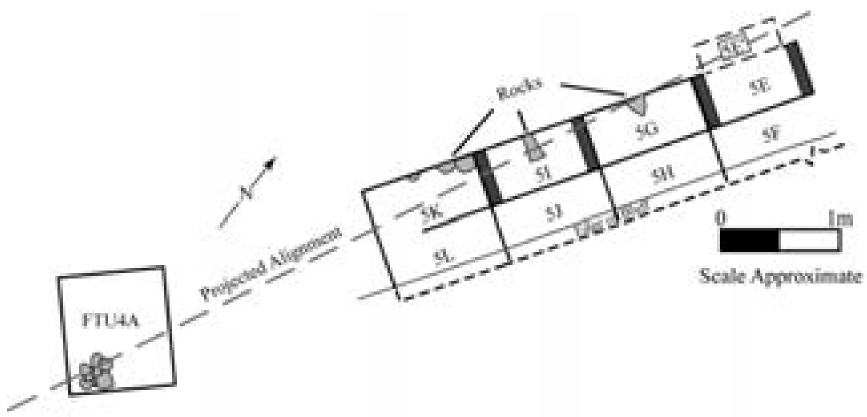

Figure 4-54: Extension of FTU5E to the west

FTU5C': Following the extension of FTU5E, unit FTU5C was likewise extended 50 cm to the west to determine whether or not more foundation stones could be located (refer to Figure 4-4). As with FTU5E', unit FTU5C' was devoid of such stones but exhibited the same demarcation of sediment types. The relatively small excavation exposed two abalone shell fragments, a glazed ceramic sherd, a clay smoking pipe stem, a copper sheathing nail, glass trade beads (n=3), green, brown, and black bottle fragments (n=17), iron nails fragments (n=37), an obsidian point, two obsidian waste flakes, one chert flake, pieces of slag (n=27), a piece of brick, and a piece of leather.

<u>Foundation Test Unit 6</u>*:* As mentioned above, the uncertainty about the projected location of the barn's east corner led to the excavation of a new test unit at the location of the alternative projected location of the corner. Designated as FTU6, the 1-x-1m unit was excavated in three levels, the first of which was excavated as a 30 cm stratum. No

evidence of the barn's corner or foundation was exposed, but the excavation exposed a slag deposit comprising pieces significantly larger than those found elsewhere on the site.

In addition to the slag (n=24), excavation of the first level produced the typical assortment of cultural material seen in the previous units. Iron nail fragments (n=20) and sherds of window pane, and clear, green, and brown bottle glass (n=16) were the most numerous artifacts recovered from the first level. In addition, an embossed brass button (80 mm in diameter), a glass trade bead, a shell bead, historic ceramic sherds (n=2), chert and obsidian waste flakes (n=4), a fragment of copper sheathing material, and a small lead tube were also recovered.

The second stratum (30-50 cm) produced more pieces of slag (n=9) but was noticeably sparser in terms of the density of cultural material recovered. Two brick fragments, 1 creamware sherd, glass fragments (n=4), an iron spike, and small pieces of charred wood (n=15) comprised the artifacts found in the second level. Excavation of the third stratum (50-70 cm) produced even fewer artifacts. An iron nail and three iron nail fragments, a chert core, small to medium-sized slag pieces (n=6), one clear glass and two green bottle glass sherds, and seven small pieces of charred redwood comprised the cultural material found in this level.

The predominant material found in the last stratum was oxidized sandstone, which was found embedded in the dark, heavy clay matrix that appeared to define the boundary between the cultural deposit and sterile ground. Consultation with a geologist who had volunteered to assist in the project confirmed that the natural substrate could be defined by an increase in the quantity and size of oxidized sandstone embedded in the dark clay matrix. To confirm level three as the bottom of the cultural deposit, a 30 cm deep hole was bored into the floor of the level. It produced only a column of heavy, black clay densely laden with oxidized sandstone. From that point, the unit was considered to be sterile and no further excavation was conducted.

Foundation Test Unit 7: In the magnetometer survey conducted in November 1996, a magnetic anomaly of 12.5 gammas was recorded in Area B, 18 m from the baseline along line 27 (refer to Figure 4-30). The anomaly was significantly larger than any of the other minor disturbances observed during the survey, and consequently became the focus of another test unit. Designated as Foundation Test Unit 7, the 1-x-1 m unit was positioned directly above the estimated center of the observed magnetic disturbance, which was located on a down slope at the toe of the bluff, approximately 112 cm below the elevation of the site datum.

With the familiarity of the overburden gained through previous excavations, the first stratum was excavated as a 30 cm level. Brick fragments (n=10), glass sherds (n=11), iron nail fragments (n=26), pieces of slag (n=18), fragments of wood (n=61), an abalone shell pendent, and five pieces of mammal bone were recovered from the first stratum. Excavation at the bottom of the level exposed a 6 inch-wide wood beam running diagonally across the unit's east corner but no evidence of the source of the magnetic anomaly was observed (Figure 4-55).

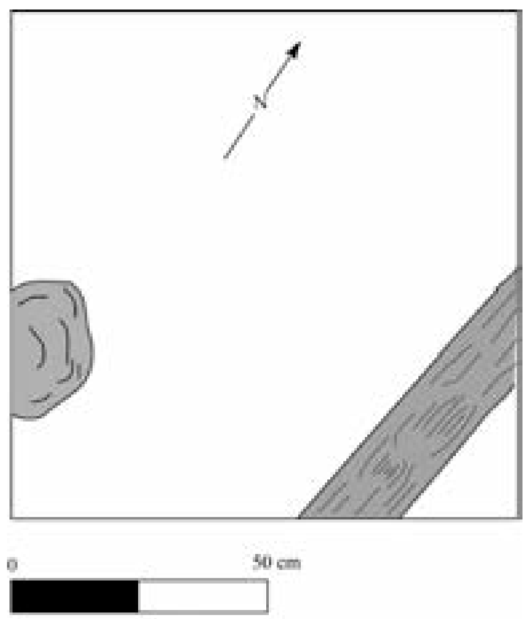

Figure 4-55: Plan View of FTU7 at 30 cm depth

Excavation continued into the second stratum, which was dug as a 20 cm level (30-50 cm). Artifacts encountered in this level were similar in nature to those found in level one. Near the center of the unit, the excavation exposed a substantial root ball, in the middle of which was intertwined a piece of cellophane. In the eastern corner, at the bottom of level two, a Styrofoam cup was also exposed. The presence of the cup and the piece of cellophane indicated that the stratum had been previously disturbed, and the artifacts recovered from the first 50 cm of the excavation were not in primary context.

An eroded fragment of wood was observed in the southeast wall that was possibly associated with the wood beam that crossed the unit's east corner. In the unit's southwest wall, an assortment of medium-size rocks, suggesting the presence of a foundation, was also observed. To further expose these potential features, FTU7 was expanded to a 2-x-2 m square. The unit was subdivided into four, 1-x-1 m squares, each of which was identified by a letter, A – D, with the original square being labeled FTU7A (Figure 4-56).

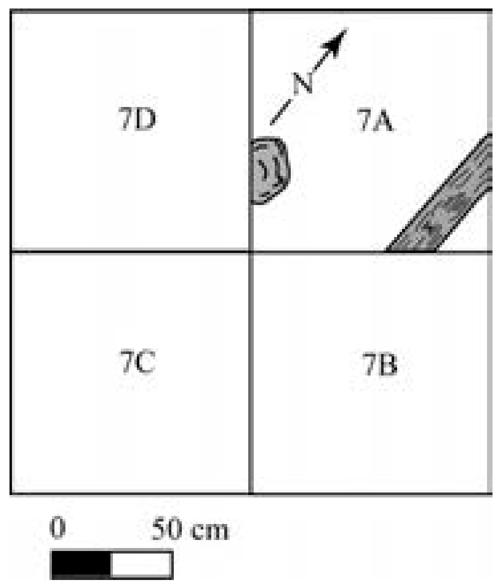

Figure 4-56: FTU7A-D

FTU7B: This unit was excavated in two levels, the first from 0-30 cm, and the second from 30-40 cm. Small bits of charcoal, glass fragments (n=2), and brick fragments (n=3) were recovered from the excavation, which served to expose the roots of a large tree stump. When the excavation reached 40 cm, virtually the entire floor of the unit was covered by the mass of the roots and stump, which continued into the north and east sidewalls. Moist, sandy, gravels and loam with some small cobbles comprised the surrounding matrix. Its nature and proximity to the nearby flow of Fort Ross Creek strongly suggested it was an alluvial deposition. The water wear evident on the roots and stump also suggested the possibility that the stump had been deposited and buried by the flow of the creek. No further excavations were conducted in FTU7B.

FTU7C: Attention next turned to unit FTU7C, which was excavated in three levels. The first 30 cm of the unit were excavated as a single stratum (0-30 cm), while the second (30-40 cm) and third (40-50 cm) were dug in 10 cm levels. No features were exposed in the excavation of the first level, although the quantity and nature of the cultural material recovered from that level were similar to that observed in FTU7A. Marine shell (n=11), green, brown, and clear bottle glass sherds (n=10), two copper sheathing nails, iron nail fragments (n=6), two historic ceramic sherds, three pieces of slag, a stem fragment from a clay smoking pipe, and a single chert flake were recovered from the first level. As in FTU7B, the matrix was composed of moist, sandy soil with high concentrations (>75%) of sub-angular, water-worn pebbles and gravels, the size of which increased with depth.

In level 2 (30-40 cm), three pieces of slag, a fragment of brown bottle glass, and an iron nail fragment were recovered. Excavation at the bottom of the level exposed a portion of an iron bar protruding from the northwest sidewall. The bar measured 3.5 cm in diameter and extended approximately 54 cm into the unit. Excavation continued below the rod into the third level (40-50 cm). Marine shell fragments (n=4), a metal screw, and two pieces of plastic were recovered from this level, suggesting the iron bar was in a secondary, disturbed context. In order to determine the rod's overall length, a large section of FTU7A and a smaller portion of FTU4C were excavated to the west, following the alignment of the rod (Figure 4-57). The completed exposure of the rod revealed an overall length of 109 cm. No other artifacts or features were observed in the excavation and it was assumed that the rod had been the source of the magnetic anomaly.

FTU7A': A fifth 1-x-1 m unit was opened to determine whether the wood beam exposed in FTU7A was associated with any other features. Designated as FTU7A', the unit was excavated in two levels, the first as a 30 cm level (0-30 cm), and the second as a 10 cm level (30-40 cm). A full-size brick, a piece of mammal bone, and several fragments of marine shell were recovered from the level. Excavation of the second level (30-40 cm) exposed the remainder of the wood beam first seen in FTU7A. The beam extended into FTU7A' approximately 44 cm. Its terminal end had been cut square. No other artifacts or features were found in the extended excavation.

The rod and the wood beam both appeared to be in secondary context and did not appear to be associated. Since they lacked any apparent diagnostic value, further excavation in the unit was terminated. The rod was recovered and the unit was backfilled, with the wood beam, roots and tree stump left in place.

<u>Foundation Test Unit 9</u>: As mentioned above in the discussion of Foundation Test Unit 5, simple geometric calculations based on the historic measurements of the barn were made to determine the projected locations of the structure's east and north corners. Because of the possible error in making these projections (as discussed above), the unit placed over the estimated location for the barn's north corner was constructed as a 1-x-2 m rectangle, aligned so that the excavations would expose any foundation remnants associated with the estimated location of the barn's corner or rear wall. The 2 m length

Figure 4-57: FTU7A-D

of the unit was divided in half, with the western portion designated as FTU9A and the eastern portion as FTU9B (Figure 4-58).

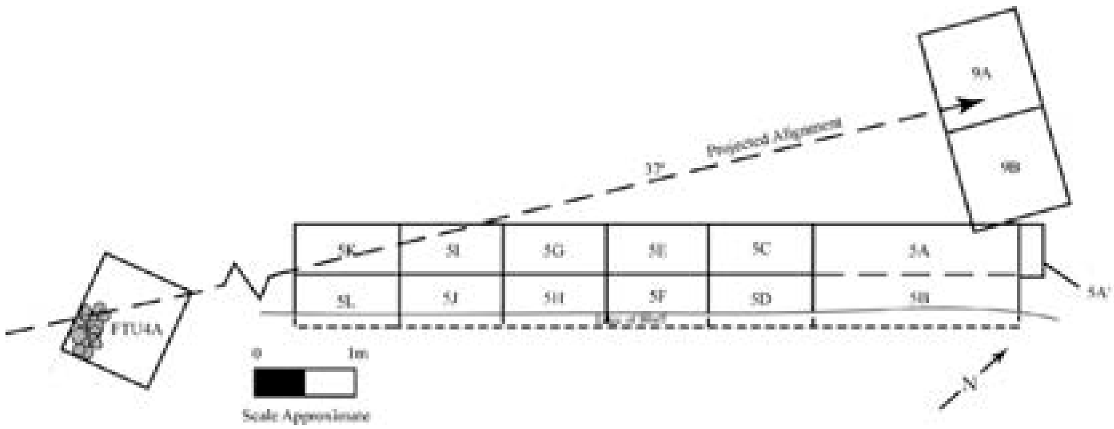

Figure 4-58: Location and orientation of FTU9A and 9B

FTU9A: As with the other units excavated later in the project, the first stratum of unit FTU9A was excavated as a 30 cm level (0-30cm). No evidence of the barn's corner or foundation was observed but a substantial quantity of slag (n=51), and iron nails and spikes (n=17) were recovered from the 1-x-1 m unit. In addition, a flat, possibly modified rectangular piece of abalone shell, a brick fragment, sherds of clear and green bottle glass (n=6), an obsidian waste flake, and three small pieces of limestone were recovered from the first stratum.

Excavators removed the second stratum of the unit as a 20 cm level (30-50 cm) and encountered the same type of artifacts as those recovered in level one. Slag was again the dominant artifact type (n=43), followed by more iron nails and pieces of oxidized flat iron (n=17). A thin fragment of slate and the pointed end and partial body of a slate pencil were recovered from the second level, as were sherds of clear, green, and brown bottle glass (n=3), a fragment of brick, fragments of charcoal or charred wood (n=13), and six pieces of heat-altered sediment or sandstone. In level 2, at a depth of 31 cm, excavation exposed what appeared to be a wood slat in the northwest corner of the unit. It measured 31 cm in length and projected into the unit approximately 6 cm. In order to expose more of the wood, FTU9A was expanded 50 cm to the north, east, and west (Figure 4-59). The expanded unit was designated FTU9A'. As with FTU9A, the first level was excavated as a 30 cm stratum (0-30 cm). A small glass trade bead, a rubber button patented in 1849, and three small brick fragments were recovered. In addition, the excavation produced glass bottle sherds (n=6), a single chert percussion flake, an obsidian core fragment, a copper sheathing nail, a fragment of a center-fire brass cartridge, iron nail fragments (n=17), a large quantity of slag (n=46) fragments of redwood (n=9), and small pieces of charcoal or charred wood (n=10).

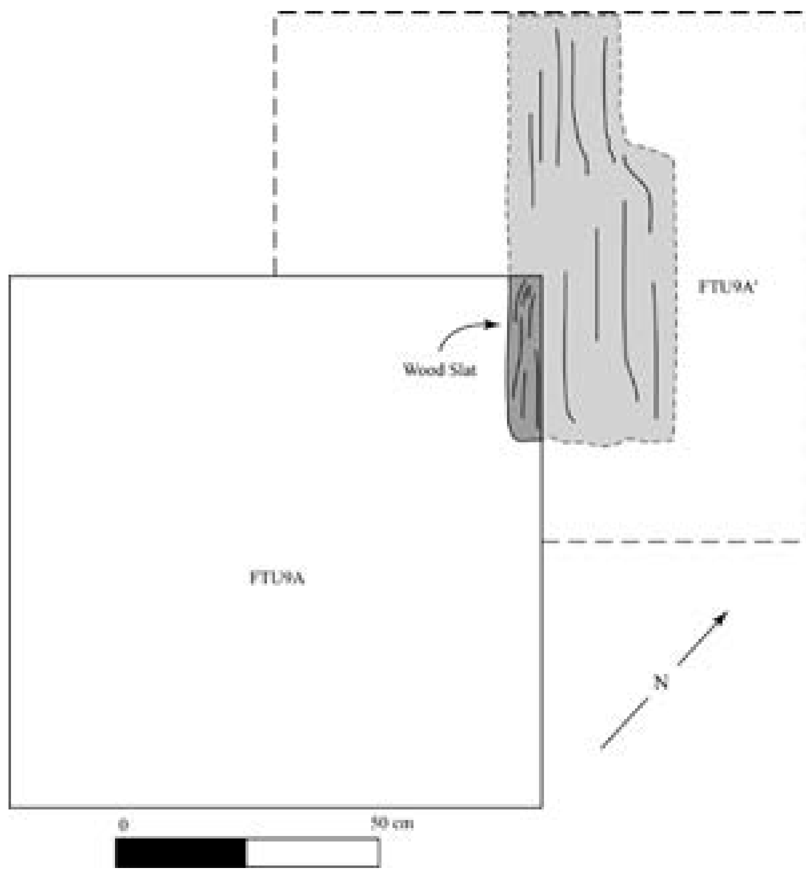

Figure 4-59: Wood slat and expansion of FTU9A

The second and third levels of FTU9A' were excavated as 10 cm strata. Excavation encountered the top of the wood slat at approximately 30 cm. What had appeared to be a slat in the northwest corner of FTU9A proved to be a degraded redwood plank approximately 30 cm wide, extending to the end of FTU9A' and into the northwest sidewall. The plank was pedestalled as excavations continued in FTU9A' to the bottom of level 3 (40-50 cm). Additional quantities of slag (n=64), brick fragments (n=2), oxidized pieces of iron and iron nails (n=6), pieces of clear window pane (n=2), and a possible gun flint were recovered.

FTU9B: As the excavation of the plank in FTU9A' continued, excavation of unit FTU9B began. Balks 10 cm in width were left in place between the northeast wall of FTU9A and the northwest wall of FTU5A. In the latter instance, it was hoped that an additional stratified profile could be obtained if the sand/clay bowl feature exposed in FTU5A was encountered in FTU9B.

Excavators removed the first stratum of FTU9B in a 30 cm level (0-30 cm). No evidence of the plank or any other foundation features were encountered. However, a noticeably larger quantity of green, brown, black, and clear bottle glass sherds was recovered (n=31). In addition excavation exposed two medium-size glass trade beads, historic ceramic sherds (n=4), a piece of slate, two copper sheathing nails, small brick fragments (n=8), small pieces of burned wood or charcoal (n=37), a chert percussion flake, iron nail fragments (n=38), slag pieces (n=52), and a .44 caliber bullet casing.

Because the excavation of FTU9B occurred at the end of the project, there was insufficient time to excavate more than one additional level. The second stratum was excavated as a 10 cm level (30-40 cm) but was not deep enough to reach the level of the sand/clay bowl feature in the adjacent unit FTU5. Two more bottle glass sherds, an iron spike, and slag pieces (n=7) were recovered from the stratum. At approximately 30 cm, the excavation exposed what appeared to be a compact clay floor, heavily flecked with charcoal and small brick fragments. Above this level the matrix was sandier, less compacted, and noticeably different from that encountered at the bottom of the level.

FTU9A' Extension: Returning to the plank in FTU9A', in order to determine its length and whether it was related to the barn's foundation, project staff extended the northwest edge of the unit an additional 50 cm and excavated a single, 30 cm stratum (figure 4-60). Excavation of the 50 cm-x-1 m unit, designated as FTU9A' Extension, determined that the end of the plank extended only another few centimeters before terminating in a square-cut end. Lying immediately adjacent to the top surface of the plank, and oriented perpendicular to it, was another, heavily degraded fragment of redwood plank. Its orientation and relationship to the larger plank suggested the two might have once formed the foundation sill for the barn's north corner. To confirm this supposition, project staff ran a string line from the location of the barn's west corner in FTU4A, to the apparent corner in FTU9A'Extension, then 90-degrees to the southeast until reaching the edge of the bluff. The distance between the west corner and the two intersecting planks in FTU9A'Extension measured 37 feet, the length of the barn as described in the historic literature (Figure 4-61).

FTU5A'North: Since the string line running to the southeast was slightly north of the previously excavated FTU5A' and no evidence of the barn's foundation had been observed in either that excavation or in FTU9B, unit FTU5A' was extended northward an additional 50 cm so that the barn's alignment as defined by the string line could be tested. The extension was designated FTU5A'North (Figure 4-62).

Figure 4-60 wood planks in FTU9A and Ext

Figures 61 and 62

Level one was excavated as a 30 cm stratum (0-30 cm). At a depth of approximately 27 m, directly beneath the string line, excavators exposed a segment of highly degraded redwood plank. Lying on top of the plank were a rock, two intact, 6-inch iron spikes, and two iron spike fragments (Figure 4-63). A third iron spike fragment lay off to the north side. The condition of the triangular-shaped redwood fragment was nearly identical to that of the two redwood fragments exposed in FTU9A'Extension, and its location directly beneath the string line strongly suggested that the plank was another remnant of the barns' foundation, this one being a portion of the barn's rear wall.

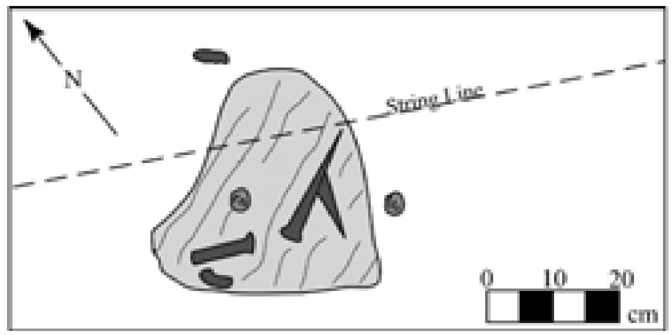

Figure 4-63: Redwood plank fragment. Plan view

The excavations that resulted in the exposures of the potential foundation members occurred at the end of field operations. Consequently, the wood plank in FTU9A'Extension and the fragment in FTU5A North were both left in place. Prior to backfilling the excavations, the brick and iron fragments exposed in FTU9A'Extension were recovered and entered into the project artifact catalog.

<u>Test Units 5 and 6</u>: Two additional 1-x-1 m test units were excavated on the east edge of the access road leading to the beach. Each was placed on the projected location of one of the barn's corners prior to the excavation of FTU9A, which ultimately exposed the likely remains of the barn's north corner. Designated as Test Units 5 and 6, respectively, both proved to be outside the line of the barn's foundation.

Test unit 5 was excavated in three levels, the first of which was dug as a 30 cm stratum (0-30 cm). Glass sherds were recovered (n=12) in the first level, as were 2 pieces of chert, a copper sheathing nail, small pieces of iron and iron nails (n=33), pieces of abalone shell (n=9), and pieces of charcoal or charred wood (n=8). In addition, a dense concentration of slag (n=60) was recovered from the first level. In level 2 (30-40 cm), which was excavated as a 10 cm stratum, more slag was encountered (n=15), as were two small pieces of shell and another sherd of green bottle glass. Level 3 (40-50 cm) was culturally sterile. No evidence of the barn's foundation or sill was observed in the excavation, which was backfilled after the excavation of level 3 was completed.

Test unit 6 was also excavated in three levels, the first of which was dug as a 30 cm stratum (0-30). Although the units were relatively close to each other, test unit 6 contained noticeably larger quantities and sizes of artifacts, slag in particular. In level 1 excavators recovered small pieces of brick (n=3), small pieces of clear bottle glass (n=3), three small sherds of historic ceramics, copper sheathing nails (n=3), an iron spike, and uncharacteristically large pieces of slag (n=80). Level 2 (30-40 cm) produced even more large pieces of slag (n=29). In level 3 (40-50 cm), the size and quantity of the slag was significantly smaller (n=4). A large brick fragment and a small, triangular shaped piece of pearlware were also recovered in that layer. As with TU5, no evidence of the barn's foundation was encountered and the unit was backfilled after the excavation of level 3 was completed.

Conclusion

A significant amount of data relating to the historic use of Sandy Cove was recovered through the project's archaeological investigations. The remains of what may be a stoving oven, the wood platform buried beneath the sands of the cove, the location and alignment of the barn, and the thousands of examples of historic material culture have the potential to provide significant insights into the industrial capabilities of the Russian American Company, the decisions about spatial organization made by its craftsmen, the social complexity of its workforce, and the activities of those who worked in the cove following the Company's departure.

In order to realize this potential, some synthesis of the data recovered through project activities is necessary. This chapter has discussed the formal characteristics of the excavation units, the features encountered in them, and the artifacts recovered from them in some detail. Now, to recognize the implications of what these data represent, a more functional interpretation of the features and artifacts is required. In the following chapter such a discussion will be presented, along with a more detailed analysis of the project's artifacts and features, in an effort to develop an interpretation of the data that may be useful in addressing the research questions raised at the project's inception.

Chapter 5: Analysis and Interpretation

The artifacts and features uncovered in the fragmentary remnants of the Russian American Company's industrial complex can provide some insight into both the technological sophistication of the Ross colony's craftsmen, and the social dynamics that existed in the small, but productive frontier enterprise. Although most of the area in which the industrial complex operated has eroded away,[1] a surprisingly large quantity of material culture associated with the enterprise was encountered during the excavations that were conducted in the small strip of ground that still remains. Over the course of the excavations, over 12,200 artifacts were recovered, catalogued, and analyzed from the 14 test units and the three beach excavations. In addition, several architectural features were exposed on both sides of the access road leading to the beach, and on the beach itself.

In order for these diverse artifacts and features to be discussed in a coherent manner, they have been organized below into two sections: the first comprises a discussion of the features exposed within the excavation units and on the beach, the second a description and interpretation of the artifacts recovered from project excavations.

Features

A number of features were exposed during project excavations (Figure 5-1). Because their investigations often led to additional excavations in adjacent locations, the

[1] Using the dimensions of the barn depicted in the 1866 photograph for scale, a rough estimate indicates that approximately 6,000 square feet (or 75%) of the ground surface depicted in that photo has eroded away.

Figure 5-1: map of test units

features will be discussed in the order of their exposure. Although the nature of some of the features has proven to be quite ambiguous, efforts to develop functional identification for each of them have been made using the historic record, interpretation of their observed spatial relationships, and analysis of their specific archeological context.

Test Unit 2 – Corduroy Road: This excavation unit was initially opened in an attempt to determine whether a line of stones would be found in parallel alignment to those observed in the sidewall of the eroded bluff, and thought to be foundation stones for the east wall of the wood barn. Although no such stone alignment was found in TU2, several stacked, hewn redwood beams, approximately 18 cm (7 in.) square, were eventually exposed in what grew to be a 2-x-2 m excavation unit. The ends of these beams were also found in the excavation of adjacent unit TU4

Analysis of the location, alignment, and configuration of the redwood beams indicates that they are probably the remnants of the Russian corduroy road[2] that wound down the hill, and passed immediately above the location of the test units. This interpretation is derived from both practical experimentation and the examination of historic photographs.

As mentioned in the discussion on TU2 presented in Chapter 4, an analytical technique developed by Gene Prince of the Phoebe Hearst Museum of Anthropology at UC Berkeley (Prince 1988) was used to visually reconstruct the past configuration of the cove. By placing a slide transparency of an 1866 photograph of the Ross stockade and cove inside a 35 mm camera, researchers could view an image of the historic setting superimposed on the modern landscape. Using this technique, project staff determined that the location and alignment of the beams exposed in TU2 were the same as that of a

[2] A corduroy road is a road built of logs, laid side by side transversely.

partially obscured feature depicted at the right edge of the historic photo (Figure 5-2, photo A). The feature was originally thought to be the remains of a short retaining wall but subsequent analysis of a second photograph determined that it was the end of the support structure for the corduroy road (Figure 5-2, photo B).

Photo B appears to have been taken at a later date than photo A, given the more deteriorated condition of the barn and the blockhouse in the background. Unlike the earlier photo however, photo B provides a good depiction of the corduroy road, and appears to confirm that it terminated at or near the location of TU2, strongly suggesting that the redwood beams exposed there are the remaining fragments of the road's support structure.

FTU1 – Stoving Oven: Perhaps one of the most significant features encountered during all project investigations was that exposed during the excavations of FTU1. As described in Chapter 4, in the first 50 cm excavated for this unit, a rich, jumbled mixture of chipped and ground stone tools, copper sheathing nails, marine shell fragments, iron nails, bottle and windowpane glass, glass trade beads, leather and brick fragments was recovered At a depth of approximately 50 cm, the tan, loosely packed sediment that had characterized the unit's matrix to that point gave way to black, coarse, granular sand -- heavily laden with bits of burned wood small pieces of oxidized sandstone. The sand stratum, which proved to be approximately 30 cm thick, appeared to have been burned, and was considerably more compact than the matrix that had been previously excavated. Below the layer of burned sand, excavation exposed a floor of rocks that covered the bottom of the unit and appeared to extend beyond the limits of its walls. The edge of this floor

Figure 5-2: Photo 5A- & 5-B

formed the stone alignment that had been observed in the face of the bluff -- the suspected foundation wall configuration that led to the excavation of TU2 discussed above. Like the sand matrix immediately above it, the floor of stones appeared to have been burned, as all the rocks were discolored and many were cracked *in situ*.

Expansion of the test unit revealed the presence of a trench cut into the burned sand matrix, a trench that had been back-filled with the same tan, loosely packed sediment that comprised the matrix of the upper levels. The trench proved to be sharply rectangular in cross-section, measuring 50 cm in width and 20 cm in depth (Figure 5-3). It appeared to continue into the north sidewall, and presumably under the adjacent access road.

The fire-cracked rocks, burned, compact sand, and the rectangular trench comprising the feature closely resemble the components of an oven used for "stoving." As discussed in Chapter 3, this was a method used in 18th century shipbuilding to soften hull planks so they would be supple enough for bending. Although no specific description of a stoving oven itself could be located to substantiate this interpretation, information about the process of stoving was found in several different sources.

Prior to 1720, hull planks were softened for bending through a process know as charring, which "consisted in subjecting the inner surface of the plank to the action of fire kept up by bavins, or old timber, whilst the outer side was kept wet" (Fincham 1851:76; Baker 1973:133). In 1720, a British shipwright named Cumberland developed an improved method for softening wood known as stoving. In his 1851 treatise on the history of naval architecture, Fincham described stoving as follows:

Figure 5-3 – (renumbered Figure 4-8)

> This process [stoving] consisted in placing the thickstuff[3] and planks in wet sand, and subjecting it to heat of such degree and for such time as were deemed the best suited to extract the remaining juices of the wood, and to bring it to the condition of suppleness that was required in using it (Fincham 1851:76).

This approach to preparing planks for bending around the frames of a ship remained in use until 1736 when another shipwright in the British dockyards named Boswell introduced the use of steam-trunks (Figure 5-4). This somewhat unwieldy device proved to be a superior method of introducing suppleness to the wood, and replaced the stoving ovens in all Royal dockyards, and soon thereafter in private shipyards as well (Fincham 1851:77).

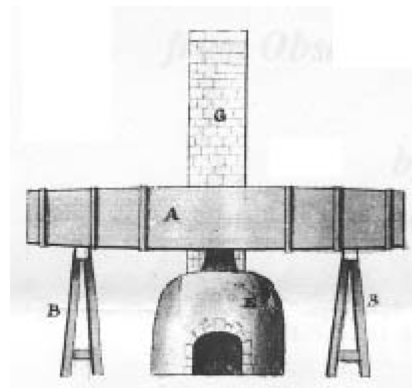

Figure 5-4: Steam Trunk
(Ollivier 1737)

Unfortunately, a specific description of what stoving ovens looked like could not been found. A contemporary account of their use in British shipyards was found in the reports of a French military spy who wrote of them in his 1737 report on the British Navy but, maddeningly, left out their description: "I shall follow these stoving-ovens closely . . . [but] will say nothing of their construction since we already have detailed plans of them" (Ollivier 1737:55).

However, Mr. Edward Uber, a retired shipwright who specialized in building reproductions of historic ships in the Mystic Seaport Museum of America and the Sea in Mystic Connecticut, provided a description of what they probably looked like. Mr. Uber (pers. com. 1998) described a process in which a fire of some magnitude was built on a

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[3] "Thick stuff" meant planks about 6 to 8 inches thick and 12 to 15 inches wide. Ordinary planking ranged from 1 ½ to 4 inches in thickness (Baker 1973:133).

bed of stones to make them red-hot. When the stones were properly heated, a layer of wet sand was spread over them and allowed to warm. When the sand was sufficiently heated, the wood hull planks, which had been soaked in water, were buried in the hot sand where they remained until they were suitably softened.

Uber's specific description and the general references to the use of heated, wet sand in the process of stoving the planks (Baker 1973:133; Fincham 1851:76; Horsley 1978:74) strongly suggests that the feature encountered in FTU1 is the remains of a stoving oven used by the Russian American Company's shipwrights in the Ross shipyard. The bed of fire-cracked rock beneath a thick stratum of burned, black sand is consistent with both Uber's description of a stoving oven, and the general explanation of the stoving process discussed in the historic literature. The trench that had been cut into the bed of burned black sand may well be the void created when the last planks were pulled from the sand bed of the oven.

The light tan sediment that filled the trench, and the varied mixture of artifacts recovered from the superincumbent layers, (all of which appeared to be in a disturbed secondary context), suggest that the open pit of the stoving oven may have offered a convenient disposal site for casual discards following the closure of the shipbuilding operation in 1827.

FTU2: This unit was excavated in an effort to determine whether any evidence of the stoving oven, specifically the rock floor, continued to the east of FTU1. Although neither a continuation of the rock floor, nor any other type of feature were encountered in the excavation of FTU2, a significant change in the nature of the unit's matrix was apparent beginning at a depth between 50 and 60 cm, the approximate depth of the rock floor in the adjacent FTU1. The matrix of FTU2 between 50 and 60 cm changed from the loose, tan sediment of the superincumbent strata, which was similar to what had been observed in the upper layers of FTU1, to scattered concentrations of granular, black sand. It appeared to be the same type of burned sand as that encountered above the rock floor in FTU1, suggesting that it was the source of the deposits found in FTU2 -- an interpretation that will be examined more fully as part of the discussion of the adjacent FTU3.

FTU3 – Charred Redwood: The presence of several burned wood fragments in the face of the erosional cut below the access road to the beach was the impetus for excavating this test unit. As discussed in Chapter 4, fragments of charred redwood dominated the cultural material recovered from this unit. FTU3 produced nearly 1,312 pieces of wood, 37% of all wood fragments recovered from the project's excavation units. Some pieces were as small as splinters but many were portions of planks and beams. All the wood recovered from this unit was charred on the outside, and most pieces that were identifiable appeared to be portions of larger members (i.e.) butt ends of beams, tailpieces of planks, etc.

The fact that the exterior surfaces were charred raises several possibilities that may account for the presence of this isolated deposit of wood. Given the proximity of the wood to FTU1, the deposit may be partially burned wood left over from the fire that last heated the rocks of the stoving oven. Once the rocks of the oven had been sufficiently heated, any unburned fuel would have been removed so that the layer of wet sand could be spread directly on the stones. It is possible that the charred deposit of FTU3 is the wood that had been removed and quickly tossed to the side so that the sand could be laid while the rocks were still hot. However, considering the wood deposit is some 23 feet northeast of the stoving oven it would have been a considerable toss. On the other hand, the possibility that this was a useful disposal method may also be seen in the neighboring unit FTU2. There the burned, granular sand matrix of the unit appears to be sand that was removed from the adjacent stoving oven -- tossed to the side after having been used to soften planks so that a new fire could be built on the rock floor of the oven.

A problem with this interpretation of the wood deposit is that one of the properties of redwood that makes it such a desirable building material is its resistance to fire. It is one of the poorest burning fuels available from the forest. If the shipwrights of Ross were using it to fuel the fire that heated the rocks of the stoving oven, they would not have had much of a fire. Then again, the charred redwood may have been the only wood that wasn't consumed by a fire built of the other woods available to the shipyard. Fragments and scraps of oak, fir, and pine, for example, would have burned to ash in a large fire, and perhaps the redwood was all that remained to be removed.

An alternative explanation for the presence of the charred redwood in FTU3 is that the shipwrights fully understood the resistance of redwood[4] to burning and were using just that property of the wood to control a fire used to char some of the hull planking. As described above, charring was an alternative to stoving and, although in Europe it was replaced by stoving, at Ross both methods for bending wood may have been used. If such were the case, the low fire produced by burning redwood would have been desirable for controlling the heat brought to bear on the face of the planking. The proximity of the charred redwood deposit in FTU3 to the stoving oven in FTU1 suggests that both stoving and charring may have been used in the Ross yard.

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4 The Russians initially were unfamiliar with the properties of redwood, and for a time thought it was a form of cedar.

A third alternative is that the charred wood is simply the remains of a fire built to dispose of the scraps left over from the last shipbuilding effort. However, all of the wood in the deposit appears to be redwood, with no evidence of pieces of oak, pine, or laurel -- woods known from historic accounts to have been used in the ships built at Ross. The wood remains that have been recovered from FTU3 are all charred on the surface, but not burnt, indicating a low temperature fire. If the fire was intended to dispose of the shipyard's scraps, evidence of other types of wood should have remained, given the low level of combustion. Since no such evidence was found, it appears that the deposit of charred redwood is from a fire built for a purpose other than simple disposal of the scrap wood.

Analysis of two beam fragments recovered from FTU3 suggests yet another interpretation: As described in Chapter 4, one of the charred redwood beam fragments recovered from the deposit retained all four of its squared surfaces. The 20 cm (8 in.) long fragment is approximately 15 cm (6 in.) wide, and 13 cm (5 in.) thick. It is split at a point where a 4 cm (1 5/8 in.) diameter hole had been bored through (Figure 5-5). The underside of the fragment has been shaped to form a gentle curve that is highly suggestive of a ship's timber. The dimensions of the timber fragment and its curvature

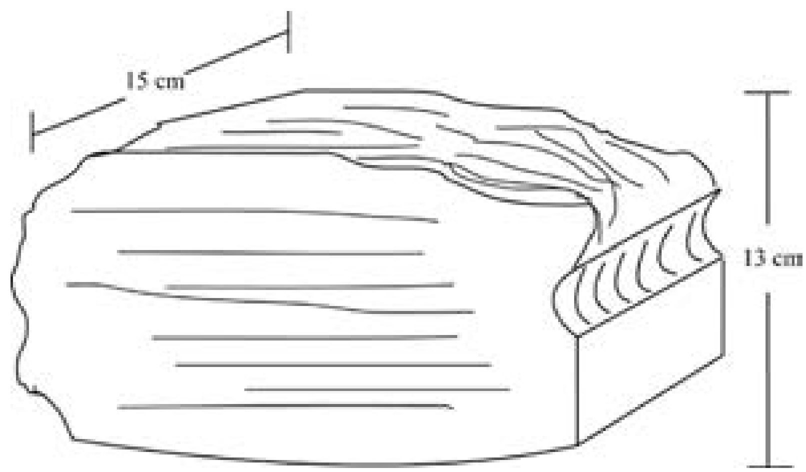


Figure 5-5: Stub-end of ship's frame

are consistent with those of the top portion of a frame (known as a futtock) for a ship of between 150 and 250 tons – the size of the ships built in the Ross shipyard (Desmond 1919:22; Khlebnikov 1861). Likewise, the diameter of the borehole is consistent with the dimension of a wood fastener (known as a treenail), which would have been used to fasten a ship of the size built at Ross (Desmond 1919: 23).

A second, smaller fragment of a similar type redwood beam is also highly suggestive of a ship's timber. Although it is degraded to the point that two of its finished sides are missing, the two sides that remain indicate the beam measured 19 cm (7 ½ in.) wide and 14 cm (5 ¾ in.) thick. A beam of this size is also consistent with the dimensions of a lower futtock in a frameset for a ship of the size built in the Ross shipyard. As with the other beam fragment, a portion of a 4 cm (1 5/8 in.) treenail borehole remains.

If, in fact, these redwood beam fragments are ship-related, they may be useful temporal indicators. In September 1820, Captain Matvei Ivanovich Murav'ev assumed the position of Chief Manager of the Russian colonies in America (Pierce 1986: 7). By 1821 the two ships built in the Ross yard, the *Rumiantsev* (1818) and the *Buldakov* (1820) were both in need of extensive repairs (Tikhmenev 1888:228). In an attempt to improve the durability of the ships built by the company, Murav'ev directed that all future construction should use pine for the ship's frames and laurel for the hull planking (Tikhmenev 1888:228). The fact that the frame portions found in FTU3 are redwood suggest that the deposit predates this directive and is probably associated with the construction of the *Volga*, whose keel was laid in September of 1820 and which was launched from the Ross ways in 1822. [5] It is also possible that the scraps are from the construction of either the *Rumiantsev* or the *Buldakov*, but since they were launched in 1818 and 1820, respectively, it is unlikely that the scraps from their construction would be lying around in 1821, the year Murav'ev's directive probably came down.

If Murav'ev's directive was followed, none of the components of the next ship built at Ross – *Kiatka* (1823-24) -- should have been fabricated of redwood. Lacking an abundant supply of fuel for the charring fires that the slow-burning redwood scraps would have provided, the Ross shipwrights may have turned to the use of a stoving oven for the planking of *Kiatka,* abandoning the charring operation represented by the redwood deposit found in FTU3. If such were the case, the heavy deposit of charred redwood found in FTU3 would predate the use of the stoving oven encountered in FTU1. Based on the absence of any significant redwood fragments in the latter unit, and the dense deposit of charred redwood found in FTU3, it appears the Ross shipwrights may have adopted a new technological strategy for the planking of *Kiatka,* and continued using it, rather than charring, in the subsequent construction of the two other vessels built for the Spanish missions.

FTU4 – West Corner of Barn: This 1-x-4 m unit was subdivided into four 1-meter squares, designated as A, B, C, and D respectively. Units A and C were excavated first, followed by units B and D. As discussed in Chapter 4, unit A was situated adjacent to the stake marking the projected location of the west corner of the wood barn depicted in an 1866 photograph. At a depth between 70 and 80 cm, excavators encountered a

[5] If other temporal indicators could be found that clearly date the FTU3 deposit to post-1822, the continued use of redwood in ship construction could also be seen as an indication that a form of low-level resistance to authority may have prevailed in the shipyard. Alternatively, it could also be seen as further evidence of the poor craftsmanship brought to the shipbuilding effort..

cluster of rocks and relatively flat stones concentrated in the southeast corner of the unit. A number of historic period artifacts (an iron spike, an iron ring, a small iron shot, etc.) were found resting on top of or immediately next to the cluster of stones. Excavation below this feature proved to be culturally sterile.

The configuration of the stone cluster, the fact that they lay within inches of the wood stake marking the barn's corner, the absence of similar rock clusters anywhere else in the unit, and the association of the artifacts exposed on and around the stones suggested the rock arrangement was the purposefully placed remains of a stone foundation support for the west corner of the wood barn. As described previously, this assumption was used to generate projections of the barn's location and orientation – projections that were confirmed with the subsequent discovery of the barn's north corner in the excavation of FTU9.

During the excavations of FTU4B and FTU4D, a large, flat stone was exposed in each unit that later proved to be in the same alignment as the stones encountered in FTU5A-K and believed to be foundation stones for the barn's west wall. The stone exposed in FTU4B was situated along the edge of a linear, gravel-filled depression that paralleled the projected alignment of the barn's western wall (Figure 5-6). Of particular interest was the observation made in subsequent analysis of the level records for FTU4A-D that indicated the bulk of the cultural material recovered from each unit was concentrated on the east side of the projected line of the barn's western wall, suggesting those materials had been deposited within the barn itself. The nature and density of some of these deposits warrants further discussion.

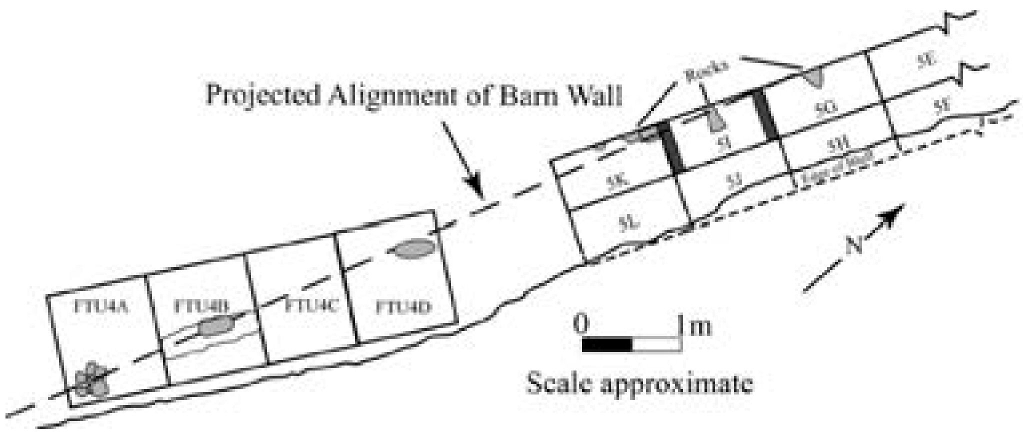


Figure 5-6: Location of foundation stones

A dense concentration of thin, flat pieces of iron was recovered from FTU4C, 4B and 4D. This material was not seen in any other excavation unit. Numbering approximately 600, the iron fragments were concentrated in FTU4C, where over 475 pieces were recovered. The remaining fragments were recovered from FTU4D, with a light scatter found in FTU4B. The iron fragments had oxidized to a bright red color on one side, but not the other, and the thickness of each was a nearly uniform 3.5mm. In those fragments large enough to exhibit a clearly defined edge, the fragments appear to have tapered slightly from edge to edge, with thickness ranging from approximately 3.6mm on one edge to 3.3mm on the other.

The historic record indicates that the rooftops of some buildings within the colony were red, as they were covered with iron shingles that had oxidized (Blomkvist 1972:106; Belcher 1979 [1839]:77; Farris 1990:480). Given the thickness of the iron fragments recovered from the units of FTU4, their rectangular shape, and the oxidation found on only one side, it is possible that they represent the remains of a deposit of a such shingles that at one time had been piled inside the wood barn, along the western wall at the location of FTU4C.

A second, unusually dense deposit of cultural material was recovered in FTU4D, immediately north of the concentration of possible iron shingle fragments. Of the approximately 900 pieces of marine shell that were recovered from all the project excavation units, 35% (n=313) were found in FTU4, with over 54% of those (n=168) found in FTU4D, the shallowest of the four units comprising the excavation. The bulk of the shell appears to be *haliotis* and all of it is fragmentary. None of it appears to have been culturally modified but much of the shell is chalky in texture, suggesting it may have been calcined.

As discussed in Chapter 3, the lime required in the preparatory stages of leather production was likely obtained for the Ross tannery by calcining marine shell, since there were no limestone deposits in the immediate vicinity of the colony (Khlebnikov 1976:128). The unusually dense deposit of the shell encountered in FTU4D suggests that a supply of such calcined shell may have been either stored or produced in the barn.[6]

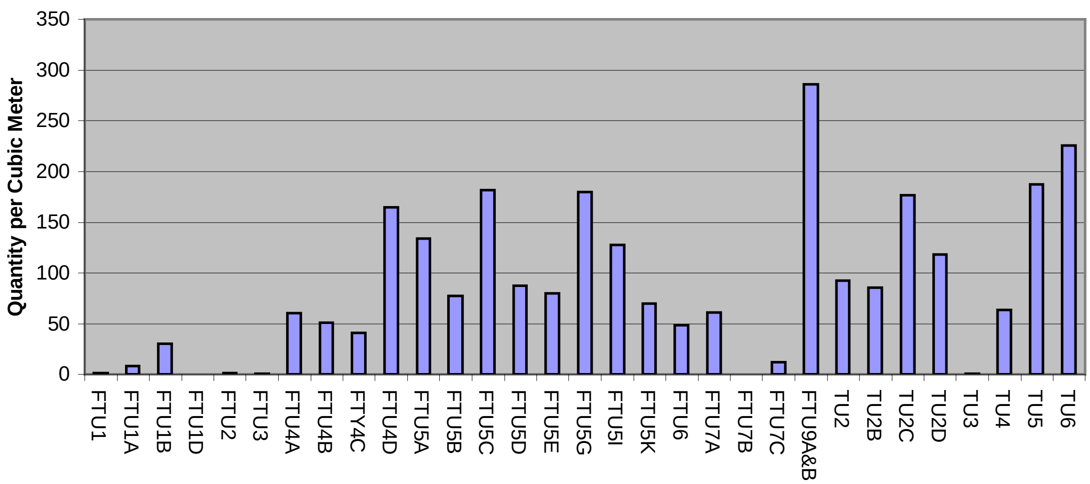
As with the marine shell, the largest concentration of animal bones was also found within the boundaries of the barn. Approximately 422 of these faunal elements were recovered in project excavations. Of these, 57% (n=240) were found in FTU4 and FTU5, both of which would have been located within or immediately outside of the barn. Interestingly, of the 240 faunal elements recovered from these two units, 82% (n=196)

[6] As discussed in Chapter 3, the historic record describes the tanning facility as being located in a very large building at the mouth of the creek, " . . . the rear half of it was used for tanning leather" (Munro-Fraser 1880:366). Although it is possible the wood barn may have housed the tannery, it is unlikely. The forge and blacksmith shop is described as being 37 feet by 26 feet in size – the dimensions of the barn as determined through project excavations, while the tannery is described as being in another building 35 feet by 21 feet in size (Dmytryshyn et al. 1989:432).

were recovered from FTU4, which would have been situated along the west wall. This location also corresponds with a dense deposit of ceramic sherds, as discussed below, suggesting that west corner area of the barn may have been a preferred refuge for taking meals. Alternatively, both deposits may represent disposal episodes following the abandonment of the barn.

FTU5 – Clay-lined Depressions: What began as a 2-x-2 m excavation unit eventually expanded into a unit encompassing ten additional 1-x-1 m units, six of which had 1m-x-50 cm extensions. The initial unit, designated as FTU5A & 5B, was situated so that excavations would expose the projected possible location of the barn's north corner. For the most part, the ten additional 1m^2 units were excavated as part of the attempt to locate evidence of the barn's western foundation. In the excavation of FTU5A, two shallow, circular clay-lined depressions were exposed, one situated on top of the other. A low mound of clay and scattered deposit of sand appeared to lie on the west side of the depressions. These were exposed more fully in the excavations of FTU5C and 5D. The clay-lined depressions were partially filled with a mixture of heavy, granular sand and clay, which included several small pieces of charred wood or charcoal. Although the function of the clay-lined depressions has not been ascertained, it is possible they may have been associated with the forge, since each had a small concentration of burned, charcoal-like material in its center. More important to this interpretation is the spatial analysis conducted on the slag that was recovered in virtually every project excavation conducted on either side of the access road to the beach. A total of 1,738 pieces of slag were recovered during excavations. These ranged in size from 12 cm to .75cm, with an average size of approximately 5 cm. The heaviest concentrations of slag were found in three discrete locations: the test units situated inside or immediately next to what would have been the footprint of the barn (FTU4A-D and FTU5A-K), TU2 - located across the road and southwest of the barn, and FTU9, which was located immediately outside the

Figure 5-7: Slag Density per Unit



barn's north corner (Figure 5-7). Analysis of these concentrations clearly suggests that the iron working activities that produced the slag took place within the confines of the barn. The excavation units situated within or next to the projected footprint of the barn produced 46% of the total slag recovered, with a density of 96 pieces per cubic meter. The deposit recovered from FTU9 accounted for 16% of the total but it was the densest deposit of all excavations ($n=350/cu^3$) (Figure 5-8). Its location at the north corner of the barn, and the density of the deposit suggest the area around FTU9 was a convenient disposal site for the waste material of the iron work, and further suggests that a door or window may have been located in the northeast wall at the rear of the barn through which the disposal may have occurred. The elevated densities of slag recovered from FTU6 and FTU7A-D ($49/m^3$ and $61/m^3$ respectively) add more weight to the suggestion that the

Figure 5-8 Contour map of slag density

ironworkers who plied their trade inside the barn used the area outside the rear of the building as a dumping ground for the waste products. The area around TU2, southwest of the barn, produced 27% of the total slag, with a density of 48/$m^{3.}$ While not as convenient a location as that found immediately behind the barn, the area at the base of the wood retaining wall discussed above apparently was also used as a disposal site for the iron waste

Although the function of the shallow, clay lined depressions found in the excavation of FTU5A has yet to be determined, the proximity of these features to the dense concentrations of slag found within and behind the barn suggests they were associated with the industrial activities that produced the iron waste. As a final, somewhat unrelated by-product of the features' discovery (whether they were associated with the forge, or with some other industrial process), the nature of the depressions, when considered with the density of the slag, ceramic, and faunal material found within the confines of the barn, strongly indicates that -- at least during one period of its use -- the barn had a dirt floor, rather than one fabricated from wood.

FTU9 – North Corner of Barn: Additional evidence for the supposition regarding the barn's dirt floor was found in the excavation of unit FTU9A and 9B. As discussed previously, this 2-x-2 m unit was excavated in two halves that were situated in the projected location of the barn's north corner, and adjacent to the excavations of FTU5A (Figure 5-9)

At a depth of approximately 30 cm in FTU9B, excavation exposed what appeared to be a compact clay floor, heavily flecked with charcoal and small brick fragments. Above this level the matrix was sandier, less compact, and noticeably different from that

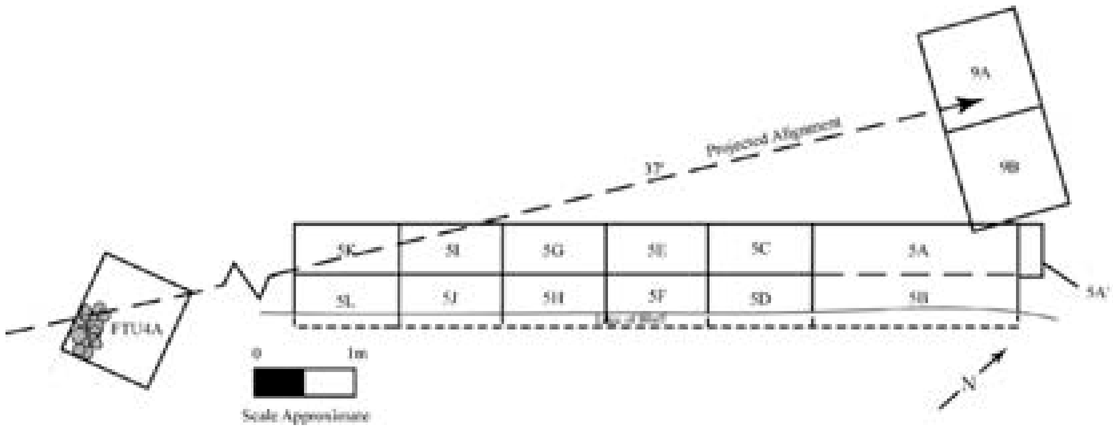


Figure 5-9: Location of FTU9A and 9B

encountered at the level of the floor. Although time constraints prevented further excavation of the unit, the matrix that was exposed lent further credence to the suggestion that the barn had a dirt floor, and that it was in this matrix that the two successive clay-lined depressions observed in FTU5A had been installed.

The most significant aspect of the excavation of FTU9 was the identification of the two intersecting redwood plank or beam remnants in FTU9A'Extension that apparently marked the north corner of the wood barn. Although highly degraded and fragmentary, the orientation of the two wood remnants indicated that one piece had been situated perpendicular to the other, suggesting that they had once formed part of the intersection of the barn's west and north walls. Whether they were remnants of a sill or another part of the building's foundation, such as a "sleeper,"[7] was not clear. Nor was it evident why, unlike the other portions of the west wall exposed in the excavations, there were no foundation stones beneath the intersecting beams. One logical supposition was that the structure's sills had been built on stones where the lower elevation of the ground required it, but were simply laid on the dirt where the terrain provided a flat, level

[7] "Sleepers" are lengths of wood laid in the ground to support structural members (Farris 1999:487).

surface, a situation not unlike what was found in excavations of the fur barn in the Company's stockade (Farris 1999).

With the discovery of the two intersecting, perpendicular plank or beam fragments, it was possible to test for additional evidence that would support their identification as corner elements of the barn, while also confirming the length of the building. As discussed in Chapter 4, a test unit was excavated at FTU5A'North, beneath a string line that extended east from the intersecting wood beam elements, perpendicular to the alignment defined by the two intersecting beams in FTU9A'Extension and the foundation stones in FTU4A (Figure 5-10). A triangular shaped, redwood plank fragment was exposed in FTU5A'North beneath the string line, with the grains of the wood suggesting an orientation parallel to that of the string. While it could not be determined with certainty, the location and orientation of the redwood fragment, and the wrought iron spikes lying on top of it, strongly suggested that it was a remnant of a foundation element associated with the barn's rear wall, and enhanced the interpretation of the two intersecting redwood fragments in FTU9A'Extension as being elements of the barn's corner.

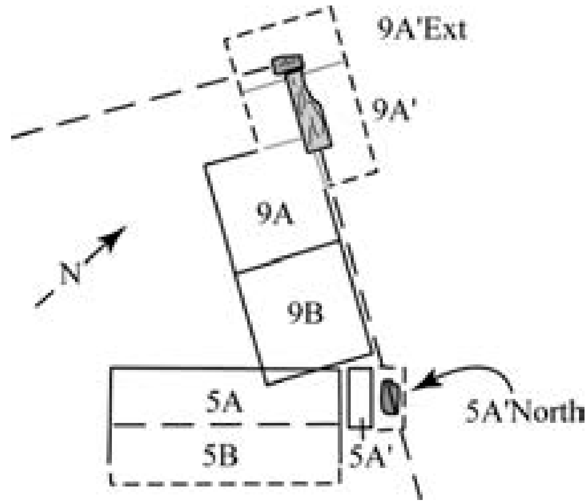


Figure 5-10: String line at rear of barn

With the spatial information obtained from these excavations, it was possible to confirm that the barn was, in fact, 37 feet long – the length described in the historic record for the building that housed the forge and blacksmith shop. Unfortunately, it was not possible to confirm the width of the historic structure since the location of both the east and south corners had eroded away, as described above. Nevertheless, the data that was developed was sufficient to determine both the precise location of the structure on the modern landscape, and to partially substantiate the accuracy of the dimensions of at least one building described in the Sutter inventory of 1841. Knowing this, it was then possible to examine the project's artifact assemblage and determine which came from within the barn, and which from without – information that, in turn, provided some insight into the types of activities that may have been conducted inside the barn.

Beach Feature: One of the most enigmatic features encountered during project excavations was the wood platform exposed beneath the beach sands of the cove (Figure 5-11). The structure had been carefully fitted together so that its component pieces reinforced each other. It was firmly embedded in the sand, with no fasteners of any type holding it together.

The fasteners that were evident had all been driven into the edges of many of the beams that were oriented perpendicular to the feature's longitudinal axis, but none were found in the beams that paralleled that axis. Although some of the fasteners appeared to be round, which would indicate a type of wire nail of post-Russian vintage, they were so degraded that it was not possible to tell if their shape had once been square.

When considered together, a number of the structure's characteristics, some of the artifacts that were found in direct association with it, and the nature of an adjacent feature provide evidence for three possible interpretations of the structure's function. These are as follows: the structure may have been associated with the shed used for storing the

Figure 5-11 (renumber figure 4-35)

Russian American Company's baidarkas, described in the Sutter inventory of 1841 as being "outside the fort," and logically located on the beach; it may have been associated with the activities of George W. Call, who purchased the Fort Ross property in 1873 and conducted several commercial enterprises there; or it may be associated with the shipyard and shipways used by the Russian American Company from 1816 to 1827.

As discussed in Chapter 4, the wood structure is configured and oriented in such a way as to suggest a type of conveyance system to and from the waters of the cove. Its large, flat platform may have provided a storage surface for the baidarkas used by the company, and the structure itself generally resembles the description of the storage shed found in the Sutter inventory: "A shed for the baidarkas, on beams, 10 sazhens long by 5 wide [70-x-35 feet]" (Dmytryshyn et al. 1989:432). The beams referred to in this description could well be those comprising the structure, and the track and crosstie configuration of the feature's western end could well be skids used to support the baidarkas as they were dragged into the shed. Additionally, the disparity between the shed's described dimensions (70-x-35 feet) and those of the beach feature (50-x-20 feet) is small enough to be explained by the possibility that portions of the structure may have either washed away over time, or been dismantled for one reason or another. However, none of the artifactual material found in association with the feature supports this supposition, as will be discussed below, and the highly asymmetrical shape of the platform and its associated structural components suggests it was built for a purpose other than as a floor for a shed.

The second possibility is that the structure is a remnant of the commercial operations of George W. Call. In 1873, Call purchased the Fort Ross property from the partnership of Charles Fairfax and John Dixon, who had acquired it in 1867 from William O. Benitz, Sutter's caretaker and the man who obtained the property in 1847. Call continued the prosperous lumber business started by Fairfax and Dixon. He built a wharf and warehouse at North Cove and exported products to San Francisco, supplying that burgeoning city with lumber, dairy products, hides, and beef, among other products (O'Brien 1980: 25). In addition to supplying large quantities of lumber, one of Call's endeavors was the production and export of wood shingles to supply the booming construction that was ongoing in San Francisco.

It is possible that the structure on the beach is the remains of a loading device of some sort used by Call to transfer some of his products to lighters moored in the cove, which would then convey their cargo to ships anchored in North Cove. Three split wood shingles found lying on the platform during its excavation add some weight to this interpretation, as does the presence in the platform itself of a keystone opening.

The ends of two short planks that had been cut at an angle formed the keystone. They were held in place and supported on either side by two of the full-length planks that form the platform (refer to Figure 5-11). One likely explanation for this opening is that it provided a socket into which a similarly shaped post could be inserted. A post secured to the platform in such a fashion could sustain considerable torque, as would be generated by the action of a pulley system working to move material to and from the water's edge. A round post in a round hole would simply turn in the hole, providing little resistance to a strong horizontal force, but the beveled edges of a keystone would lock the post in place and prevent it from turning when such a force was applied (Figure 5-12).

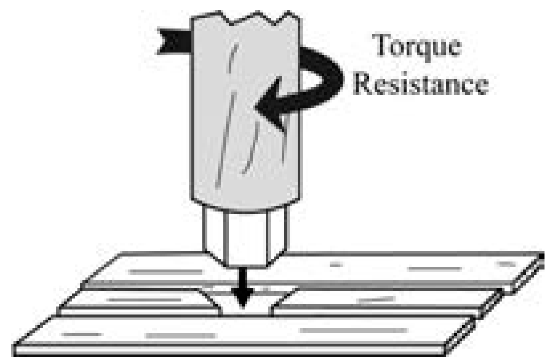


Figure 5-12: Keystone and post

Leather: Some information about the age of the structure, or at least some indication about when it was last exposed, may be provided by several pieces of leather that were found on the surface of the platform. The toe portions of two soles, the partial remains of a heel counter; three medium-size leather fragments, one of which may be the remains of a shoe tongue, and 12 other assorted leather fragments were found on the platform during its excavation.[8]

Except for the two sole portions and the possible tongue fragment, none of the leather fragments provided any temporally diagnostic information. The partial counter lacks any evidence of how it may have been attached to a shoe, and the remaining leather fragments are not marked in any way.

One of the two sole portions appears to be the outsole - the portion in contact with the ground. It is from a wooden-pegged shoe, and portions of the wood pegs remain in the leather. The other sole fragment appears to be a portion of the insole – the portion of the sole that rests against the bottom of the foot. No perforations of any type were found along the edge of the insole, which retains a thin strip of leather welting around its perimeter. Neither of the sole fragments is large enough to indicate whether the shoes were lasted, and the fact that one fragment is perforated and the other is not indicates the fragments are not from the same shoe. The fragment of soft leather that may be the

[8] The "vamp" is that portion of a shoe that covers the front of the foot, from the instep to the toes; a "quarter" covers the back of the foot, from instep to heel. A "counter" is a semi-circular, rectangular, or trapezoidal piece of leather sewn over the quarter to reinforce the back of the shoe.

remains of a shoe tongue is perforated with two curving, parallel rows of closely spaced holes. These appear to have been made by a sewing machine, although no stitching remains.

In the 19th century, shoe soles and uppers were fastened together with numerous small wood pegs (Saguto 1984:6). This task was made easier with the invention of a hand-operated pegging machine in 1829, and improved upon with the invention of the Davey Pegging Machine in 1854 (Anderson 1968:58-59). The sewing machine, patented in 1846, led to rapid mechanization in the shoe industry (Anderson 1968:58-59). In 1860, Lyman Blake invented a machine that sewed a shoe's upper to the sole, although it did not stitch the toe or heel. This was improved upon in 1862, when Gordon McKay patented a machine that stitched the entire shoe with thread, eliminating the use of nails and wood pegs (Anderson 1968:59). Cementing shoe uppers to soles was attempted in the 1850s but it was eventually abandoned due to a deficiency in the glue that was not solved until the 1920s (Wilcox 1948:140).

Marshalling the parameters established by these dates, it appears that the leather fragments found on the wood platform are from shoes that may have been manufactured between 1846 and 1862. The machine-made holes in the fragment that appears to be part of shoe's tongue could not have been made before 1846, when the sewing machine was patented. The wood pegs in one sole fragment appear to be uniformly spaced around its perimeter. This suggests the shoe was pegged automatically by machine, rather than by hand, which could not have happened before 1854. The absence of any perforations in the other sole fragment – the insole, implies that it was either cemented, or sewn with Blake's machine, which would not have perforated the toe portion of the sole. The presence of a welt on the insole fragment indicates the latter is probably the case, since the purpose of a welt is to reinforce the seam connecting the upper to the sole, evidence that at least a portion of the sole was sewn. If the shoe and leather fragments were all discarded at approximately the same time, which is likely considering their spatial association, it appears that they were deposited on the surface of the wood platform sometime after 1860. Given the rapid advancement of technology in the shoe industry during the latter half of the 19^{th} century, the manufacturing techniques evident in these shoe fragments can be used as fairly discrete temporal markers.

Although it is possible the shoes could have been produced around 1860, worn, and then discarded some 13 years later –after George W. Call acquired the property in 1873 –it is somewhat unlikely. It is more reasonable to assume that the shoes were worn for less than 13 years and discarded sometime before Call arrived at the Ross property, that is – sometime between 1860 and 1873. If that is the case, the presence of the leather fragments on the surface of the wood platform indicate that the platform was probably covered before the Call era, suggesting that the structure was either associated with the activities of Benitz, Fairfax and Dixon, or the Russians who preceded them.

A third interpretation of the wood platform is that it is a structure associated with the shipways used by the Russian American Company during the 11 year period in which the company's shipyard was in operation. Although the platform is neither sturdy enough to be the shipway itself, nor of the proper configuration for that task, it may have provided the ground-level work surface and the foundation for part of the falseworks[9] that would have been required to build a ship (Figure 5-13)..

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[9] Falseworks are the temporary frameworks and scaffolding on which a structure is wholly or partly built and supported, until it is made strong enough to support itself.

The feature's possible association with the shipyard is suggested by a number of things, one of which was the recovery of a piece of copper sheathing found lying on the surface of the wood platform when it was first exposed. It is rectangular in shape and measures 15 cm-x-10 cm. The copper fragment is pierced with nail holes along each of its long edges. A rectangular hole has been cut into the center of the piece and when the sheathing was found, it was folded along its longitudinal axis, along the line of the hole. The perforations along the edge indicate that the nails had been driven from opposite sides, and that the piece of sheathing had been fastened so that the two surfaces were perpendicular to each other along the line of the fold. Although it is too small to be a piece of the copper sheathing that was used to cover the hulls of the ships built in the Ross shipyard, it is a piece of sheeting of the thickness typically used as such sheathing. It is pierced with holes consistent with those made by a sheathing nail, and it was found in direct association with the platform, all of which suggests it, and the platform on which it lay, may have been associated with the shipbuilding operation.

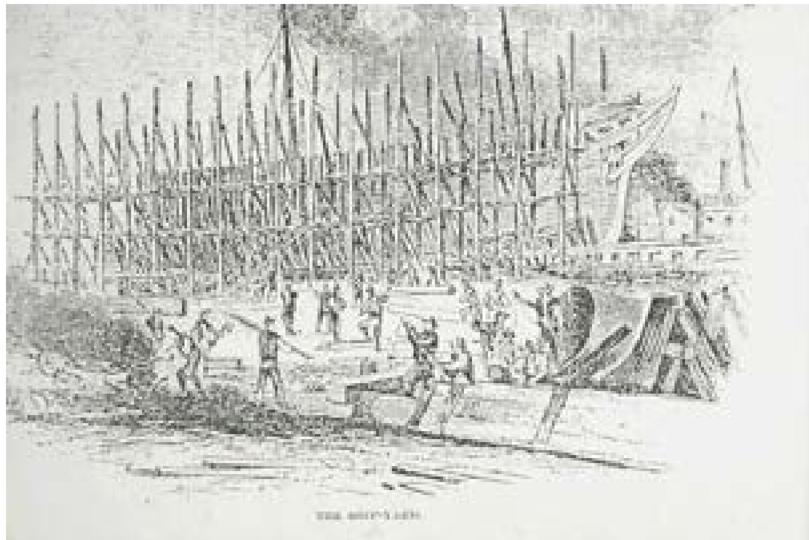


Figure 5-13: Typical falseworks

The heavily concreted nails that had been driven into the edges of many of the platform's planks suggested that upright pieces of framing or timber had been fastened to the planks, perpendicular to the horizontal surface of the platform. These uprights may have been the basic structural components of the falseworks. One possible problem with this suggestion, however, is that the nails may post-date the period of the Russian American Company. Dr. Glenn Farris, Associate State Archaeologist with the Department of Parks and Recreation kindly examined one of the spikes and suggested that, although it was corroded, it more closely resembled a sizeable round nail, than a square iron spike (pers. comm. 1997). If the nails are round[10], it would be substantial evidence that the platform was exposed during the Call era, if not for a significant time afterwards, since round wire nails became increasingly more common in the latter half of the 19th century, eventually replacing the square wrought iron spike as the common fastener (Nelson 1968:9).

As discussed above, the keystone opening and the post it would have accepted could also have been utilized in the shipyard's operation, and may have provided support for any number of operations associated with the construction of a ship.

One additional element found during the platform's excavation might point to its use during the era of the Russian American Company. As described in Chapter 4, the pointed end of a single square spike protruded approximately 15 cm (6 in.) above the surface of one of the planks near the center of the platform. The spike had been driven from the bottom of the plank, before the plank had been set in place. This was the only fastener found on any portion of the structure, except for the nails mentioned above that had been driven into the edges of the planks. Unlike those nails, however, the spike was not corroded in any way. It was faintly gold in color and, although it may have been

[10] A sample of the nails was collected and is being stored. The concretions surrounding the nails will have to be removed and the nails conserved before an overall assessment of nail types can be made. This work is pending.

bronze, it lacked the characteristic green patina typically found with cuprous metals that have been exposed to a marine environment. Rather than bronze, the spike may have been an unusual type of cast iron made by the Russians and described by John McKenzie, who served as a curator, historian, archaeologist, and ranger at Fort Ross State Historic Park beginning in 1948. On January 15, 1948, McKenzie wrote:

> An ingot of iron approximately 15 inches square and 5 inches thick was among the artifacts at the fort. I took it to the UC Berkeley Metallurgy Lab for analysis. They reported that it had been cast in 'Black Sand,' an exceptional gold ore, and that the surface of the ingot was almost "GOLD PLATED." [sic] This may explain the exceptional rust resistant condition of the original iron nails found in the chapel and in the soil near other building sites at the fort. (pers. comm. John Sperry August 29, 1997)

Since the spike could not be recovered without disassembling a portion of the platform, it was examined *in situ* under magnification. The spike had been cast and, although it could not be ascertained with certainty, its shiny, gold-colored patina and complete lack of corrosion indicated it could well have been cast from the type of ingot described by McKenzie. If so, the spike and the platform in which it was embedded would both be attributable to the era of Russian occupation.

In examining the possibility that the beach feature was a possible component of the Russian American Company's shipyard, one final piece of archaeological evidence must be considered. The discussion of the beach feature's excavation presented in Chapter 4 describes the magnetometer survey geophysicists conducted over and around the feature. The configuration of the beach feature provided the impetus for this survey, since its asymmetrical shape suggested it was only one half of a larger structure. The magnetometer survey was conducted in an effort to locate the other half.

Two anomalies identified in the survey were selected for investigation. Respectively, they were situated approximately 8 and 15 meters northwest of the beach feature. The trench excavations that were dug to examine the source of the anomalies led to the identification of a stratum of heavy, black, fibrous material that appeared to be a layer of highly degraded wood, completely embedded in the natural clay substrate. Heavy oxidation stains were found in various locations throughout the fibrous clay, beneath which lay a number of large rocks. The organic deposit had a defined edge that indicated it lay parallel to the alignment of the beach feature (Figure 5-14). Subsequent measurements determined that the flat fibrous stratum was approximately 100 cm below the elevation of the beach feature.

Examination of the magnetic contour maps generated from the survey data revealed that a natural geological channel lies below the location of the fibrous stratum (Figure 5-15). It appears to be a natural streambed of Fort Ross Creek (pers. comm. Rob Huggins-Geometrics, August, 1997).

The relationship of the organic stratum to the beach feature, and its location in what appears to be the creek's natural watercourse suggests that the shipway itself may have been built in the streambed of Fort Ross Creek, after the creek's flow had been temporarily diverted. The black, fibrous organic material embedded in the clay substrate may be the highly degraded remains of the shipway, which appears to have been supported by a series of large stones placed beneath it. The oxidation stains scattered throughout the fibrous stratum may be the remains of iron nails used either in the construction of the shipway itself, or dropped and lost during the construction of the last ship launched from it.

Figure 5-14 fibrous mtrl in trenhes (renumber 4-19)

Figure 5-15 color mag maps

The meandering path of the creek today, and the significant quantity of water that flows through it during the winter months would absolutely preclude any sort of year around industrial operation on the beach. In order to provide a dry, workable shipyard throughout the course of a year, the shipwrights must have had the ability to control the creek's flow, with the flexibility to direct it as needed. If such were the case, building a ship in the dry, natural watercourse of the creek would provide a powerful tool to aid in its launching. When it was completed, the shipwrights could launch the ship by redirecting the flow of the creek into its natural course, so that its waters could be used to float the vessel off the ways. If done at a very high tide, such a launching would be aided by the proximity of the waterline to the mouth of the creek, if not the presence of a substantial quantity of water on the beach itself.

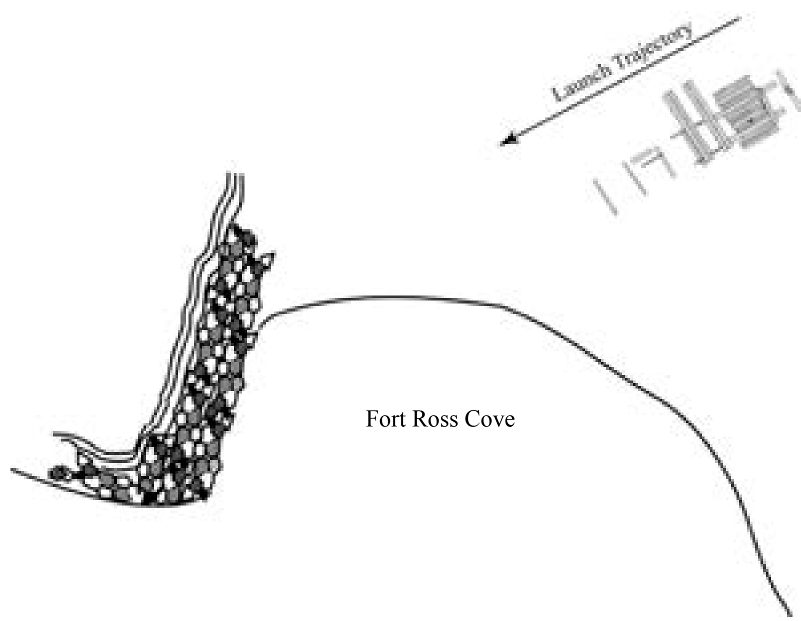


Figure 5-16: Orientation of wood platform to rock fall

However, the orientation of the wood platform on the beach and the parallel fibrous stratum in the creek bed raises a possible problem in this interpretation. A traditional stern-first launch down the then-flooded ways would send the newly christened ship directly into the rocks that lie at the foot of the elevated marine terrace on the west side of the cove (Figure 5-16).

In view of this, and the fact that the waters of the cove are fairly shallow (which would make a stern-first launch even more problematic), it is much more likely that the ships were launched sideways, rather than stern first, which would explain why the shipwrights selected the particular location in the creek for the shipway that they did. As depicted in the magnetic contour map (refer to Figure 5-15), the fibrous stratum that may be the shipway is situated in a very wide portion of the natural creek bed, which is angled in such a way that the ship could be positioned as parallel to the shoreline as possible.

Once the creek waters were allowed to return to their natural course beneath the ship, and assuming the vessel was launched at a flood tide, the oblique orientation of the platform and the shipways relative to the waterline of the cove would have provided a gentle, controllable sideways entry into the cove. However, the large quantities of water that would have been moving across the shipyard and beneath the ship would have necessitated some method of controlling the vessel as it floated free. One possible means of achieving this is described by Khlebnikov in his reference to the launching of *Kiakhta* in 1824. Khlebnikov wrote "With regard to work on the ship, Mr. Schmidt wrote in two lines that the launching structure was ready, but that there were not enough rafts available" (Khlebnikov 1824:162). Reference to the use of rafts in launching the ship suggests that the shipwrights may have used them to control the ship on the flooded plain of the yard, as the ship moved off the shipway and floated into the cove.

Although this interpretation is speculative, the lines of evidence brought to bear on it present a stronger explanation of the function of the wood feature than either of the two previous suggestions. While it may have been associated with the shed used to store the Company's baidarkas, the platform's asymmetrical shape suggests it was not built as a floor for such a building. It may also have been associated with the Call era of ranching and commerce, but its orientation leading directly to the rocks suggests it would have made neither a convenient nor efficient loading mechanism for moving materials to and from the beach, and the temporal information provided by the leather fragments recovered from the platform suggest it was covered before Call acquired the property, assuming the shoes were discarded in a reasonable amount of time following their manufacture.

Given its location and orientation, its proximity to both the natural watercourse of the creek and the fibrous remains found in that watercourse, the possible link to the Russian ironworkers evident in the spike, the piece of copper sheathing, the evidence of the vertical structural elements suggested by the corroded iron nails, and the industrial activity indicated by the keyhole opening in the platform, it seems most likely that the platform is related to the ambitious, if ill-fated shipbuilding efforts of the Russian shipwrights.

Artifacts:

The artifacts recovered during project excavations were sorted into categories by material type: bead, button, brick, charcoal, clay, faunal, floral, glass, historic ceramic, lithic, leather, metal, mollusk, unknown, and wood. Artifacts in the bead, button, faunal, glass, historic ceramics, lithic, and metal categories have been analyzed and will be discussed below. Although some artifacts in the remaining categories have been analyzed, more remain to be done. Consequently, with the exception of items that have already been discussed (the leather shoes and the redwood fragments, for instance), artifacts in the brick, charcoal, clay, floral, leather, and mollusk, and wood categories will not be discussed here. Provenience tables for the artifacts discussed below are presented in Appendix A. The complete artifact catalog is presented in Appendix B.

Beads: Twenty-seven glass trade beads were recovered from 17 of the 51 excavation units (39 test units and 12 auger bores). To maintain consistency with the analysis of the beads recovered from both the Native Alaskan Village Site (NAVS) outside the stockade and the Fort Ross Beach Site (FRBS) (see Lightfoot et al. 1991, 1997), adjacent to the industrial complex excavations, the same analytical scheme employed by Ross (1997) was used in analyzing these beads.

The bead assemblage analyzed by Ross comprises 564 beads, 548 recovered from NAVS and 16 from the FRBS. Within this collection, Ross identified 497 beads as being drawn, and classified them into five different types, which he subdivided into 47 varieties. Ross also identified eight types of wound beads, a single type of blown bead, and a molded bead. In his analysis of this assemblage, Ross suggests the 16 beads from the FRBS were recovered from a disturbed, secondary context related to the NAVS site located upslope from the deposit. All but a single variety of the 16 beads found in the FRBS were also found in the NAVS (Ross 1997:191).

The 27 beads recovered from the industrial complex are all drawn beads that fall into two of Ross' type categories (Table 1, Table 2 in Appendix A). These have been further identified as falling into four of the 47 varieties that Ross established. With one exception, none of the bead varieties found in the industrial complex was also found in the FRBS, but all varieties found in the industrial complex were found in the NAVS. This suggests that the beads recovered from the industrial complex are not a scattered

Table 1: Bead Types

Type D/MCHU: drawn, monochrome, cylindrical, hot-tumbled, undecorated[11]					
Variety	*Decoration*	*Diaphaneity* *Luster* *Patina*	*Layering* *Color* *Munsell Notation*	*Shape* *Length* *Finish*	*Quantity*
16	Undecorated	Opaque Dull No Patina	Monochrome White N 9.5/	Cylindrical Short Hot Tumbled	18
5	Undecorated	Translucent Dull No Patina	Monochrome Greenish-blue 7.5BG 4/8	Cylindrical Short Hot Tumbled	3
21	Undecorated	Transparent Dull to Shiny No Patina	Monochrome Clear N 9/	Cylindrical Short Hot Tumbled	2
Type D/PCHU: drawn, polychrome, cylindrical, hot-tumbled, undecorated[1]					
Variety	*Decoration*	*Diaphaneity* *Luster* *Patina*	*Layering* *Color* *Munsell Notation*	*Shape* *Length* *Finish*	*Quantity*
18	Undecorated	Opaque on Opaque to Translucent Dull No Patina	Polychrome (2) Brownish-red (10R 3/8) on Dk. Red to Black (10R 1-2/1-6)	Cylindrical Short Hot Tumbled	4

continuation of the beads found in the FRBS, but are probably more closely associated with the people and activities of the NAVS. Like the beads found in the NAVS, beads that are white/clear in color dominate the assemblage recovered from the industrial complex (with red and blue colored beads also present.) Likewise, the sizes of the beads comprising the assemblage recovered from the industrial complex are similar to that of the assemblage found in the NAVS (Figure 5-17). As mentioned, it appears that the beads recovered from the industrial complex are more closely related to those found in the NAVS, rather than those found in the secondary context of the more proximate FRBS.

[11] Per Ross 1997:184-186

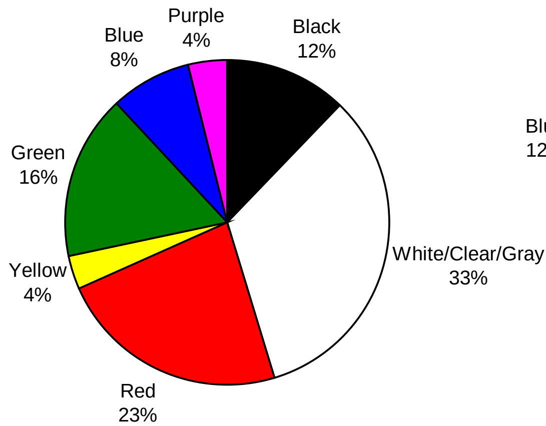
In his discussion of the NAVS beads, Ross mentions that the assemblage was varied, but the majority of the beads were "confined to a few varieties" (Ross 1997:202). This is also true for the assemblage recovered from the industrial complex.

Of the beads comprising the NAVS drawn bead assemblage, 72 percent are assigned to seven of Ross' 46 varieties. Although it is a much smaller sample, the entire assemblage of beads found in the industrial complex are identified as belonging to only four of Ross' 46 varieties.

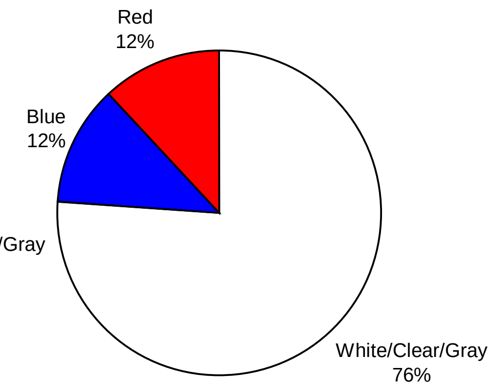
In addition, bead types D/MCHU and D/PCHU dominate both the NAVS and the industrial complex assemblages.[12] As Ross points out in his discussion of the NAVS beads, these types represent inexpensive, undecorated, monochrome and polychrome embroidery beads, suggesting the beads represent casual loss during routine daily activities, rather than activities associated with displays of wealth or ceremony in which more expensive beads would most likely be lost or discarded. This, in turn, points to the ongoing daily presence and interaction of the native population with the activities that were conducted in the industrial complex. This interaction appears to have been centered around the area of the barn, as most of the beads recovered during project excavations were found in the units that are in or around that building's projected footprint.

Buttons: Only six buttons were recovered during project excavations, one four-hole button that may be ceramic, one plastic button, one button that may be leather, one cast brass button, one rubber button, and one Phoenix button (Table 3).

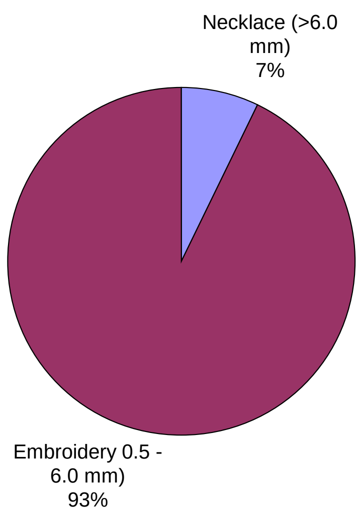
[12] NAVS: 53% D/MCHU, 43% D/PCHU. Industrial Complex: 88% D/MCHU; 12% D/PCHU.



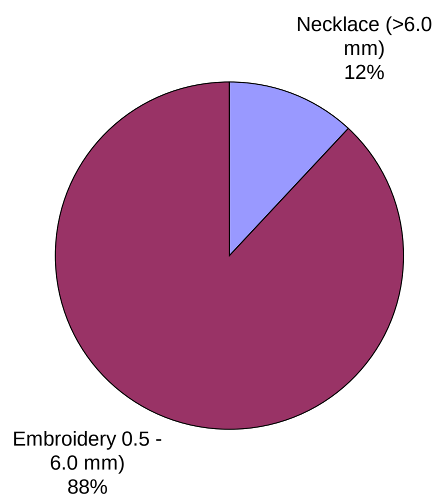
Bead Colors: NAVS



Bead Colors: Industrial Complex



Bead Sizes: NAVS



Bead Sizes: Industrial Complex

Figure 5-17

Table 3: Provenience of Buttons				
Unit	*Level*	*Depth*	*Quantity*	*Description*
TU2	8	70-80	1	Phoenix button
FTU4D	3	20-30	1	Leather
FTU5A	1	0-30	1	4-hole ceramic
FTU6	1	0-30	1	Brass "uniform"
FTU7	1	0-30	1	Modern plastic
FTU9A'	1	0-30		Rubber "Novelty Rubber Co.

The four-hole button contains no diagnostic elements, so it was not possible to determine either a temporal or cultural affiliation. The plastic button appears to be modern. The button that may be leather is extremely fragile and so degraded that its material composition cannot be determined with certainty. It was recovered from FTU4D, well within the confines of the historic barn, at a depth of 20-30 cm.

Figure 5-18: Brass "uniform" button

The brass button appears to be a uniform button of some type (Figure 5-18). It is 5/8-inch in diameter, two-piece, and dome shaped with a key shank attachment. The obverse of the button is embossed with a shield surmounted by a crown and crossed by two diagonal stripes. This particular button did not appear in any of the consulted texts on historic or military uniform buttons, but the manufacture of two-piece buttons post-dates

1860 (IMACS 2001). It is possible that the button is simply a generic "military" button, often found on children's clothing.

The rubber button was recovered from FTU9A', outside what would have been the barn's north corner. Cast into the button is: "Novelty Rubber Co. New York-Goodyear's Patent 1849-51." Nelson Goodyear patented and improved the manufacture of hard rubber between 1849 and 1851. The name "Goodyear" and the dates 1849-1851 are often molded into the backs of hard rubber buttons. These dates refer to the patent dates, and not the date of the button's manufacture. The Novelty Rubber Co. was in the business of manufacturing hard rubber buttons from 1855-1870 (IMACS 2001). The temporal information on this button makes it one of the few, if not the only, artifact in the collection that was found in the vicinity of the barn and clearly post-dates the period of the Russian American Company.

Of the six buttons in the artifact collection, the Phoenix button provides the most discrete temporal information. Phoenix buttons were produced for the uniforms of the army of King Christophe of Haiti. They were popular trade items for the Northwest-Coast Indians around 1830, probably having made their way into the Indian trade through the activities of Nathaniel Wyeth, an amateur fur trader on the Columbia River in the early 1830s (Strong 1975:74-77). Although numerous examples have been recovered in the areas of the lower Columbia River and Klamath Falls, Oregon, only one other button has been found at Fort Ross. Along with a single button recovered at Fort Elisabeth, the Russian American Company's outpost on Kauai, Hawaii (Mills 1996), the Phoenix button found in the industrial complex indicates that the Company also participated in trading these buttons, at least to a certain extent. This also suggests a commercial relationship with the fur hunters of the northwest as early as 1830, who may have been the source of the buttons that found their way into the Company's trading vector.

Faunal: A total of 452 vertebrate skeletal fragments were recovered from 20 of the 51 excavation units (Table 4 below; Table 5 in Appendix A). The bone fragments were sorted and catalogued by unit location, date of acquisition, excavation level, and material type, as described above. Using available texts on mammalian osteology, research assistants conducted a preliminary, cursory analysis of the bone fragments. Subsequently, the bone fragments were sent to the UCLA Zooarchaeology Laboratory for

Table 4: Identified Vertebrate Species from the Fort Ross Industrial Complex

		NISP	*MNI*	*Weight*
Scorpaeniformes				
Hexagrammidae				
Ophiodon elongatus	Lingcod	1	1	0.26
	Total Fish	1		0.26
Rodentia				
Geomyidae				
Thomomys bottae	Pocket Gopher - Botta's	2	1	0.89
Arvicolidae				
Microtus californicus	Vole - California	1	1	0.12
	Total Rodentia	3		1.01
Carnivora				
Mustelidae				
Enhydra lutris	Otter - Sea	1	1	10.78
Pinnipedia				
Otariidae	Eared Seal Family	1		23.21
Zalophus californianus	Sea Lion - California	1	1	2.6
		----		---------
	Pinnipedia	2		25.81
Perissodactyla				
Equidae				
Equus caballus	Horse - Domestic	1	1	16.87
Artiodactyla	Even-toed Ungulates - Unid	2		5.19
Cervidae				
Odocoileus hemionus	Deer - Mule	3	1	3.27

Bovidae				
Bos taurus	Cattle - Domestic	30	1	339.83
Capra/Ovis sp	Goat or Sheep	1	1	5.11
		----		---------
	Artiodactyla	36		353.4
Mammalia	Mammal - Unid	141		16.04
Mammalia, lg	Mammal - Large	265		164.07
Mammalia, sm	Mammal - Small	2		0.66
	Total Mammal	451		588.64
	Total Site	**452**		**588.9**

further analysis. Using the lab's comparative collection, Dr. Thomas Wake and his staff identified each bone specimen to the most discrete taxonomic level possible, and identified modifications to the bone specimens that included evidence of burning, cut marks, gnaw marks, and tool or other artifact manufacture.

Wake identified nine vertebrate genera and eight species in the diverse assemblage, which was dominated by mammalian skeletal elements. A single fish vertebral specimen was identified. As illustrated in Tables 4 and 5, a variety of mammal species comprise the remaining 451 specimens, which were recovered from various levels in the 20 excavation units. Bones representing cattle, sheep, and goats are the most common specimens, but wild mammals such as black-tailed deer, sea otter, and California sea lion are present as well.

The proximal tibia of a California sea lion, the proximal radius of an eared seal, and the ilium of a sea otter represent the only marine mammals in the assemblage. The sea otter ilium represents a locally extirpated marine carnivore that is generally rare in other Fort Ross SHP vertebrate archaeofaunas (Wake 2001:2). It is also the only specimen that bears cut marks.

Based on the sample obtained from the excavations in the industrial complex, it appears that terrestrial resources were apparently more important than marine resources in the diet of those responsible for the faunal deposit. Bone specimens of large terrestrial mammals comprise the majority of the collection (66.6%).[13] Of these, cattle constitute 73% of the identified assemblage. No other identified species constitute over 1% of the overall assemblage. The presence of cattle bones is consistent with previous studies of the vertebrate faunal assemblage from the Fort Ross Beach Site, the Native Alaskan Village Site, and from within the stockade walls that show a strong dietary preference for domesticated species (see Wake 1995, 1997a 1997b) (Wake 2001:2).

Although they are comparatively small in number (n=4), the marine vertebrates in the assemblage suggest those responsible for the deposit also may have been exploiting the coastal environment, but to a much smaller degree. The identification of the sea otter ilium with cut marks could be significant since only 13 sea otter specimens have been previously identified from all of the known excavation loci and sites within Fort Ross State Historic Park (Wake 2001: 3). As mentioned, the sea otter population was rapidly extirpated from the vicinity of Ross just a few years after the Russians arrived on the coast of California (Khlebnikov 1976, 1990). Otter skeletal remains do not appear to have been transported to Ross with any regularity, since their hunters were primarily concerned with the valuable pelts, and skinned their prey far from Ross (Ogden 1941; Wake 1995). Although the sea otter specimen may date to a relatively early portion of the Ross occupation (Wake 2001:3), it was recovered from a disturbed, secondary context

[13] : For classification purposes, size categories are defined as follows: for mammals, large represents deer size or greater, medium represents smaller than deer but larger than jackrabbit, and small represents jackrabbit or smaller; for birds large represents goose size or greater, medium represents ducks to roadrunners, and small represents jays or smaller.

in FTU1 so unfortunately, its value as a specific temporal indicator is substantially diminished. This is also true of the sea lion (Zalpphus californianus) tibia, which was recovered in the secondary context of TU2. However, the lingcod (*Ophiodon elongates)* vertebra and the eared-seal radius both appeared to be *in situ* when they were recovered from FTU4D, level 4 and FTU2, level 7, respectively.

Previous studies of the Historic Period have clearly illustrated a mixed diet that included utilization of domesticated, marine, and wild terrestrial resources (Wake 1995, 1997a, 1997b). In combination with the identifiable evidence of domesticated sheep, goats and cattle (n=31), and the 408 unidentifiable remains of various mammals, the marine resources (n=3) and wild game (n=5) in the faunal assemblage recovered from the industrial complex suggest a continuation of this resource utilization by those who appear to have taken at least some of their meals in the cove.

<u>Glass:</u> In 1992, U.C. Berkeley Anthropology student Allison Cohen conducted an extensive analysis of the windowpane sherds recovered from the FRBS and NAVS, as well as sherds recovered from earlier excavations conducted within the stockade at the site of Kuskov House[14], and the north wall of the stockade (Cohen 1992). Following a similar analysis of the thickness of windowpane sherds conducted by Roenke (1978), Cohen established that the glass sherds recovered from the NAVS and FRBS date to the period of Russian occupation. Her conclusion is based on the similarity of the mean thickness of the Fort Ross glass assemblage to the thickness of sherds from sites with known temporal parameters that were measured by Roenke, who demonstrated that average pane thickness increases through time. Cohen found that the mean thickness of

[14] Also known as the Commandant's House, this structure was built for the first manager of the colony, Ivan Kuskov.

the Fort Ross assemblage was very close to those from assemblages recovered from three fur trading sites of the Pacific northwest: Spokane House (1810-1826), Fort Okanagon (1811-1835), and Fort Nez Perces (1818-1855, 1857-1882).

Elements of Cohen's analytical approach were applied to the glass assemblage recovered from the industrial complex. In all, 1076 glass sherds have been catalogued in the artifact collection. Of these, 73 sherds are thought to be windowpane glass, a supposition based on the relative thickness and the absence of any curvature in the small, clear sherds (Table 6 in Appendix A). Using a slide caliper, researchers measured the thickness of each sherd in both millimeters and hundredths of an inch.

Unlike the sherds in Cohen's research, the primary thickness mode of the windowpane recovered from the industrial complex is 2.0 mm (Figure 5-19). Cohen's measurements returned primary thickness modes of 1.2 for the glass recovered from the NAVS, 1.5 mm for the glass recovered from Kuskov House, and 1.7 mm for the FRBS.

When the occupational history of each site is considered, Cohen's measurements appear to be consistent with the age ranges for primary modes of window glass thickness as developed by Roenke (1978:116). The 1.2 mm modal thickness for NAVS is consistent with an age range of 1810-1835. As Cohen points out, unlike the Kuskov House, the area on which the NAVS was situated was probably not occupied after the departure of the Company, so the thickness mode would naturally fall into a fairly discrete temporal period. In this case, that would be the period of native occupation that coincided with the Company's presence at the site, 1812-1842. In contrast, the 1.5 mm primary thickness mode of the glass recovered from Kuskov House suggests an occupational period between 1845 and 1855, later than the period of the Company's

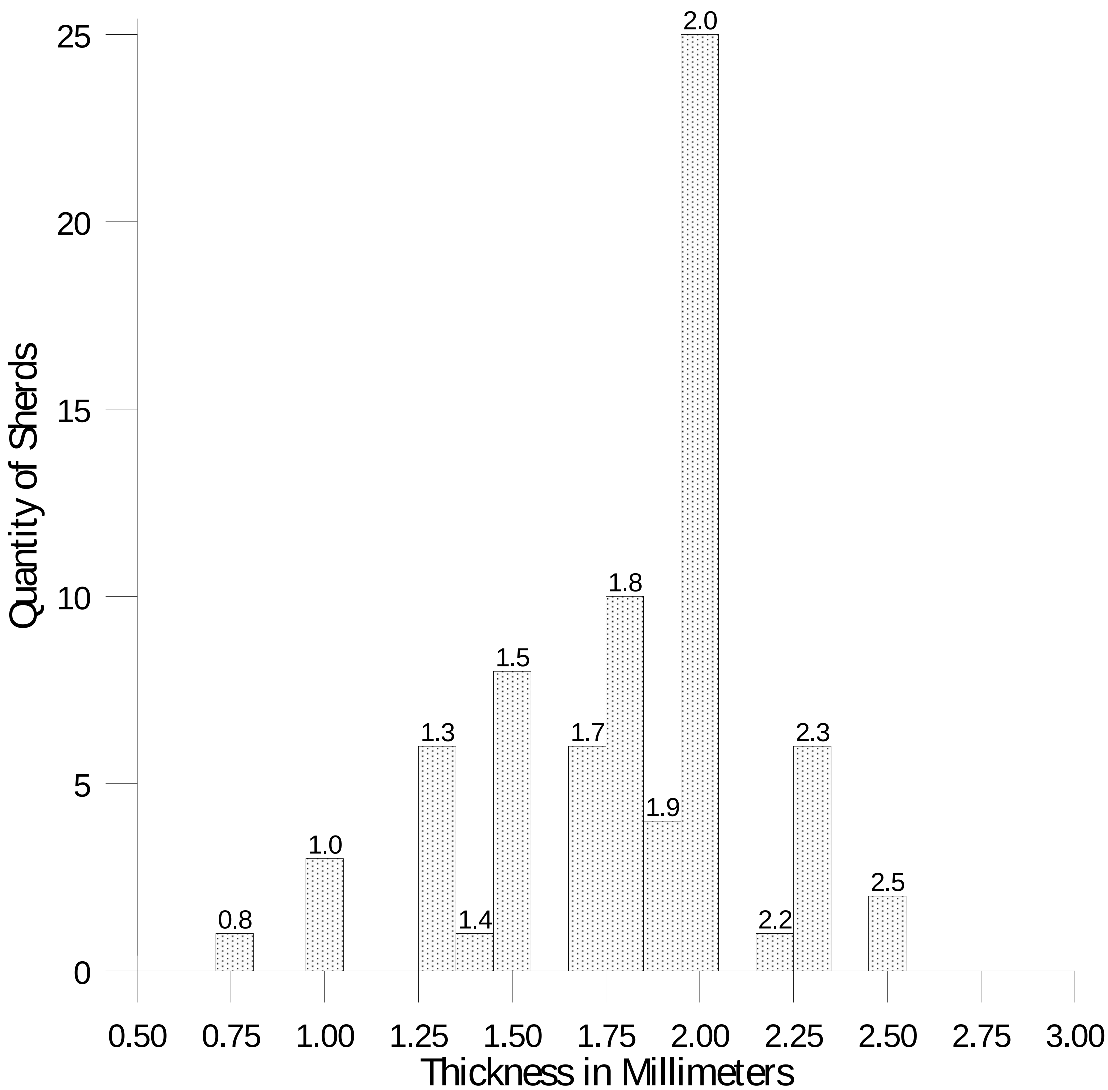


Figure 5-19: Glass recovered from the industrial complex

ownership. Cohen argues that this is a result of statistical skewing resulting from the fact that the house was occupied for a considerable time following the Company's departure, increasing the period during which windows would be broken and replaced.

The primary thickness mode of 1.7 for the FRBS is likewise a statistical oddity resulting from the fact that the site was a midden, and apparently used as a dumping area after the departure of the Company. The thickness mode of 1.7 mm suggests an occupational period of 1850-1865, but the secondary thickness mode of 1.2, which is just slightly smaller in number than the primary mode, suggests a period of 1810-1835. The temporal period defined by these near-identical modes covers the entire period of the Russian American Company's occupation, as well as the early ranching and timber period of period of Fairfax and Dixon.

The 73 windowpane sherds recovered from the industrial complex comprise quite a small sample in comparison to those of Cohen (n=1,600) and Roenke (n=21,965). This is no doubt a reflection of the fact that there were fewer buildings in the industrial complex than in either the NAVS or within the walls of the stockade, that those buildings were smaller in size, and except for the barn, none were still standing by the early 1860s. Small as the assemblage is, however, it is still capable of providing some insight into the activities that took place in the cove.

The primary thickness mode of 2.0 mm for the glass sherds recovered from the industrial complex correlates to Roenke's estimated occupational period of 1855 to 1885, some 13 years after the Company's departure. As with the temporal range provided by the windowpane recovered from the Kuskov House, the post-Russian period suggested by the thickness of the sherds from the industrial complex is probably due to the longevity of the historic barn and its continued use during the Benitz, Fairfax and Dixon, and Call eras. As discussed previously, the barn was standing in 1865, well after the departure of the Russian America Company. That its windows could have been broken and replaced on a number of occasions is a likely possibility, especially in the post-Russian occupation period, when glass would have been more readily available.

Although windowpane sherds were recovered from almost every excavation unit, FTU4D and FTU5A had the highest density of these sherds per cubic meter (Figure 5-

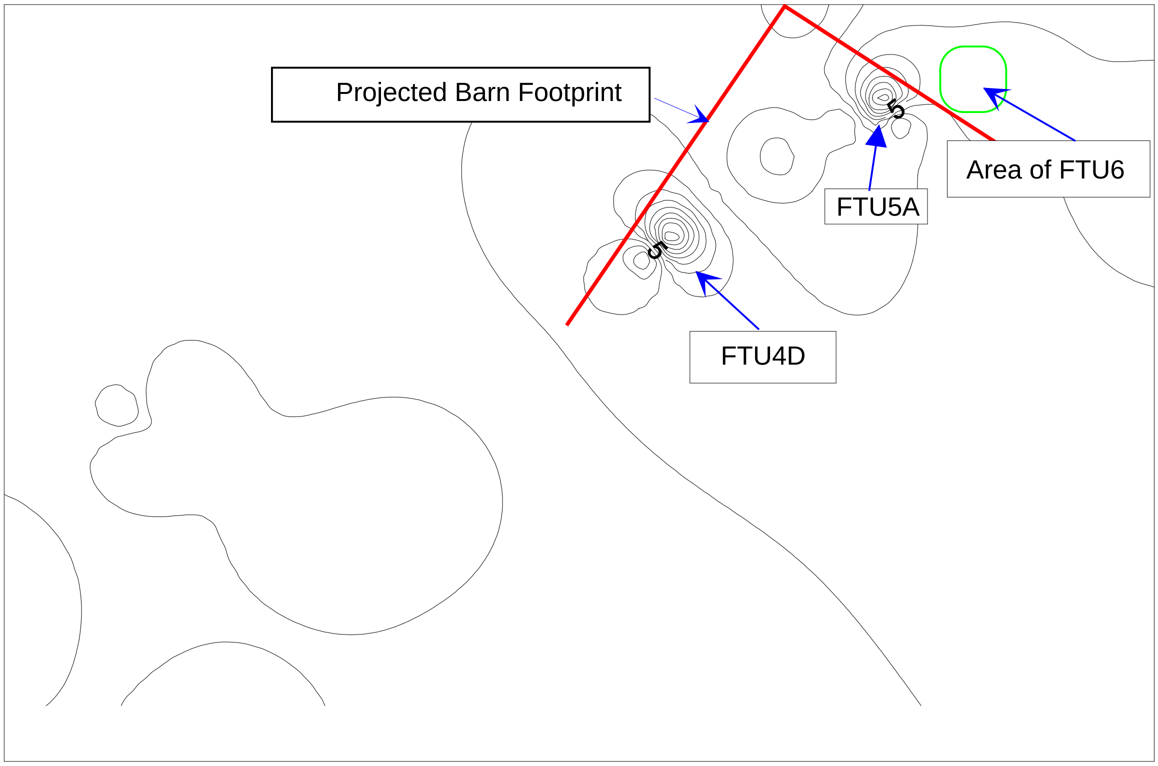


Figure 5-20: Density concentration of windowpane sherds (Contour interval=1)

20). Unlike the sherds recovered from FTU1, which were scattered through all strata from the surface to a depth of 60 cm, those found in FTU4D and FTU5A were recovered in the discrete layers between 20 and 40 cm, and appeared to be in primary context. Over 31% of the total sherds thought to be windowpane were recovered from these two units, 16% from FTU4D, and 15% from FTU5A. FTU4D was located along what would have been the historic barn's western wall, immediately inside the west corner. FTU5A was located near the north corner of the barn, near the barn's north wall. The density of sherds from these two units, both within the confines of the barn, strongly suggests that a window may have pierced the barn wall at these two locations. Lending additional credence to this supposition, at least in regards to a potential window in the wall above

FTU5A, is the significant deposit of slag discussed previously that was encountered in FTU6, immediately behind the barn, and adjacent to where the window might have been.

Ceramics: A total of 154 ceramic sherds were recovered from project excavations. Of these, three are stem fragments from a clay smoking pipe, one is a clay pipe bowl fragment, and two are fragments from a glazed terra cotta figurine. The remaining 148 sherds appear to be fragments of ceramics associated with foodways - hollowforms in particular, as discussed below.

In comparison to the ceramic assemblages recovered from NAVS and the FRBS, the ceramic fragments recovered from the industrial complex are both few in number and small in size. The former circumstance is not unexpected, given the non-domestic, non-habitation nature of the site. The extremely small size of the recognizable sherds, however, makes any sort of coherent functional or formal analysis extremely difficult. Ranging in size from 1.5-x-1.5 mm to 20-x-30 mm, the average dimensions of the sherds is approximately 8-x-11 mm.

Although classifying 18th and 19th century ceramics into typological schemes based on the concept of "ware" has been criticized, the utility of using this approach to organize a ceramic assemblage along an approximate temporal continuum has also been acknowledged (Majewski and O'Brien 1987). Given the miniscule size of most of the ceramic fragments, the near-universal absence of any decoration, relief, or marking, and the lack of any definitive formal character for most of the ceramic artifacts, analysis of the assemblage began with just such a typological scheme.

In consultation with Dr. Laurie Wilkie of U.C. Berkeley, project staff made visual identification of ware types for most of the sherds. Refined earthenwares (creamware, pearlware, and whiteware) comprise approximately 68% of the 148 ceramic sherds that appear to be related to foodways, with porcelain, ironstone, stoneware, and earthenware fragments making up the remaining 32%. Unlike a number of ceramic artifacts recovered from the NAVS and FRBS, none of the artifacts in the assemblage have been modified or "utilized"[15] (see Silliman 1997:147). All breaks are clean, and there are no indications of attempted modification or use wear along any edges of the individual ceramic sherds.

The refined earthenware sherds comprising the industrial complex assemblage are the same material types as those recovered from the NAVS and FRBS. The fact that none of the sherds have been modified suggests, among other things, that the modifications observed in the sherds from the NAVS and FRBS were products of native recycling conducted in the domestic areas, and not the sort of endeavor that was attempted within the confines of the industrial complex.

As mentioned, the number of ceramic sherds comprising the assemblage is much smaller than that of the FRBS and NAVS. Excavations at NAVS, for example, averaged 108 ceramic artifacts per cubic meter, while the 51 excavation units in the industrial complex yielded an average of only six ceramic artifacts per cubic meter. Since the NAVS is considered to be a domestic site, the comparatively higher number of sherds from excavations there is to be expected, since they could have entered the deposit as either pieces of broken vessels or as discards from native recycling. Although smaller in number, the quantity of sherds recovered from the industrial complex is still somewhat surprising.

[15] As Silliman (1997: 147) points out, "utilized" refers to use of the artifact as raw material, not to its original function.

Despite its size, the ceramic assemblage recovered from the industrial complex may afford some insight into the activities and organization of the enterprises conducted there. In particular, the artifacts may provide some evidence of consumption preferences during the workday, information about the chronology of the site's formation, and indications of a particular disposal pattern.

Consumption: Most of the sherds in the ceramic assemblage are too small to allow a formal identification, although of the 148 sherds thought to be associated with food-related vessels, 38 have been tentatively identified as to their function (Table 7 in Appendix A). Evaluation of rim and body curvature, decoration, and the thickness of the sherds was used to identify probable vessel shape. Eight ceramic sherds appear to be from plates, while 31 sherds appear to be from hollowforms[16]. While the sample of identifiable sherds is admittedly small, the preponderance of hollowforms within the subset of identifiable forms suggests that, if food was consumed in the industrial complex (as Wake suggests in the faunal analysis above) it was possibly in the form of small, snack-like meals, with the predominant refreshment being taken in liquid form, such as water, coffee or tea.

Chronology: Majewski and O'Brien (1987:104-105) point out that ware-based classification schemes have numerous pitfalls, not the least of which is the difficulty in visually distinguishing between pearlware and whiteware. Nevertheless, where it is possible to make such identification, the three types of refined earthenware known as creamware, pearlware, and whiteware – along with identifiable decorative patterns -- may

[16] These include fragments from the following forms: 17 cup, 1 bowl , 2 mug, 1 water jug, 3 pitcher or teapot, and 7 saucers.

be used as rudimentary temporal indicators, since the development of each are "points along a continuum of technological development" (Majewsji and O'Brien 1987:106).

Given the limitations of the sample size, identification of ware types for placement along this continuum was one of the few analytical approaches that could be attempted. The specific technological distinctions that separate the types of refined earthenware are not considered here, as they are better discussed elsewhere (see, for example, Deetz 1977; Noël Hume 1970; Majewski and O'Brien 1987; South 1977). For purposes of this analysis, the basic temporal progression of refined earthenware types, and the period during which each was ascendant, is considered to be as follows: creamware (ca. 1760-1810), pearlware (ca. 1790-1840), whiteware (ca. 1820-1900) (Deetz 1977:48; South 1977:211-212). Although there is some overlap in these periods, the basic trend may be used to examine the temporal component of the industrial complex's site formation.

Based on the temporal periods suggested by the relative proportions of these ware types, and by the nature of other artifact categories recovered from these strata, it appears that the bulk of the ceramic assemblage was deposited during the middle decade of the Russian occupation of Ross (ca. 1822-1832). This would be consistent with the period of greatest, most labor-intensive activity conducted in the cove, since - among its other industrial pursuits, it was the time during which the Company operated the shipyard (1816-1827).

<u>Disposal:</u> Analysis of the spatial concentrations of the ceramic artifacts suggests a bifurcated disposal pattern in which a large number of ceramic fragments were discarded

intentionally in an available pit feature, while the remainder apparently were inadvertent discards associated with accidental breakage and inadequate clean up.

As depicted in Figure 5-21, of the 154 sherds comprising the ceramic assemblage, 21% (n=33) were recovered from excavation unit FTU1, and 35% (n=54) were recovered from the 1-x-4 m unit designated as FTU4A-C. FTU1 is the location of the stoving oven used during the period of the shipyard's operation. As discussed above, following the closure of the shipbuilding operation in 1827, it appears that the open pit of the former stoving oven may have offered a convenient disposal site for casual discards. In addition to the ceramic sherds found there, a mixture of marine shell fragments, lithic materials, copper sheathing nails, small fragments of copper sheathing, iron nails, bottle and windowpane glass, glass trade beads, leather and brick fragments were all recovered from the matrix above the abandoned working floor of the oven.

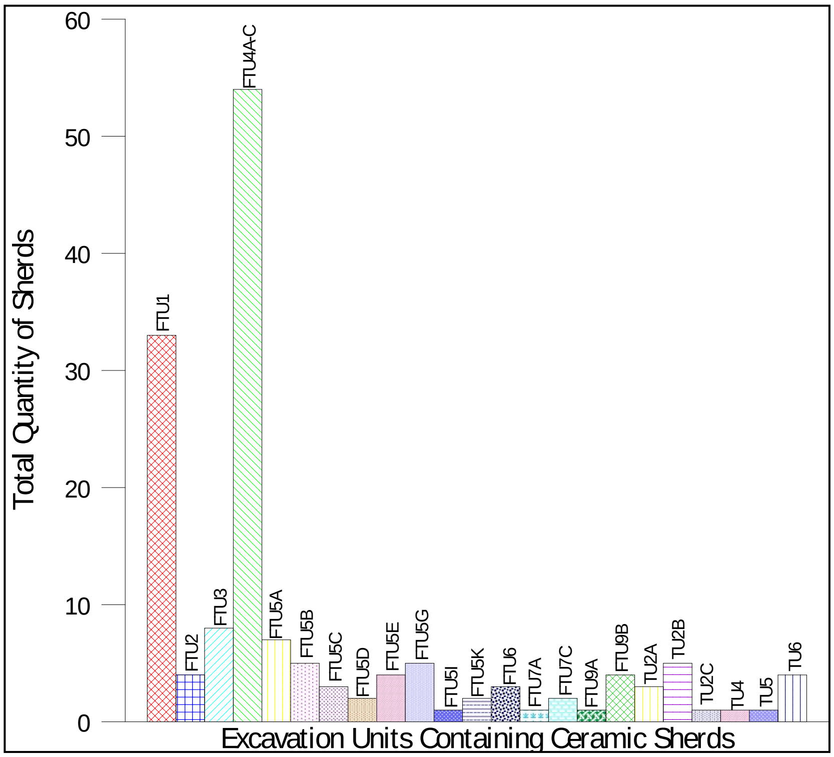


Figure 5-21: Quantity of ceramic sherds per test unit

Whiteware dominates the composition of the ceramic wares recovered from FTU1 (Figure 5-22). Beginning with the abandonment of the oven (at approximately 50 cm below surface), the quantities of discarded creamware and pearlware fragments decrease over time, while that of whitware increases, a pattern consistent with both the accepted temporal progression of the different ware types, and the post-1827 time period following the shipyard's closure.

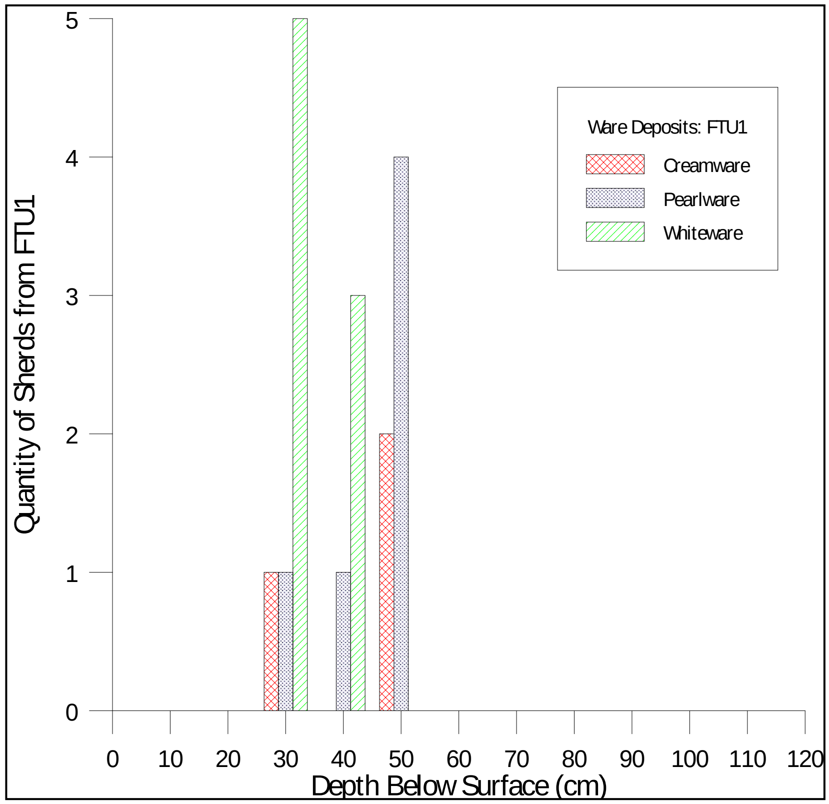


Figure 5-22: Quantity of sherds from FTU1

In contrast, the 54 sherds recovered from FTU4A-D comprise a highly mixed, temporally inconsistent deposit of ware types that suggests a pattern of unintentional discard (Figure 5-23). As discussed previously, excavation unit FTU4A was situated at what proved to be the western corner of the wood barn that once stood in the industrial complex. The adjacent test units FTU4B, 4C, and 4D were situated in close proximity to the projected alignment of the barn's west wall (Figure 5-24). The concentration of ceramic sherds recovered from FTU4A-D suggests that the sherds may have collected along the barn's foundation sill during periodic cleaning episodes of the barn's dirt floor. This interpretation is enhanced by consideration of the dispersal pattern of the remaining sherds

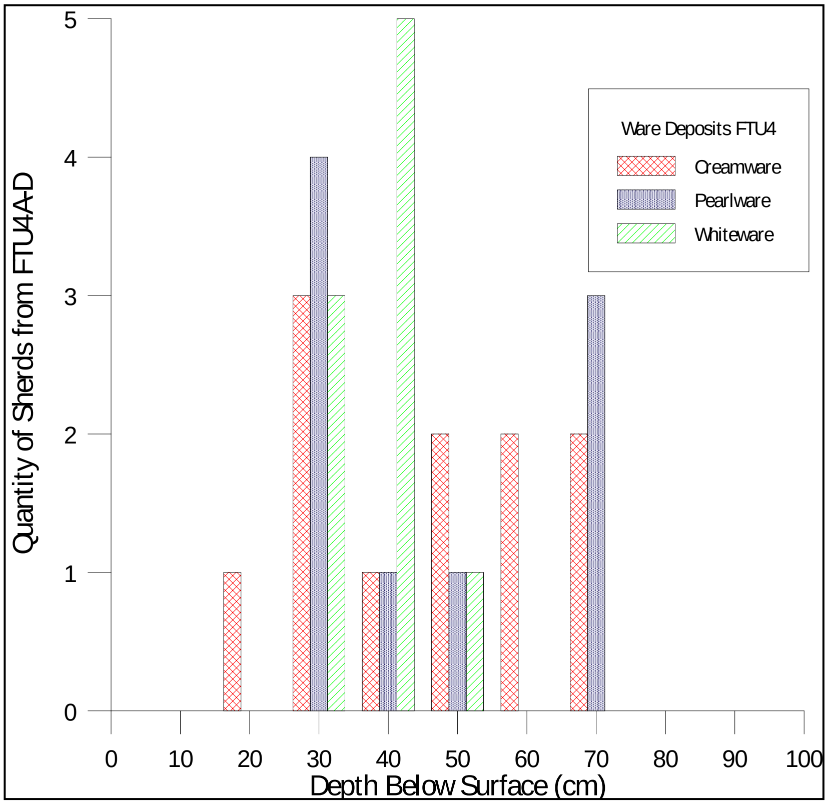


Figure 5-23: Quantity of sherds from FTU4A-D

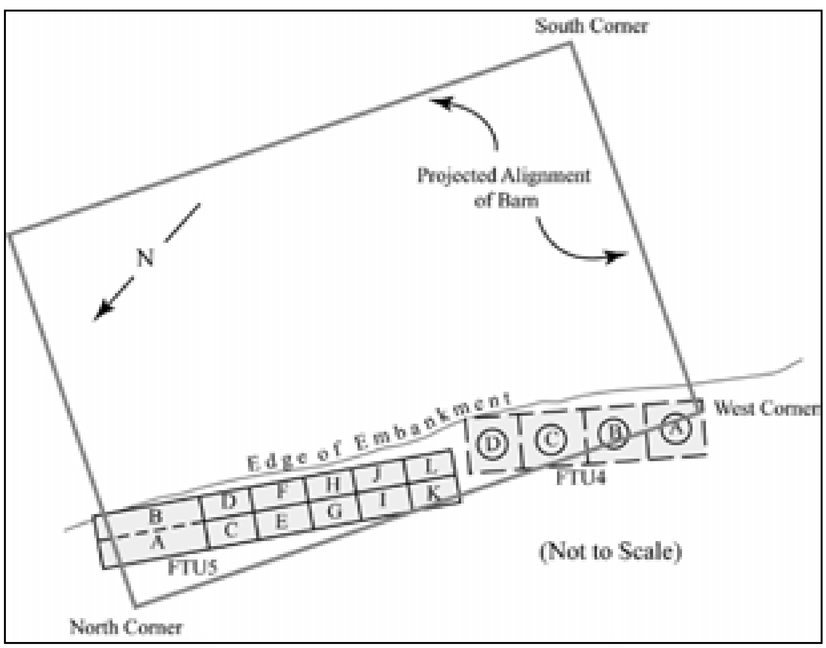


Figure 5-24: Plan of barn superimposed on FTU4A-D

Of all the sherds in the assemblage, 55% (n=84) were recovered from the test units that were situated in what would have been the interior of the barn. Of these, 54 sherds (64%) were concentrated in the 4 m^2 that comprised FTU4A-D, and the remaining 30 sherds (36%) were scattered across the 14 m^2 that comprised FTU5. This suggests that the latter were fragments from random breakages that were either ignored or unnoticed, and eventually worked into the dirt floor of the barn, as opposed to the sherds recovered from FTU4A-D, which appear to be a concentration of sherds pushed to the edge of the floor, possibly during efforts to clean the barn. In any event, unless the ceramics are a collection of sherds from random breakages tossed into the barn after its abandonment (as a convenient disposal site, perhaps) the disproportionate number of sherds recovered from within the projected location of the barn point to the fact that much of the food consumption that took place in the industrial complex may have occurred within its sheltered confines.

Lithic: As might be expected, numerous rocks, stones, and pebbles were recovered during project excavations. A fair number of these were fire-cracked rocks associated with the stoving oven found in FTU1 and the detritus from its periodic cleaning, as found in FTU2 and FTU3. Scattered throughout the matrices of nearly every excavation unit, however, were pieces of chert, obsidian, and groundstone, many of which appeared to have been culturally modified (Table 8 in Appendix A).

Project staff conducted preliminary analysis of the lithic collection in order to separate those artifacts that had, in fact, been modified by human hand from those that had been cracked or altered through natural geologic processes. All obsidian was treated as having been culturally modified since none of the fragments retained any cortex[17] and, since it is a material that does not occur naturally in the immediate environs of Fort Ross, it is presumed to have been imported for conversion into tools. As discussed below, the obsidian artifacts were subjected to hydration testing, during which the individual samples were identified as debitage, projectile points, or bifaces. The obsidian artifacts number 63, among which are three biface fragments, two projectile points, and the base from a third. Flake debitage comprises the remainder of the obsidian assemblage.

Analysis of the chert artifact collection identified 142 pieces that are probably reduction debitage, percussion flakes, and cores. There are no finished points or tools in the assemblage. Specimens of chert that contained negative flake scars were considered particularly if any cortex remained. Smaller flakes lacking any cortex but retaining evidence of the Hertzian cone of force were considered debitage from percussion flaking

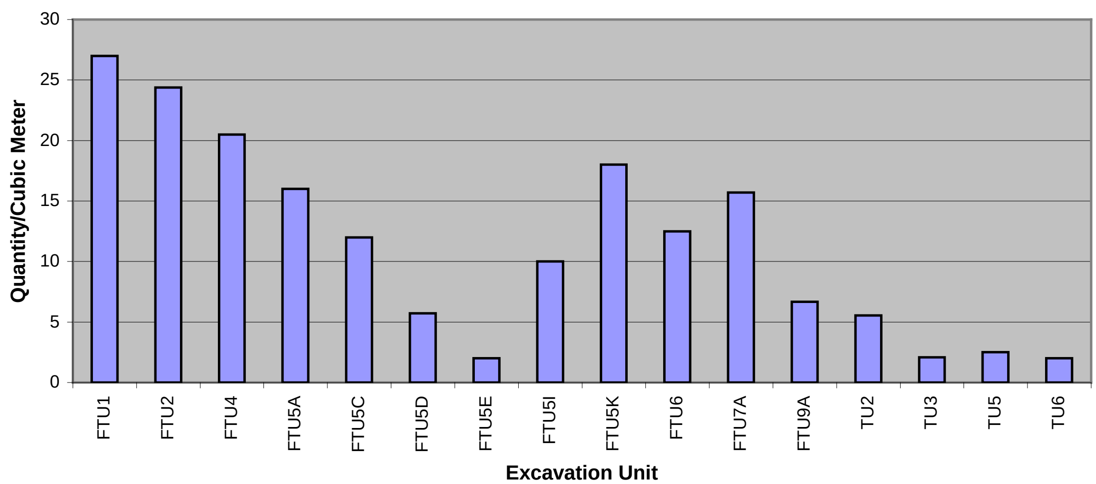
The groundstone assemblage is the smallest of the three lithic types, comprising just 37 pieces. It is also the most culturally ambiguous. When it was encountered in excavations, the groundstone did not appear to be part of the natural geological matrix so it was retained as being a possible cultural indicator. However, in subsequent analysis, none of the pieces exhibited strong characteristics of cultural use or modifications. Some may be small hammer stones, others small hand tools of one sort or another, but the evidence for these types of uses is not clear. Nevertheless, they are included in this discussion because the matrix from which they were recovered did not appear to be their natural geological context.

Lithic material was recovered from nearly every excavation unit, but the densest concentrations were found in FTU1 (n=27/m^3), FTU2 (n=24/m^3), FTU4 (n=21/m^3),

[17] Cortex is the outer, weathered surface –or "rind" of a rock.

FTU5A (n=16/m^3), FTU5K (n=18/m^3), and FTU7 (n=16/m^3), as depicted in Figure 5-25. Although FTU2 had the second highest concentration, the bulk of the material was situated in the deeper strata, below what was considered to be the historic layer. With that exception, in all the units from which lithic material was recovered the obsidian, chert, and groundstone artifacts appeared to be concentrated in the strata most strongly

Figure 5-25: Lithic Density



associated with the historic period (levels 30-80). This was especially true for the obsidian and chert pieces found in FTU1, FTU4, FTU5A, FTU5K, FTU6, and FTU7, as depicted in Figures 5-26 and 5-27.

The highest concentrations of obsidian recovered from the historic period strata were found in FTU1 (n=9), FTU4 (n=16), FTU5A& 5B (n=5), FTU5C-5K (n=7), and TU2 (n=7). The highest concentrations of chert recovered from the historic strata were found in FTU1 (n=26), FTU4 (n=10), FTU5A&5B (n=10), FTU5C-5K (n=15), FTU6

Figure 5-26: Obsidian Distribution

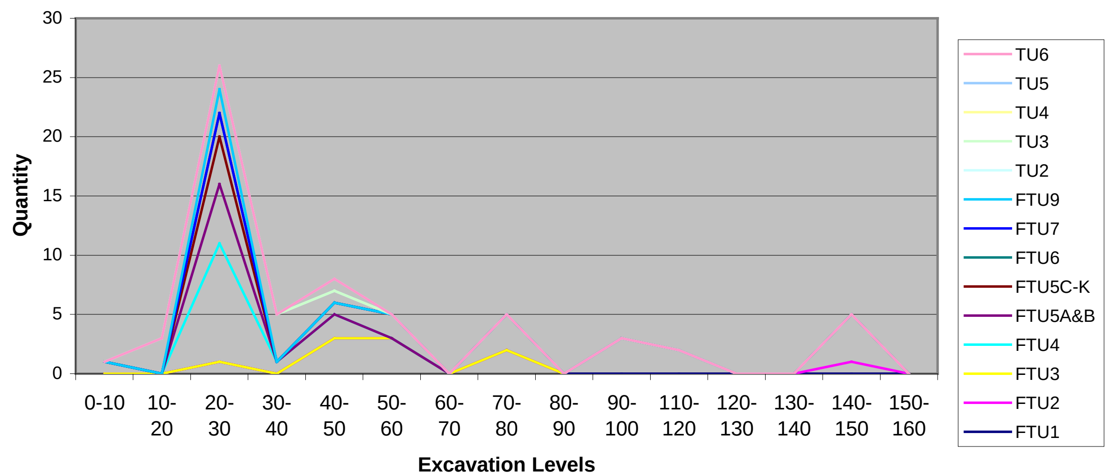
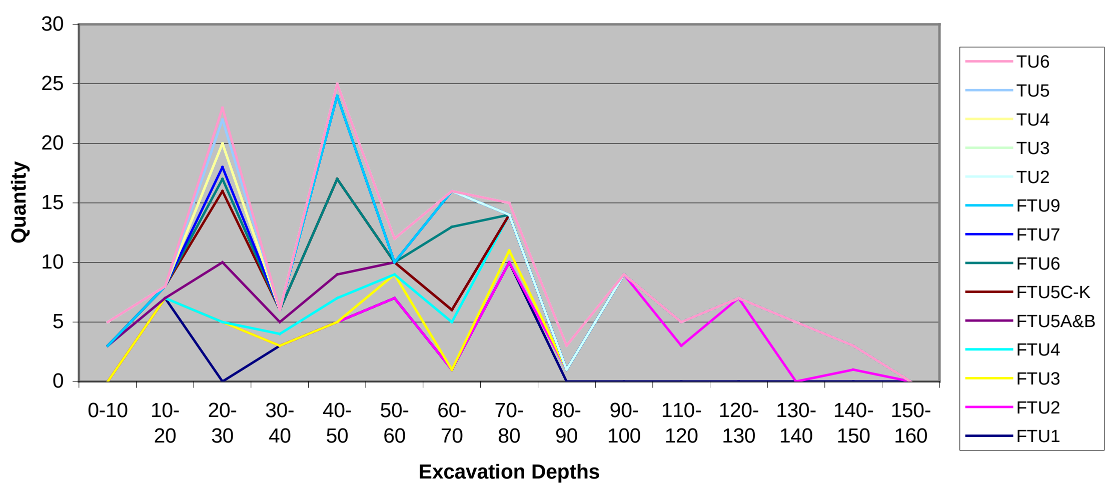


Figure 5-27: Chert Distribution



n=7) and FTU7 (n=10). The groundstone was concentrated in FTU1 (n=11), with the second highest concentration found in FTU4 (n=5).

As an indicator of cultural activity, the quantity of chert and obsidian recovered from FTU1 should be considered with some skepticism. FTU1 was a pit that was clearly backfilled after it was no longer needed as a stoving oven. It is likely that the dense concentration of lithic material (and other cultural material, for that matter) in this unit is a secondary deposit that does not necessarily reflect either temporal stratification or any particular cultural behavior. The groundstone from this unit, on the other hand, lacking as it does any distinctive evidence of cultural use or modification, is most likely associated with the rock floor that formed the basic component of the stoving oven.

The concentrations of obsidian and chert in FTU4, FTU5A&5B, FTU5C-5K, FTU6, and FTU7 are situated in locations that would have been inside of, immediately behind, and directly east of the barn, -- the building that appears to have been the nexus of activity in the industrial complex.

Obsidian hydration dates derived from testing conducted by Mr. Tom Origer of the Anthropological Studies Center at Sonoma State University contribute additional depositional information for the lithic assemblage. Obsidian hydration dating is based on the rate moisture is absorbed by a piece of obsidian after it has been fractured. The absorption of moisture creates a thin, measurable band known as the hydration rim. Its thickness can be correlated to the passage of time once the source of the material is identified, a necessary requirement since absorption rates differ according to both material types and location. The thickness of the hydration rim, measured in microns (µm), can be used to ascertain fairly discrete dates that indicate when the obsidian was fractured, and by inference, when it was intentionally modified. The hydration rate is affected by temperature, as well as the chemical composition of the sample. Because of this, it is necessary to calibrate the samples within a limited geographical area against a sample of known age and similar chemical composition.

There is an inherent potential error of ± 0.2 μm in the measurement of the hydration rims due to the optical limitations of the equipment (Origer pers. comm. September 11, 2000; Silliman 2000:26). For historic period artifacts, this error range makes obsidian hydration as a dating technique somewhat problematic. However, the range of dates created by applying the ± correction to each median date can be used as an indication of potential periods of manufacture or use.

Of the specimens that Origer tested, 36 retained measurable hydration rims. The rims ranged in thickness from 0.9 to 6.0 μm. After adjusting for the differences in geographical area and material type[18] the dates derived from these measurements, including the ± 0.2 μm error range, are from 92 BP to 207 BP at the earliest, and 1555 BP to 3500 BP at the latest (1793 AD to 1908 AD, and 445 AD to 528 BC, respectively). Median dates are 150 BP at the earliest to 2528 BP at the latest (1850 AD to 528 BC).

Using the median date calculations, the obsidian from approximately 20% (n=7) of the assemblage potentially dates to the period of occupation by the Russian American Company[19], and of these 86% (n=6) are from the excavation units that would have been inside or directly behind the barn: FTU4, FTU5A&B, FTU5D, and FTU6.

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[18] Obsidian hydration for northern California is calibrated against samples recovered from the Napa Valley. Differences in temperature for coastal sites, like Fort Ross, require an adjustment to the measurement of thickness.

[19] The period of Russian occupation was 1812 – 1842. Applying the range of potential error to the obsidian hydration dates provides a time span from 1691 at the earliest to 1863 at the latest. The mean dates are 1785 and 1822.

The remaining piece of obsidian that potentially dates to the period of Russian occupation was recovered from FTU1, from which the largest number of specimens was recovered (n=7). The median dates for the samples from this unit range from approximately 4000 BC to 1550 AD. They were recovered from every excavation level and the range of dates from one level to the next indicates they were in a mixed, or non-stratified matrix, adding further weight to the suggestion that the artifacts recovered from FTU1 were in a disturbed, secondary context the resulted from the backfilling of the stoving oven.

The chert and obsidian artifacts recovered from the units directly associated with the location of the barn, and in levels directly associated with the period of the Russian American Company's historic occupation of the Ross colony, give strong indication that the native Californians, whose technology the lithic material represents, had a presence in the industrial complex, although it is difficult to know in what capacity. This presence appears to have been localized in and around the barn area, and the nature and spatial extent of the lithic deposits suggests a possible continuation of native lithic tool production within the industrial center of the colony.

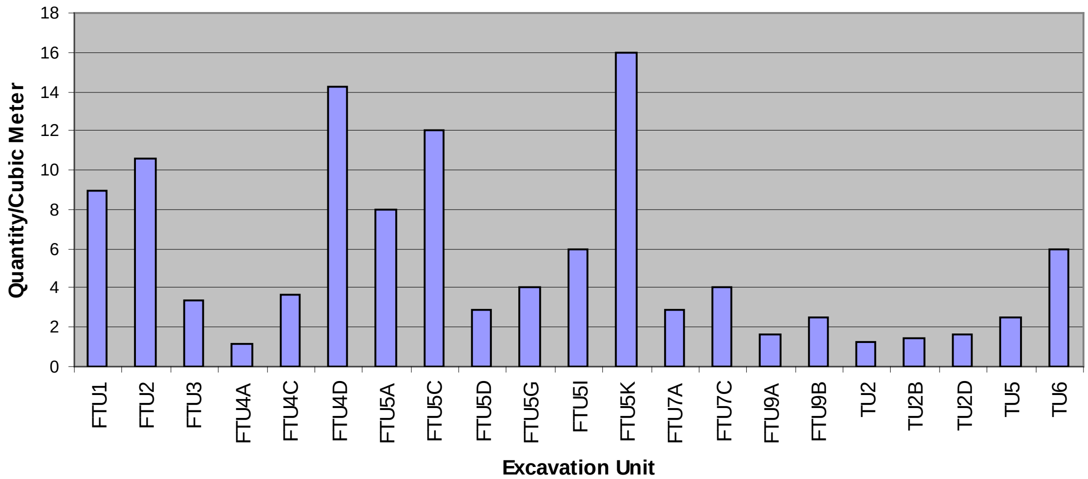
Metal: The metal objects recovered from project excavations form one of the largest of the artifact assemblages. Over 4,000 iron, copper, and lead objects have been catalogued in the collection (Table 9 in Appendix A). Of these, over 1,600 are whole or portions of wrought iron nails and spikes. All were heavily oxidized, and most of the recovered nails, nail heads, and nail bodies were encapsulated in concretions formed as the nails oxidized in their buried, dirt matrix. The five 6-inch long spikes recovered from the redwood beams in TU2, and the two 6-inch long spikes and two spike fragments recovered from FTU5A'North (lying on the wood sill of the barn's rear wall) were the least oxidized of all the spikes, probably because in both instances, the spikes were lying on top of redwood and somewhat isolated from complete encapsulation in the surrounding matrix.

A number of the spikes have been conserved through electrolytic reduction and a large sample of the complete nails is scheduled for future conservation. When this is completed, it will be possible to conduct an analysis of the iron itself and the manufacturing process used to make the fasteners. A cursory study of the spikes that have been conserved suggests that they were hand-wrought, a process that may account for some of the large quantities of slag found throughout the industrial complex.

Nearly 100 copper sheathing nails and copper spikes, as well as pieces of copper sheathing are included in the assemblage. Copper sheathing nails are distinctive in both shape and size, and by their very nature they are associated with 18th and 19th century wood ship construction. The latter is obviously also true of the fragments of copper sheathing.

The copper sheathing nails and sheathing fragments were concentrated in the excavation units situated inside of the historic barn's footprint. As depicted in Figure 5-28, the highest density of copper nails and fragments was found in units FTU4D and FTU5K, which were located adjacent to each other, near the middle of the barn's west wall (Figure 5-29). The next highest densities were found in FTU5C - also inside the barn's perimeter, and in FTU2, situated between FTU1 and FTU3, approximately 10 meters southwest of what would have been the barn's front door.

Figure 5-28: Density of Copper Nails and Sheathing Fragments



In each unit, the copper nails and sheathing fragments were concentrated in a very discrete stratified band. The bulk of the copper artifacts were recovered from depths between 15 and 20 cm, the strata from which the majority of the other historic artifacts were recovered and the levels most likely associated with the activities of the Russian American Company.

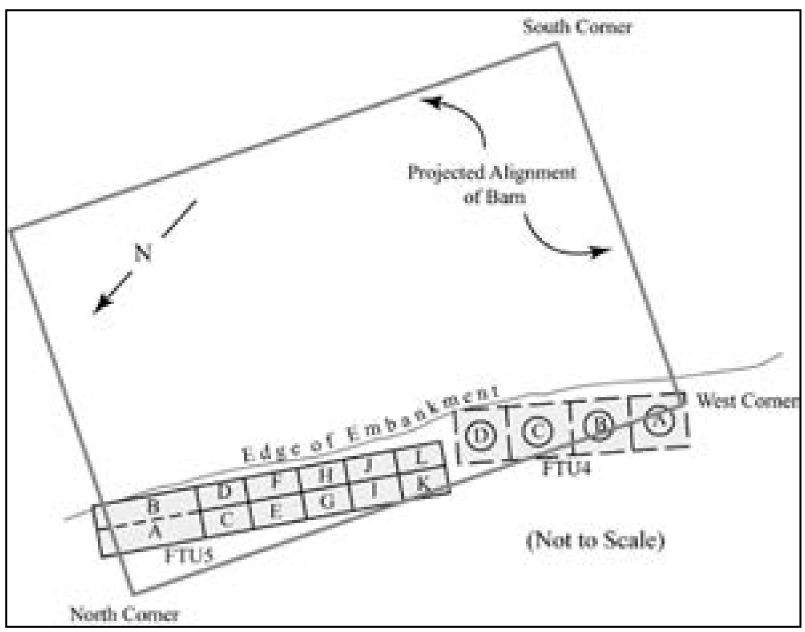


Figure 5-29: Location of test units relative to the projected footprint of the barn.

Although the sample is relatively small, the spatial distribution of the copper sheathing nails and sheathing fragments strongly suggests that the Ross shipwrights were using the barn as a workshop and probably stored some of their raw material there, possibly in the area along the center of the west wall. The secondary concentration in the area of FTU2 also suggests that some type of specific activity related to the sheathing of a ship's hull took place there, close to the stoving oven found in FTU1.

As described in the discussion of FTU4 above, over 375 pieces of flat, iron, shingle-like material were recovered in the excavations of that unit. These too were concentrated inside the barn, in a discrete area along the barn's west wall. Although the individual pieces of iron were not point provenienced, the deposit was centered in FTU4C between levels 6 and 8 (70-100 cm).

Seven lead shot, one lead bullet slug, one lead bale and five pieces of lead sprue were also recovered during the excavations, along with 2 iron horseshoes. Like the copper nails, the largest number of lead sprue fragments were found inside the barn's footprint, in unit FTU4D. Two of the lead shot were also recovered from this unit.

The iron slag mentioned above in the discussion of FTU5 is the most ubiquitous of the metal artifacts recovered from the excavations, comprising 43% (n=1,738) of the entire metal collection. The different smelting and refining techniques that could have produced this slag were discussed in some detail in Chapter 3. As mentioned, it is very difficult to distinguish between slag created through the finery, puddling, chafery or bloomery processes, and no attempt has been made to identify the slag from the industrial complex in these terms. However, visual analysis and measurements of the individual pieces have provided some insight into the nature and possible location of the iron working industry practiced by the Ross smiths.

The absence of flow patterns on the external surfaces of the slag pieces recovered from the industrial complex indicates the slag was probably removed from the hearth or furnace after it solidified, rather than having been tapped in a molten state. The absence of dirt or sand on the surface of the pieces, which would have adhered to the molten slag on contact if it had been tapped, further substantiates this possibility.

Slag that has cooled rapidly will solidify as glass; while slow cooling slag will either be crystalline, or vesicular from the evolution of gas bubbles from its interior (Bachmann 1982:4; Gordon 1997:10; Percy 1861:25). The slag pieces from the industrial complex exhibit both crystalline and glassy characteristics, suggesting the slag cooled in the hearth between its uses. The glassy surface would be that portion exposed to cooling air, while the vesicular area would be that portion closer to the surface of the hearth, which cooled at a much slower rate as the hearth cooled.

The slag in the collection is dark gray in color, with shades of blue, brown and black. As discussed in Chapter 3, the blue color found in slag is oxide of iron and is an indication of relative temperature levels in the furnace. In high temperatures, the oxide turns blue (Percy 1861:28). As further discussed, smithing slag tends to have a plano-convex or concave-convex shape, with low silica and high iron oxide values that make them susceptible to weathering. They are usually brittle and often coated with light to medium-brown crusts of iron oxides and hydroxides (Bachmann 1982:5).

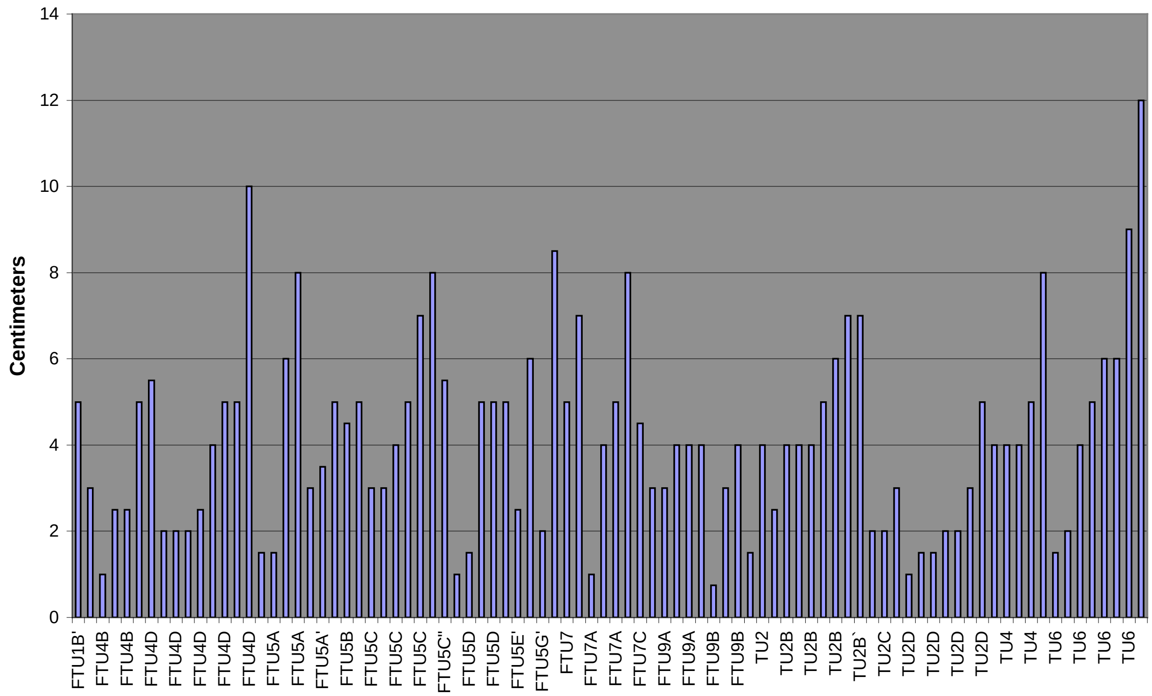
Several pieces of slag from the industrial complex contain the blue color suggestive of high temperatures. None of the slag pieces are either plano-convex or concave-convex in shape; rather they are irregular and clumpy; in addition, none appear to have the coating of brown iron oxide on their exterior surfaces. This, along with the likelihood that the slag was formed in high temperatures, suggest the slag was formed in a hearth or furnace, rather than through hammering or smithing, and that periodically the hearth was cleaned when not in use. As mentioned in the discussion on FTU5, it appears that this disposal frequently took place through a door or opening near the north corner of the barn.

In order to develop a spatial analysis of the slag deposits based on the size of the individual pieces, researchers measured the size of the pieces in a 40% random sample of the slag assemblage. Since the pieces of slag were provenienced by lot, each catalog entry for this category represents a bag containing a number of pieces of slag, varying in size. The largest piece in each bag was measured and entered into the analysis. Given the vagaries of the random selection, several samples from each excavation unit were often selected

Using the underlying concept of the "Schlepp Effect,"[20] project staff assumed that the largest pieces of slag would be closest to the point of manufacture and the smallest farthest away. With this in mind, a spatial analysis was prepared to determine whether any clustering on the basis of size could be identified. As depicted in Figure 5-30, the largest pieces of slag were found in units FTU4D, FTU5A, and FTU5C, FTU5I, which were in very close proximity to each other inside the projected barn's footprint, in TU6, outside the barn's north corner, and in FTU7, outside the barn's east corner. Using the average size of the slag pieces from each excavation unit in the random sample, the spatial distribution of the slag can be looked at another way. Figure 5-31 depicts the concentrations of slag in the random sample on the basis of their relative size. As with

[20] The "Schlepp Effect" is a concept used in faunal analysis. It is based on the idea that the number of bones found at a kill site (and the amount of butchering that took place there) is directly related to the size of the animal and the distance it must be transported to the place of consumption (Schiffer 1977:20).

Figure 5-30: Size distribution of slag sample



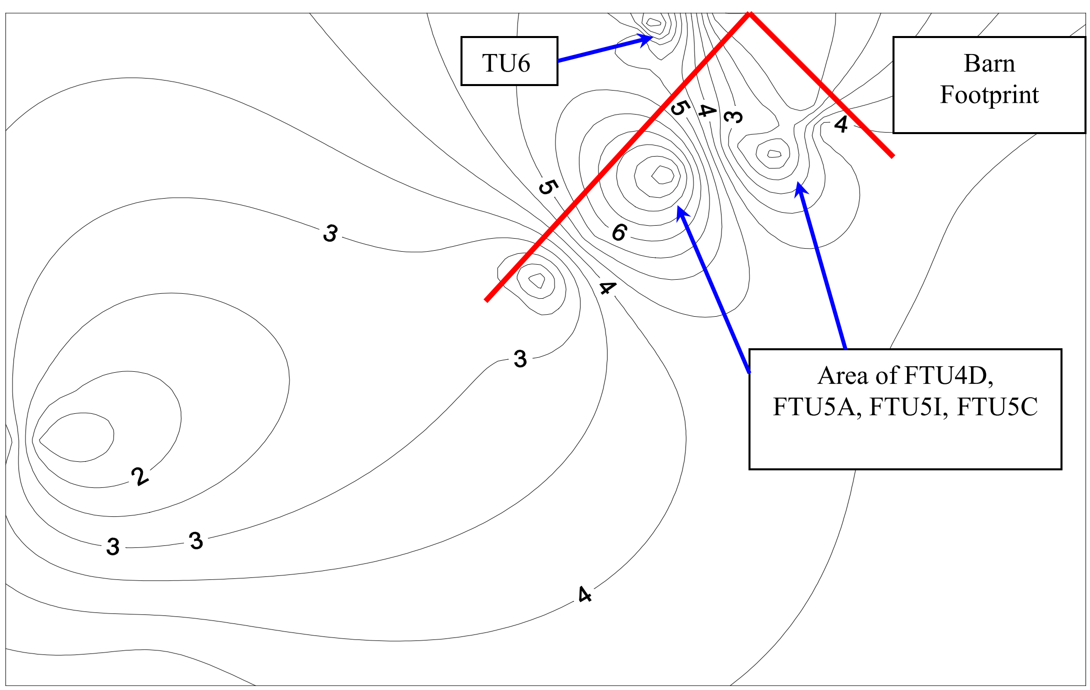


Figure 5-31: Size distribution of slag samples (contour interval=.5mm)

the chart in Figure 5-31, this contour map indicates that the largest pieces of slag in the sample were found in and around the barn area – the north corner in particular. From that locus, the individual slag pieces decreased in size in a radial pattern that emanates away from the barn, extending as far away as the location of FTU1. Along with the density calculation described in the previous discussion of FTU5, the spatial analysis strongly suggests that the activity that produced the slag occurred within the confines of the barn. Since no evidence of high temperatures was observed in any of the excavations within the confines of the barn, it is possible that an elevated hearth or furnace was employed in the iron working processes that produced the slag.

However, it should also be noted that the shallow clay-lined depressions described in the discussion of FTU5 were located in the immediate vicinity of the deposits containing the largest pieces of slag, suggesting that the pits may have been associated with the iron working activities of the colony.

Conclusion

The industriousness of the Russian enterprise at Ross is still very evident in the fragmentary structural remains and scattered detritus of the Company's various manufacturing efforts. Despite the fact that most of the ground on which the Russian craftsmen operated has eroded away, the small strip of land that still remains has produced a remarkable assemblage of cultural material that provides a glimpse of how at least some of their industries might have been conducted. In some instances it has been difficult to distinguish between material that might have been used or discarded by the Company's workers, and that which might have been left by those who came after them. Many of the iron nails and spikes, for example – one of the most ubiquitous of the artifact assemblages in the collection – were surely produced by the Company's smiths, but it is difficult to distinguish those from the spikes and nails that were undoubtedly produced and used during the eras of Benitz, Fairfax and Dixon, and Call. A materials analysis might help to determine the source of the iron used in the spikes, but such an inquiry was beyond the scope of this project. This is also true for the collection of slag. It is one of the largest of the artifact assemblages and has the potential to provide substantive information about the ironworking industry that was conducted in the cove. Planning for a materials analysis of this assemblage is underway.

What are more clearly related to the Company's industrial pursuits are the copper sheathing nails, the remains of the stoving oven, the widely dispersed collection of slag, and -- presumably -- the wood platform on the beach. Although the latter is somewhat ambiguous, there is little doubt that the stoving oven is a remnant of the Russian's shipbuilding efforts. In addition to its value as a remnant of 18^{th} century technology, it is both evidence of the adaptability of the shipwrights to the deprivations inherent in a 19^{th} century frontier industry, and testimony to one of the likely causes for the poor durability of the vessels produced from its issue.

The inefficiencies of the stoving method may be seen in the fact that it was used for only a relatively short period of time in the shipyards of Europe, before being quickly replaced by steam trunks and steam chests. The Company's shipwrights at Ross were apparently limited by the circumstances of the frontier, and had little choice but to revert to an outmoded technology. Combined with what was apparently a poor understanding of the nature of the timber in the nearby forests, the primitive equipment available to the shipwrights virtually insured that the vessels they produced would be substandard, and doomed to fail. That they pursued this industry in the face of these shortcomings for a period of 11 years is an admirable testament to their determination.

Aside from the wood remnants of the barn's foundation and the remains of what appears to be a retaining wall associated with the corduroy road, no structural evidence of the tannery or any of the other buildings known to have once stood in the complex was seen. Given the extent of erosion of the original ground surface, this is not surprising. It is possible, however, that more of the industrial complex may still lie buried on the north side of the access road. In the excavations of FTU1 and its assorted extensions, it became clear that the remains of the stoving oven continue beneath the access road to the beach, stretching towards the wood retaining wall exposed in TU2. Analysis of the 1866 photograph of the barn suggests that the area behind (or northwest) of the retaining wall is flat. If such was the case, it may be that some of the buildings in the complex once stood on that terrace, and had been dismantled prior to the time the photograph was taken. Although the area between the lower and upper roads has been impacted through the road's construction, the impact appears to have been largely surficial, and it is possible that more of the industrial complex remains beneath the gentle slope that lies between the two roads.

Although a number of the artifact assemblages suggest patterns of behavior that may have occurred in the industrial complex, the absence of a broader archaeological deposit makes these interpretations somewhat uncertain. It appears, for example, that both the native Californians and the native Alaskans had a presence in the industrial complex, but the evidence is relatively sparse and limed by circumstances to what could be recovered from a relatively small part of the original ground surface. If additional evidence of the industrial complex can be identified in the ground north of the access road, it may be possible to develop a broader understanding of the spatial arrangement of the complex. As it is now, much of the interpretation of cultural activity is based on what was found inside the barn, compared to what was outside. This preliminary interpretation would be enhanced immeasurably if the location of another structure could be identified and its cultural assemblage compared to that of the barn. Pending that discovery, however, analysis of the extent artifact collection will continue in an effort to understand the activities and cultural interactions that occurred in the narrow strip of land that today defines the industrial complex.

Chapter 6: Conclusions

As part of the project's research framework discussed in Chapter 1, several questions were developed to help guide the analysis of data recovered during the archaeological investigation of the industrial complex. The questions were divided into two sections, the first addressed the possibility that material culture from either the prehistoric or protohistoric eras would be encountered, the second involved the expected recovery of material culture from the period of the Russian American Company, and later. In concluding the interpretation of the artifact and features that began in Chapter 5, the data recovered during project excavations will be used to address the research questions raised in Chapter 1.

The questions in the first section raised the possibility that material culture of the native Kashaya Pomo could be encountered during project excavations, and that such data might provide some insight into Kashaya life ways during the period of Russian occupation of Ross. Specifically, three research questions were developed that asked: (1) whether the recovered material culture could be placed in a chronological context based on typological variation or chronometric dating techniques; (2) whether the recovered cultural material could be associated with what is known of the Kashaya life ways at the time of the Russian American Company's presence; and (3) whether the recovered materials could provide data useful in illustrating a continuation of the prehistoric or protohistoric Kashaya subsistence strategies during the time the Russian American Company maintained their outpost at colony Ross.

None of the units excavated during the entire project exposed any archaeological features that were clearly associated with the native Californians, nor was any evidence encountered that indicated how the cove may have been utilized in prehistoric times, if it was used at all. However, at least two of the artifact categories described in Chapter 5 are useful in addressing all three of the research questions. As described above, glass trade beads and modified lithic material attest to the presence of the Kashaya in the industrial complex during the time it was being used by the Company.

The glass trade beads recovered from the excavations in the industrial complex are consistent with those recovered from the Native Alaskan Village site, and the Fort Ross Beach site, all of which date to the period of Russian occupation. The type, color, and relative scarcity of the beads strongly suggest that they were casual losses of the native Californians and native Alaskans at a site "dominated by daily activities" (Ross 1997:202).

Many of the chert artifacts were recovered from the excavation levels directly associated with the period of the Russian American Company's occupation, and seven of the obsidian specimens (points and flakes) returned absolute dates of the same period, adding further indication that the native Californians had a presence in the industrial complex. On the basis of the excavations conducted in the remaining site area, this presence appears to have been localized in and around the barn. The chipped stone technology, and the type and size of the projectile point and point fragments suggest that, at least in a limited way, the Kashaya continued a native lithic tool production within the industrial center of the colony. Given the nature of the Russian enterprise in the complex, it is highly unlikely that this tool production was related to the Company's industrial efforts. Although in some respects the industrial effort was relatively primitive, especially in comparison to how the same industries were conducted in Europe at the time, the craftsmen of the Company were accomplished and resourceful, especially in their capability of producing tools. It is highly doubtful that they would have incorporated native production techniques into their regimen for manufacturing tools. Rather, it appears that, while in the complex, the Kashaya may have occasionally turned to their own technology to produce a tool that would be useful in advancing their own interests.

Aside from these two artifact categories, no other cultural material was recovered that specifically linked the native Californians to the industrial complex. The relatively small proportion of Kashaya material culture found in the excavations compared to that of the Europeans (and to some extent the native Alaskans) is probably a good reflection of the level of their contribution to the industrial effort. As described in the historic record, the native population was generally employed in the agricultural enterprise and, while the Kashaya were clearly present in the industrial complex at times, it does not appear to have been often – at least based on what they left behind. On the other hand, since they were employed primarily as agricultural workers, there may not have been much reason or occasion for them to leave any evidence of their presence, and they may have been in the industrial complex more frequently than the quantity of their associated cultural material suggests.

The questions raised in the second section of the research framework address the possibility that the archaeological record could provide some insight into the interactions of the pluralistic community that operated in the industrial complex, the nature of the work they conducted, the level of their skills, and how they organized their space. Specifically, five research questions were posed that asked: (1) whether the archaeological record would reflect the interactions of the multiethnic workforce of Russian aristocrat, Russian peasant, native Alaskan, and native Californian that comprised the colony's labor force; (2) whether the nature of the industrial activity that occurred in the cove and the skill levels necessary to make it successful could be observed in the archaeological record; (3) whether the location and configuration of the Ross industrial facilities and the colony's shipyard could be determined through examination of their sub-surface remains; (4) whether the archaeological resources would provide any evidence of previously undocumented or poorly documented industrial or technological processes; and (5) whether the archaeological evidence of the industrial facilities could be used in a comparison with the design and construction of similar facilities in the Russian-American Company outposts at Sitka and Kodiak?

Some elements of the archaeological record found in the industrial complex have proved useful in illuminating the presence there of a multiethnic workforce, a presence that was at least sporadic, if not ongoing. As might be expected, the artifact assemblage is dominated by European material culture but, as discussed above, the glass trade beads and chipped stone artifacts of the native Californian offer some testimony to their presence in the industrial complex. In addition, the dietary preferences identified in the analysis of the faunal remains recovered from the complex suggest that the native Alaskans also had an active presence there. As mentioned in that analysis, the faunal remains indicate that traditional subsistence practices of the native Alaskans continued in combination with the utilization of introduced European resources.

Although it is only a single specimen, the sea otter ilium with cut marks, while not necessarily a reflection of dietary preference, is very interesting - since the sea otter population was rapidly extirpated from the vicinity of Ross just a few years after the Russians arrived in California. The presence of that cut bone in the industrial complex suggests that the native Alaskan hunters may have been there during the relatively early portion of the Ross enterprise, which is not surprising. The identification of the bones of *pinnipedia* (a preferred food source of the native Alaskans) in other deposits in the complex is additional indication of the presence of the native Alaskans, and may suggest they had an active role there, possibly having been recruited into the workforce of the industrial complex after their primary role of hunting was diminished with the extirpation of their prey.[1]

In addressing the second research question, with two possible exceptions, the specific industrial activities that the Company's artisans conducted in the small complex in Sandy Cove could not be clearly identified in the archaeological record, but evidence of the skill levels brought to bear on some of the products they produced is evident in portions of the artifact assemblage.

The historic record indicates the Company manufactured high quality bricks, leather, barrels, and iron products, as well as ships. No specific evidence of the tannery was found, although many pieces of abalone shell were recovered that might have been calcined, possibly for use in tanning leather. No evidence of the brickyard was encountered either, not a surprising occurrence in view of the fact that most of the ground surface of the industrial complex has washed into the ocean. Over 250 brick fragments were found scattered throughout the site, but none were whole and only three were larger than half–size. There was no discernible pattern in their dispersal, nor were there any

[1] As mentioned previously, the sea otter population in the local waters of Ross and San Francisco Bay was decimated between late 1818 and early 1820, just about the same time the industrial enterprise began in earnest.

concentrations of fragments evident that would have suggested a production or storage facility. Even less evidence of leather production was found. A few small leather fragments were recovered in the excavation of FTU1, but they appeared to be in secondary context. Nothing of the tannery itself was encountered, nor was any evidence found of the vats -- known from the historic record to be housed inside of it. Aside from the possibility discussed previously that the remains of the tannery and the brickyard may still exist beneath the slope that lies between the upper and lower roads, the absence of such evidence suggests that the tannery, and possibly the brickyard, were situated south of the lower access road and have been lost to erosion. Although the historic record indicates the tannery was located in the industrial complex, the record is not as clear about the location of the brickyard, other than to provide information about its removal to Bodega Bay in 1832 (Gibson 1969:207). It is possible that when the brickyard was in operation at Ross, it was situated somewhere other than the industrial complex.

As with the tannery and brickyard, no evidence of the structure housing the cooperage was found, although it is possible that the manufacturing requirements for this industry were small enough to have taken place in that part of the barn lost to erosion. However, the Sutter inventory of 1841 describes the cooperage as being in a separate building, one with dimensions considerably smaller than that of the barn. A number of barrel hoop fragments were recovered throughout the site, and a set of nested barrel hoops was recovered in the excavation of a portion of FTU1, but these are the only indicators of the activities that might have been conducted in the cooperage, and they are probably more closely related to the activities of the forge. Given the lack of any structural evidence in what is left of the industrial complex, it appears that the cooperage may have shared the same fate as that of the tannery and, possibly, that of the brickyard.

Evidence of the shipyard has possibly been found on the beach, as discussed previously. Certainly the stoving oven and the possible charring hearth associated with the deposit of scorched redwood are strong indications of where at least part of the shipbuilding effort occurred. The wood platform buried beneath the sands of the cove, and the adjacent, degraded feature that appears to be present in the buried natural watercourse of Fort Ross Creek are highly suggestive of the shipyard itself. Their configuration, spatial relationship, and proximity to the stoving oven and charred wood feature provide additional indications that the location of the shipyard may have been identified.

On the basis of the slag deposits and the potential presence of two hearths inside the barn's footprint, it is possible that some evidence of the iron working enterprise has also been identified. Although more analysis of the slag remains to be done – analysis that may provide some indication of the types of metal work conducted at the forge – the concentrations of slag and their spatial arrangement suggest that the work that produced them was centered in the rear half of the barn.

Figure 6-1 illustrates the spatial arrangement of the structures and possible industrial features that were encountered during project excavations. Although only a portion of the facilities once present in the complex have been found, they nonetheless provide a strong indication of the industriousness and entrepreneurial spirit that characterized the Company's industrial effort. Even though specific evidence of many of the industrial activities conducted in the complex could not be found, some indication of

Figure 6-1 spatial arrangement of complex the skill levels brought to the various enterprises may be seen in the artifacts they produced. In particular, the wrought iron spikes recovered in numerous test excavations appear to be exceptionally well made, as do several fragments of what may be plowshares, and an iron spoke shave. The spike found in the wood beach feature appeared to have been cast and was also extremely well made, reflecting the work of a highly skilled craftsman.

Despite the apparent loss of any evidence of the brickyard itself, a number of brick fragments and nearly whole bricks were also recovered from various excavations. Like the iron artifacts, these too appear to have been well made. They were properly fired, retain their integrity and mass, and in all likelihood, could probably be used today if they were whole. The quality apparent in the manufacture of the bricks is evident in these remnants, and adds confirmation to the contemporary accounts of the Ross bricks as being of very high quality.

As posed in the third research question, the archaeological investigation of the complex did in fact determine the location and configuration of at least one of the colony's industrial facilities, and quite likely the location of the colony's shipyard as well. Although the Sutter inventory describes five separate structures; a forge and blacksmith shop, a tannery, a public bath, a cooperage, and a shed for the baidarkas, only the location and orientation of the building that matches the length of the forge and blacksmith shop was found. Evidence of the other structures may remain in the narrow strip of land between the edge of the embankment and the modern access road that winds down to the beach from the marine terrace, but it is more likely that whatever evidence did remain has disappeared through the erosion that has taken away most of the ground surface of the industrial complex.

Identification of the location and orientation of the wood barn, the probable forge and blacksmith shop described in the Sutter inventory, provided a valuable tool in analyzing the features and artifacts encountered during the excavations along the edge of the embankment. Knowing the location of two of the building's corners and the alignment of the west wall enabled researchers to identify the archaeological resources that were within the confines of the building, and those that were outside – leading to conclusions about the activities that may have been conducted in the barn, and the material that apparently had been disposed of outside of it. The length of the barn, matching as it does the historic description of the forge and blacksmith shop, the spatial distribution of the slag, which appears to have originated near the barn's north corner, and the presence there of the two, superimposed shallow, clay-lined depressions strongly suggest that at least some of the iron working activity of the colony took place within that building. If such was the case, it may explain the concentration of calcined marine shell that was encountered during the excavations of FTU4D, which was located within the confines of the barn, adjacent to the location of the two shallow depressions. The lime derived from the calcined shell could have provided the fluxing material necessary to carry any non-metallic residuum of iron out of the furnace or hearth in the form of slag, as the iron was being worked (Boylston 1936:8). According to West (1902:59), lime is the most important of the fluxing agents, since it readily aids the formation of slag.

As described in the section on leather production presented in Chapter 3, lime is also an essential ingredient in the tanning of hides, and is used in considerable quantity.

While the presence of the calcined marine shell within the confines of the barn may not reflect the actual tanning operation, it may indicate that the shell was calcined there, possibly in the forge, for use in both the metalworking and tannery operations.

The fourth research question asks about the possibility of discovering evidence of previously undocumented or poorly documented industrial or technological processes. The exposure of the wood feature on the beach, in all likelihood a structure associated with the colony's shipyard; provides important insight into how at least a portion of the shipyard's activities may have been conducted. Along with the stoving oven found in FTU1, and the possible charring station found in FTU3, the wood beach feature may provide just such evidence of these processes.

If, as described in Chapter 5, the beach feature is the foundation of the falseworks that paralleled the shipway itself, its alignment and configuration offers significant testimony to the methods the Company shipwrights employed to launch an unwieldy and unstable vessel into the shallow waters of the cove. Traditional shipyards are usually situated along a watercourse that is both convenient to access and deep enough to allow for a launch that would not imperil the safety of the newly christened vessel. In the frontier shipyard at Ross, those advantages were absent, thus requiring an approach to launching that was somewhat unique. Building the shipway at a steep oblique angle to the water's edge, and situating it in the diverted watercourse of Fort Ross Creek allowed for a controlled sideways launch into the shallow cove, and were two ingenious approaches to solving the inherent limitations of the shipyard site.

The difficulties of conducting a project as massive as building a ship in the rugged, undercapitalized environment that existed on the frontier of the Russian America

Company are further illustrated in the use of the stoving oven and possible charring station found in FTU1 and FTU3, respectively. While the contemporary shipyards of industrialized Europe and the United States were using steam trunks and steam chests to soften wood planks for bending, the shipwrights of Ross – lacking such modern amenities -- turned to technologies that had been abandoned in modern shipyards at least 80 years earlier. While these entrepreneurs deserve much credit for adapting to the shortcomings inherent in conducting a large and difficult industrial enterprise on the ragged edge of the Company's frontier, it is probable that the attempts to soften the planks at the charring station and in the stoving oven produced poorly fitting planks that leaked, no doubt contributing to the rot that led to the well documented, premature failures of the vessels built in the Ross yard.

The unusual alignment and configuration of the shipway, and the use of the stoving oven and charring station in the construction of the Ross ships are perhaps the only elements of the Ross industrial complex that provide enough evidence for comparison with the technologies of other contemporary shipyards. The fifth research question addresses this issue, inquiring about the potential of the archaeological evidence in the industrial facilities to be used in a comparison with the design and construction of similar facilities in the Russian-American Company outposts at Sitka and Kodiak.

Following completion of the analysis of the artifact collection, and after additional research into both the historic literature that may describe the operation and arrangement of the Company's shipyards in the north Pacific, and the archaeological research that has been conducted in those areas subsequent to the investigation of the Ross shipyard, just such a comparison will be made. The data obtained about the spatial organization and construction methodology used in the Ross shipyard will provide a very powerful tool in determining the types and degree of modification to contemporary building practices the Ross shipwrights brought to bear on their efforts in Sandy Cove.

Whatever evidence once remained of the various enterprises conducted in the Ross industrial complex, only a small portion of what was probably the Company's forge, the probable remains of the shipyard's falseworks on the beach, and the vestiges of the stoving oven have been found. Of these, perhaps the resources with the best comparative potential are the beach feature and the stoving oven. Certainly they both retain sufficient integrity for comparison to the remains of the Company's shipyard in Sitka, the place where the *promylshennik* Vasilii Grudinin was trained as a shipwright before volunteering to build ships for the Ross colony.

Concluding Summary

Through the efforts of a very large number of interested and enthusiastic volunteers, a great deal of information, both recognized and potential, has been gathered from the archaeological investigation of the industrial complex. Data pertaining to the spatial organization of a least a small part of the complex has been recovered from the remaining piece of ground that once supported the entire operation. Preliminary analysis of the cultural material recovered through project excavations has provided some potential insight into how the enterprise operated, and who might have participated in the various manufacturing efforts. As the analysis continues, this perspective can only be enhanced.

The fragmentary remains of what is probably a portion of the shipbuilding effort have provided substantive information about some of the adaptations that were necessary to accomplish the Herculean task of building six sailing vessels at the very edge of both the Russian and Spanish colonial empires. Although this effort in particular eventually met with failure, the fact that it was even attempted in such a difficult environment commands admiration. Exploration of the remains of the shipbuilding industry at Ross has provided additional insight into the potential causes of this failure – one that historically has been attributed simply to the poor quality of timber available to the Company. With the additional information derived from the archaeological investigation of the industrial complex, it now seems evident that the failure of that particular enterprise had more to do with the shipwrights approach to the work, rather than from the raw materials they chose.

More information about the metal industry carried out in the complex remains to be developed. The large quantity and different types of slag that comprise the collection have the potential to provide significant new information about the smithing techniques, and possibly the types of products produced in the Company's forge and blacksmith shop. This type of analysis, and the comparative investigation of the Company's shipyard, will be the focus of the next phase of the project. The artifact collection is both extensive and varied, and holds great potential for providing additional information about the Russian American Company's industrial efforts, and those of the Ross colony in particular.

Without doubt, remains of the stoving oven extend under the modern access road, and there is a good possibility that more cultural resources lie buried in the surrounding area to the north. Under normal circumstances, these resources could be considered safely encapsulated, and preserved for investigation in a future time. However, the immediate past environmental history of the area suggests otherwise.

Although efforts to redirect the flow of Fort Ross Creek have succeeded to a large extent, the potential for continued erosion of the ground on which the Russian American Company once operated its varied industries remains quite high. Even with the successful efforts to control the creek, during the three years in which field investigations occurred, significant, and noticeable erosion occurred along the base and the upper edge of the terrace where the complex once stood. As evidenced by the fragmentary remains that are left, a considerable portion of the industrial complex has already disappeared.

It should be noted that in the face of persistent environmental pressure, not to mention the normal impacts associated with park visitation, the Rangers and staff of Fort Ross State Historic Park have done an excellent job of protecting and managing the archaeological resources that are under their care, both in the remainder of the industrial complex, and throughout the park. They were, in fact, instrumental in the successful accomplishment of the archaeological research that is the subject of this dissertation.

However, despite the earnest and continual efforts of park personnel, nature -- as usual -- appears to have the upper hand. Accordingly, in the absence of aggressive and permanent efforts to keep both the creek and surficial water runoff away from the remaining component of the industrial complex, further archaeological investigation and data recovery should be considered. Knowing that archaeological resources with the potential to provide additional insight into the site's history remain beneath the road should make the matter a simple choice. Management decisions in the near future will hopefully determine to either permanently protect the resources from further erosion, and the subsequent loss of irrecoverable information, or recover them before nature takes its course and carries the remaining evidence of the industrial complex out to sea.

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Appendices

Appendix A

Provenience Tables
(sorted by excavation unit)

Table 2: Provenience of Beads

Type D/MCHU: drawn, monochrome, cylindrical, hot-tumbled, undecorated

Unit	*Level*	*Depth*	*Variety*	*Quantity*
Aug5	15	0-150	16	1
FTU1A	3	40-50	16	1
FTU1D	1	0-10	16	1
FTU4A	1	0-30	16	1
FTU4A	4	60-70	16	1
FTU4A	4	60-70	5	1
FTU4C	5	60-70	5	1
FTU5A	1	0-30	16	2
FTU5B	2	30-40	5	1
FTU5C'	1	0-30	16	3
FTU5C	1	0-30	16	3
FTU5G'	2	10-20	16	1
FTU5I	1	0-30	16	1
FTU6	1	0-30	16	2
FTU9A'	1	0-30	16	1
FTU9B	1	0-30	21	1
TU3	7	6070	21	1

Type D/PCHU: drawn, polychrome, cylindrical, hot-tumbled, undecorated

Unit	*Level*	*Depth*	*Variety*	*Quantity*
FTU3	3	20-30	18	1
FTU4D	1	0-15	18	1
FTU5A	1	0-30	18	1
FTU9B	1	0-30	18	1

Table 5: Provenience and description of faunal material

Unit	*Level*	*Depth*	*Taxon*	*Element*	*Part*	*Count*
Aug 11	1	0-150	*Mammalia*	indeterminate	fragment	4
Aug 5	1	0-150	*Odocoileus hemionus*	carpal,scaphoid	fragment	1
Aug 5	1	0-150	*Odocoileus hemionus*	carpal,lunar	most	1
Aug 5	1	0-150	*Odocoileus hemionus*	carpal,cuneiform	most	1
FTU1	4	30-40	*Enhydra lutris*	innominate,acet	fragment	1
FTU1	4	30-40	*Mammalia, lg*	indeterminate	fragment	2
FTU1	5	40-50	*Bos taurus*	humerus	head	2
FTU1	5	40-50	*Mammalia*	indeterminate	fragment	16
FTU1	5	40-50	*Mammalia, lg*	indeterminate	fragment	20
FTU1	8	70-80	*Mammalia, sm*	innominate,isch	fragment	1
FTU1A	6	50-60	*Bos taurus*	indeterminate	fragment	7
FTU1A	6	50-60	*Bos taurus*	femur	distal	1
FTU1B	3	30-40	*Mammalia, lg*	indeterminate	fragment	1
FTU1B	5	50-60	*Mammalia, lg*	indeterminate	fragment	4
FTU2	1	0-20	*Mammalia*	indeterminate	fragment	17
FTU2	2	20-30	*Bos taurus*	tooth	most	1
FTU2	3	slump	*Bos taurus*	phalanx	fragment	1
FTU2	3	slump	*Bos taurus*	vertebrae	spinous process	1
FTU2	4	40-50	*Mammalia*	indeterminate	fragment	4
FTU2	5	50-60	*Mammalia, lg*	indeterminate	fragment	19
FTU2	7	70-80	*Mammalia, lg*	indeterminate	fragment	20
FTU2	7	70-80	*Otariidae*	radius	proximal	1
FTU2	8	80-90	*Mammalia*	indeterminate	fragment	4
FTU2	30	slump	*Mammalia, lg*	indeterminate	fragment	1
FTU3	8	70-80	*Mammalia, lg*	indeterminate	fragment	23
FTU3	10	90-100	*Mammalia, lg*	indeterminate	fragment	4
FTU3	3	0-30	*Mammalia, lg*	indeterminate	fragment	1
FTU3		slump	*Mammalia, lg*	indeterminate	fragment	3
FTU3+	3	0-30	*Thomomys bottae*	mandible	horizntl ramus	1
FTU4A	4	60-70	*Bos taurus*	tooth	complete	1
FTU4A	4	60-70	*Mammalia*	indeterminate	fragment	40
FTU4A	4	60-70	*Mammalia, lg*	limb	shaft	1
FTU4B	3	20-30	*Bos taurus*	tooth	fragment	2
FTU4B	4	30-40	*Mammalia, lg*	indeterminate	fragment	1
FTU4B	6	50-60	*Mammalia, lg*	indeterminate	fragment	41
FTU4B	7	60-70	*Bos taurus*	humerus	distal	1
FTU4B	5	40-50	*Mammalia, lg*	indeterminate	fragment	45
FTU4C	1	0-30	*Mammalia*	indeterminate	fragment	2
FTU4C	1	0-30	*Mammalia, lg*	limb	shaft	1
FTU4C	4	50-60	*Mammalia*	indeterminate	fragment	16
FTU4C	5	60-70	*Mammalia*	indeterminate	fragment	5
FTU4C	6	70-80	*Mammalia, lg*	indeterminate	fragment	1

Table 5: Provenience and description of faunal material

Unit	*Level*	*Depth*	*Taxon*	*Element*	*Part*	*Count*
FTU4C	7	80-90	*Mammalia, lg*	indeterminate	fragment	1
FTU4D	2	10-20	*Bos taurus*	rib	shaft	1
FTU4D	3	20-30	*Mammalia*	indeterminate	fragment	19
FTU4D	3	20-30	*Mammalia, lg*	indeterminate	fragment	6
FTU4D	4	30-40	*Bos taurus*	tooth	fragment	4
FTU4D	4	30-40	*Bos taurus*	rib	fragment	1
FTU4D	4	30-40	*Mammalia*	indeterminate	fragment	5
FTU4D	4	30-40	*Mammalia, lg*	rib	fragment	1
FTU4D	4	30-40	*Ophiodon elongatus*	vertebrae	centrum	1
FTU5A	2	30-50	*Mammalia, lg*	indeterminate	fragment	1
FTU5G	1	0-20	*Equus caballus*	tooth	fragment	1
FTU5G	3	30-40	*Bos taurus*	tooth	fragment	5
FTU5K	1	0-30	*Mammalia, lg*	indeterminate	fragment	1
FTU6	1	0-30	*Bos taurus*	patella	most	1
FTU6	2	30-50	*Thomomys bottae*	humerus	complete	1
FTU7	1	0-30	*Artiodactyla*	vertebrae	process	1
FTU7	1	0-30	*Capra/Ovis sp*	vertebrae	most	1
TU2	2	10-20	*Bos taurus*	phalanx	fragment	1
TU2D	2	10-20	*Mammalia, sm*	limb	shaft	1
TU3	10	90-100	*Mammalia*	indeterminate	fragment	8
TU3	11	100-110	*Mammalia*	indeterminate	fragment	30
TU3	11	100-110	*Mammalia*	tooth	fragment	1
TU3	11	100-110	*Mammalia, lg*	indeterminate	fragment	10
TU3	5	40-50	*Mammalia*	indeterminate	fragment	8
TU3	7	60-70	*Mammalia*	indeterminate	fragment	2
TU3	9	80-90	*Artiodactyla*	tibia	shaft	1
TU3	9	80-90	*Mammalia, lg*	rib	fragment	1
TU3	9	80-90	*Mammalia, lg*	indeterminate	fragment	10
TU3	9	80-90	*Zalophus californianus*	tibia	proximal	1
TU4	2	20-30	*Mammalia, lg*	indeterminate	fragment	4
TU4	3	30-40	*Microtus californicus*	mandible	complete	1

Table 6: Provenience and description of selected glass records (windowpane)

Unit	*Level*	*Depth*	*Qty*	*Description*
FTU1	4	30-40	3	glass fragments: 2 brown, 1 clear
FTU1A	1	0-20	13	fragments of brown bottle glass and window pane
FTU2	1	0-20	8	Glass sherds: 4 clear, thin w/slight curve; 3 thick, chunky (bottle glass?); 1 brown glass.
FTU3	6	50-60	6	clear glass fragments
FTU4A	2	30-50	5	glass fragments: 2 brown, 2 aqua, 1 clear
FTU4A	3	50-60	2	very small glass fragments
FTU4A	4	60-70	1	tiny fragment of green glass
FTU4B	6	50-60	1	small sherd of clear, flat glass. pane?
FTU4D	2	10-20	25	9-Clear glass, 2-Blue, 5-Green, 8- 'Black' , 1-Brown
FTU4D	3	20-30	6	small frags of clear glass -clear window pane
FTU4D	3	20-30	40	40+ glass fragments: clear, brown, green some bottle or container frags
FTU4D	4	30-40	50	Glass frags: 1 brown, 4 green, 2 black, ~`40 clear (some pane, some very thin, possible drinking glass).
FTU4D	4	30-40	7	small fragments of flat. clear glass. May be window pane.
FTU5A	1	0-30	100	green and clear bottle glass fragments, no marks. One small bottle base, one clear prescription finish. Three of the glass fragments appear to be melted.
FTU5A	2	30-50	1	1 piece of glass
FTU5A'	1	0-30	3	2 pieces of green glass, 1 piece of clear
FTU5A'	1	0-30	6	3 clear glass sherds (pane glass?); 1 clear bottle glass sherd; 1 green glass sherd; 1 black glass sherd (with corner edge.
FTU5B	1	0-30	7	Pieces of green and clear glass
FTU5C	1	0-30	6	3 small sherds of green bottle glass; 3 sherds of clear glass, possibly drinking glass and one pane sherd
FTU5D	1	0-20	2	very small sherds of clear glass - may be pane glass.
FTU5D	5	50-60	5	4 clear glass fragments, 1 blue glass fragment
FTU5E'	2	30-50	32	small glass fragments, green, aqua, clear, some possibly worked
FTU5I	1	0-30	25	various colored glass fragments (clear, green, brown)
FTU5K	1	0-30	1	small black glass fragment
FTU5K	2	30-50	1	clear glass frag, possibly window pane
FTU6	1	0-30	16	Glass frags: clear bottle glass, clear window pane, green bottle glass, brown bottle glass
FTU6	2	30-50	2	one clear, one green glass frag
FTU7A	2	30-50	1	i piece of clear glass, curved, thin--possibly from drinking glass.
FTU7A	4	60-70	9	3amber, 1 green bottle glass fragment--5 flat, clear pieces of windowpane.
FTU9A'	2	30-40	2	2 small window pane fragments
FTU9B	1	0-30	17	varied colored glass: clear, red, dark green, light green, balk side wall cleanup
TU2	1	0-10	2	Clear glass fragments
TU2B	3	20-30	6	2 green bottle glass frag; 4 clear glass frags, one possibly from a finish
TU2B	4	30-40	1	small green glass fragment

Table 6: Provenience and description of selected glass records (windowpane)

Unit	*Level*	*Depth*	*Qty*	*Description*
TU2B	6	50-60	2	2 clear glass fragments, 1 pane(?), one vessel(?)
TU2C	1	0-10	2	2 clear glass fragments, one with ridges or scored lines.
TU2D	4	30-40	2	one 'black' glass bottle fragment, one clear glass frag (pane?)
TU3	4	30-40	2	sherd of clear glass (windowpane?); sherd of green bottle glass
TU3	7	60-70	3	small, clear glass fragments
TU5	1	0-30	12	12 pieces of glass; 7 clear, 2 green, 2 brown, 1 blue
TU6	1	0-30	3	small pieces of clear bottle glass

Table 7: Provenience and description of ceramic sherds

Unit	*Level*	*Depth*	*Qty*	*Description*
Aug 2	4	140-160	1	blue edge, hand painted pearlware - (teacup)
FTU1	1	0-10	1	small polychrome fragment. Hand painted pearlware teacup frag.
FTU1	2	0-10	1	small ceramic rim fragment, -whiteware per L. Wilkie
FTU1	2	0-10	1	small fragment of red ceramic. Molded w/exterior glaze. redware/terra cotta. Probably figurine.
FTU1	2	0-10	2	1 blue, hand painted saucer; 1 annular pearlware sherd, probably mug.
FTU1	2	0-30	1	small ceramic sherd. Light blue transfer printed whiteware -- (post 1835-per L. Wilkie)
FTU1	3	20-30	4	3 transfer printed white ware - willow pattern teapot or canister.1-flow blue white ware - saucer
FTU1	3	30-40	1	small sherd of blue-on-white, hand painted pearlware
FTU1	4	30-40	1	ceramic cup or bowl frag. No marks. Whiteware
FTU1	4	30-40	1	fragment of dark blue ceramic (vent feature). Flow blue whiteware
FTU1	4	30-40	1	green glazed ceramic, possibly melted.
FTU1	4	30-40	1	sherd of glazed, sand temper, heavy earthenware. Possible Spanish botello (olive jar)
FTU1	5	40-50	4	small ceramic fragments: 4 pieces of pearlware
FTU1	6	50-60	1	blue-glazed ceramic sherd. Chinese porcelain, probably Canton
FTU1	#	90-100	1	blue hand-painted pearlware
FTU1A	1	0-30	1	blued ironstone handle fragment
FTU1A	3	40-50	1	small creamware fragment
FTU1A	5	50-60	2	1 blue-on-white, hand painted Chinese porcelain; 1 blue on white transfer print
FTU1A	6	60-70	1	blue, shell-edged ceramic pearlware.
FTU1B	2	20-30	1	small sherd of white ceramic
FTU1B	3	30-40	1	small piece of white ceramic. Overglazed hand painted Chinese porcelain
FTU1B	5	50-60	2	small fragments of creamware
FTU1B	6	60-70	1	small pearlware fragment
FTU1D	0	0	1	small porcelain fragment-no marks-found on surface
FTU1D	2	20-30	1	small hand painted pearlware frag
FTU2	1	0-20	1	Very small ceramic sherd. Transferware? Chinese porcelain
FTU2	4	40-50	1	ceramic sherd. Whiteware - per L. Wilkie
FTU2	6	50-60	2	1 blue hand painted Chinese porcelain; 1 blue transfer printed pearlware-per L.Wilkie
FTU3	6	50-60	2	(1) 3 x 13 mm fragment: ironstone. (1) 5x7mm fragment: pearlware per L.Wilkie
FTU3	8	70-80	2	one small pearlware fragment - 7x7mm: blue, transfer printed pearlware-teacup. one small porcelain fragment.
FTU3	9	80-90	2	(1) 15 x 17mm creamware frag; (1) 10 x 15mm porcelain frag.
FTU3(+)	3	0-30	2	two whiteware teacup frags. per L. Wilkie (possible creamware)
FTU4A	1	0-30	3	(1) piece of blue transferware;(1) creamware(1)blued ironstone per L.Wilkie
FTU4A	2	30-50	2	Two ceramic sherds,. One is burnt ironstone, the other is blue transfer printed pearlware.
FTU4A	2	30-50	1	creamware fragment
FTU4A	2	30-50	1	ceramic frag (whiteware)-recovered from biodisturbance level.
FTU4A	3	50-60	2	tiny ceramic fragments

Table 7: Provenience and description of ceramic sherds

Unit	*Level*	*Depth*	*Qty*	*Description*
FTU4A	4	0-30	3	1 overglazed hand painted porcelain; 1 creamware; 1 pearlware
FTU4B	1	0-10	2	(1) white pearlware. 1 hand painted white and blue pearlware
FTU4B	2	10-20	1	small creamware sherd
FTU4B	3	20-30	1	small creamware sherd
FTU4B	5	50-60	3	small creamware sherds (creamware 1765-1810)
FTU4B	6	50-60	1	blue-on-white ceramic fragment
FTU4B	7	60-70	2	small creamware sherd, fragment of pearlware w/ gold decoration
FTU4C	1	0-30	4	(1) blue transfer printed whiteware; (1) undecorated whiteware; (2) white ball clay smoking pipe frags -- per L. Wilkie
FTU4C	1	0-30	2	1 blue & white annular decorated pearlware; 1 light-brown, burnt ironstone sherd
FTU4C	2	30-40	1	small pearlware fragment.
FTU4C	3	40-50	2	one creamware; one Chinese porcelain with ghost residue of overglazed hand painted design -- probably contemporaneous with creamware.
FTU4C	5	60-70	3	1 blue on white Chinese porcelain; 1 pearlware; 1 creamware
FTU4C	5	60-70	1	small fragment of red ceramic. Molded w/exterior glaze. redware/terra cotta. Probably figurine.
FTU4C	6	70-80	1	small pearlware(?) frag.
FTU4D	1	0-30	3	2 (probably) modern porcelain frags. (1) blue-glazed porcelain frag
FTU4D	1	0-10	3	1 white porcelain frag.2 Blue-on-white; transfer printed pearlware
FTU4D	1	0-10	1	small water worn Chinese porcelain frag -appears to be blue-on-white
FTU4D	1	0-15	1	Round ironstone handle fragment. Appears modern. Recovered from 1st 15 cm of So. balk.
FTU4D	2	10-20	1	ironstone; possible ring base fragment - probably mid-19th c. - per L.Wilkie
FTU4D	2	10-20	1	clay smoking pipe stem fragment
FTU4D	3	20-30	1	Small pearlware sherd. Recovered from south balk wall
FTU4D	3	20-30	1	White, unmarked ceramic sherd -- pearlware?
FTU4D	3	20-30	1	small, glazed ceramic sherd - whiteware
FTU4D	4	30-40	1	unmarked whiteware ceramic fragment, probably post 1820 per L.Wilkie
FTU4D	4	30-40	4	small sherds of whiteware -- post 1820 per L.Wilkie
FTU5A	1	0-30	3	overglazed, hand painted porcelain mug frag. 1 brown Chinese ware (stoneware) pot frag, 1 undecorated blued ironstone saucer - mid 19th century.
FTU5A	2	30-50	1	clay pipe stem fragment
FTU5A	2	30-50	1	Thick footrim fragment, may be stoneware/whiteware
FTU5A	4	50-60	1	small fragment of creamware
FTU5A'	1	0-30	1	tiny, triangular shaped fragment of creamware
FTU5B	0	0	1	polychrome exterior, white interior glaze. pearlware bowl; annular ware - marbelized mocha
FTU5B	1	0-30	2	one pearlware sherd, one blue-on-white transfer print
FTU5B	2	30-40	2	1 creamware frag; 1 blue, hand painted Chinese porcelain -- per L. Wilkie
FTU5C	3	30-40	1	small fragment of pearlware
FTU5C'	1	0-30	1	small fragment of green on white glazed ceramic
FTU5C'	1	0-30	1	Portion of clay smoking pipe stem -- no markings.
FTU5D	1	0-20	2	1 blue on white porcelain sherd; 1 creamware sherd with painted

Table 7: Provenience and description of ceramic sherds

Unit	*Level*	*Depth*	*Qty*	*Description*
				(?) decoration.
FTU5E'	1	0-30	2	1 creamware rim sherd; 1 blue-on-white glazed ceramic sherd
FTU5E'	2	30-50	2	(1) blue, hand painted pearlware. Hollowform -- probably teacup. 1 porcelain - probably Chinese -- per L. Wilkie
FTU5G	2	20-30	1	blue transfer printed pearlware -- probably saucer. 1785-1830 per L. Wilkie.
FTU5G	3	30-40	4	1 blue, shell-edged, hand painted whiteware plate - late 19th century.3 small pieces of creamware
FTU5I	1	0-30	1	blued ironstone -- mid 19th century. per L. Wilkie
FTU5K	1	0-30	1	1 small piece of blued ironstone, mid 19th century
FTU5K	2	30-50	1	small creamware sherd
FTU6	1	0-30	1	Chinese porcelain. blue on white transferware - probably Canton , late 1700s - early 1800s per L. Wilkie.
FTU6	1	0-30	1	Small tan Chinese stoneware frag, impressed on one side.
FTU6	2	30-50	1	small fragment of porcelain
FTU7	1	0-30	1	1 piece of buff colored ceramic. Unglazed Chinese stoneware.
FTU7C	1	0-30	2	Pearlware fragments
FTU9A	3	50-60	1	creamware frag
FTU9B	1	0-30	2	2 small sherds, one glazed redware - probably a pipe, probably American, 19th century - per L. Wilkie. 1 small 1mm x 1mm pearlware sherd
FTU9B	1	0-30	2	2 pieces of ceramic,. 1 creamware; 1 whiteware. Recovered from balk side wall cleanup
TU2	1	0-10	1	Ironstone frag.
TU2	3	20-30	1	unmarked, blued ironstone
TU2A	3	20-30	1	pearlware(?) fragment
TU2B	1	0-10	1	small, white, porcelain sherd
TU2B	2	10-20	2	2 white ceramic sherds, one possible pearlware
TU2B	3	20-30	2	1 porcelain; 1 blued ironstone
TU2C	3	20-30	1	ironstone ceramic sherd -
TU4	2	20-30	1	small creamware sherd;
TU5	1	0-30	1	1 piece of pearlware
TU6	1	0-30	3	two small pieces of blue, transfer-printed pearlware, small piece of creamware?
TU6	3	40-50	1	small triangular-shaped fragment

Table 8: Provenience and description of lithic materials

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
Aug11	4	140-160	chert	1	small chert flake
Aug5	15	0-150	groundstone	1	groundstone(?)-possibly fire-affected.
FTU1	2	10-20	chert	6	possible chert fracture flakes
FTU1	2	10-20	chert	1	chert core fragment
FTU1	2	10-20	sandstone	1	sandstone or groundstone --possible net sinker
FTU1	2	10-20	sandstone	1	possible hammerstone
FTU1	2	10-20	sandstone	1	possible hammerstone from barrel hoop feature
FTU1	3	20-30	groundstone	1	medium-size groundstone cobble
FTU1	3	20-30	lithic	4	possibly fire-altered rock fragments. Type unidentified.
FTU1	4	40-50	chert	1	Possible core fragment, recovered from barrel hoop feature
FTU1	4	30-40	groundstone	1	one medium-size groundstone cobble fragment
FTU1	5	50-60	chert	4	2 chert cores, two percussion flakes
FTU1	5	50-60	chert	1	chert flake
FTU1	5	40-50	chert	1	small percussion flake with cortex
FTU1	5	40-50	chert/obsidian	4	two chert frags, one obsidian frag, one unid
FTU1	5	40-50	groundstone	2	two groundstone fragments
FTU1	5	50-60	groundstone	1	fragment
FTU1	5	40-50	groundstone	7	FCR
FTU1	5	40-50	groundstone	1	small sandstone (groundstone?) hand tool-hammerstone? Pestle?
FTU1	5	40-50	groundstone?	1	burned groundstone (?)
FTU1	5	50-60	obsidian	2	percussion flakes
FTU1	5	40-50	sand	2	medium-size pieces of burned sand (?)
FTU1	5	50-60	sandstone	3	fire-altered rock
FTU1	5	40-50	sandstone	4	four pieces (FCR?)
FTU1	6	50-60	chert	2	core fragments? both show flake scars
FTU1	7	60-70	chert	1	core fragment.
FTU1	7	60-70	groundstone	4	fire-cracked rock
FTU1	8	70-80	chert	10	small chert percussion flakes
FTU1	8	70-80	groundstone	3	fire-cracked rock
FTU1	8	70-80	groundstone	20	fire cracked rock
FTU1	8	70-80	obsidian	1	Fragment from worked projectile point. Recovered from 94 cm BD @30S; 66E.
FTU1	8	70-80	obsidian	1	worked obsidian fragment
FTU1A	1	0-30	obsidian	1	obsidian fragment
FTU1A	3	40-50	chert	1	tiny fragment of possibly-worked chert
FTU1A	3	40-50	obsidian	1	small flake, possibly worked, possibly glass
FTU1A	4	50-60	groundstone	4	small pieces of groundstone
FTU1A	4	50-60	obsidian	1	small point tip
FTU1A	5	70-80	groundstone	1	groundstone, possibly cultural, worn in center
FTU1A	6	60-70	groundstone	1	small lithic fragment, possible limestone on outside surface.
FTU1B	3	30-40	chert	3	small flakes, one possible core fragment
FTU1B	3	30-40	limestone	1	one (possible) limestone fragment
FTU1B	3	30-40	sandstone	1	large rounded frag, possible culturally shaped
FTU1B	4	40-50	obsidian	1	percussion flake

Table 8: Provenience and description of lithic materials

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU1D	1	0-20	Groundstone	1	oblong, smooth groundstone
FTU2	4	40-50	groundstone	1	1 round groundstone
FTU2	5	50-60	basalt(?)	3	fire-altered lithic frags
FTU2	5	50-60	groundstone	1	medium-size fragment, may be fire-altered
FTU2	5	50-60	groundstone	1	medium-size fragment
FTU2	6	50-60	sandstone	1	possible mano ~9' long x 5' wide, nicely rounded at point.
FTU2	8	80-90	chert	1	Worked flake
FTU2	8	80-90	groundstone	1	Small, round stone, possibly groundstone.
FTU2	8	80-90	sandstone	26	Assorted sandstone fragments. Possibly fire-altered.
FTU2	9	90-100	chert	1	chert shatter flake
FTU2	9	90-100	chert	4	chert shatter fragments
FTU2	9	90-100	chert	4	interior flakes
FTU2	9	90-100	obsidian	2	One obsidian flake, one small projectile point fragment.
FTU2	9	90-100	obsidian	1	small obsidian flake
FTU2	9	90-100	sandstone	1	Fire-altered sandstone fragment
FTU2	9	90-100	sandstone	10	Fire-altered sandstone fragments
FTU2	10	100-110	chert	3	2 shatter flakes, 1 interior flake
FTU2	11	110-120	chert	7	3 chert shatter flakes, 4 interior flakes
FTU2	11	110-120	obsidian	2	small obsidian flakes
FTU2	13	130-140	groundstone	1	Groundstone fragment, possibly fire-altered.
FTU2	14	140-150	chert	1	long, interior flake
FTU2	14	140-150	groundstone	1	groundstone fragment-possibly fire-altered
FTU2	14	140-150	obsidian	1	interior flake fragment
FTU2	14	140-150	sandstone	2	possible fire-altered rock
FTU2	15	150-160	groundstone	2	two groundstone fragments-- possibly fire-altered
FTU2(+)	3	30	chert	5	chert frags, some possibly worked
FTU3	0	0	chert	1	chert flake recovered from slump area.
FTU3	6	50-60	chert	2	2 small chert fragments
FTU3	8	70-80	chert	1	gray chert flake,
FTU3	8	70-80	groundstone	2	possible groundstone fragment, flat, rounded edge. Also small slate fragment.
FTU3	9	80-90	sandstone	4	oxidized sandstone, may be fire-altered.
FTU3	12	110-120	chert	1	chert flake
FTU3	12	110-120	chert	1	chert percussion flake
FTU3	13	120-130	jasper	1	jasper fragment, may be percussion flake.
FTU3	13	120-130	sandtone	2	Oxidized sandstone
FTU3	14	130-140	chert	5	small chert fragments--may be percussion flakes
FTU3	14	130-140	groundstone	2	groundstone, possibly fire-altered
FTU3	14	130-140	sandstone	2	fire-altered sandstone. Can be refit
FTU3	15	140-160	chert	1	chert core w/ flake scar. Recovered from levels 15-16.
FTU3	15	140-150	chert	1	one fragment, possibly chert
FTU3	15	140-160	groundstone	6	medium-size, fire-altered groundstone
FTU3	15	140-160	groundstone	2	fire-altered groundstone

Table 8: Provenience and description of lithic materials

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU3	15	140-150	groundstone	1	groundstone fragment, possibly fire-altered.
FTU3	15	140-150	obsidian	3	two small chert flakes; 1 obsidian flake
FTU3	15	140-150	obsidian	1	finished projectile point. Found at south end of unit.
FTU3	15	140-160	Sandstone	4	Four sandstone fragments, two refit.
FTU3	16	150-160	chert	1	percussion flake
FTU3	16	150-160	groundstone	2	groundstone, possibly fire-altered
FTU3	17	160-170	sandstone	1	medium-sized sandstone cobble, probably fire-altered.
FTU3(+)	3	30	sandstone	2	fire altered sandstone fragments
FTU4A	1	0-30	Obsidian	1	small obsidian flake
FTU4A	2	30-50	obsidian/chert	3	(1) obsidian flake; (2) chert flakes
FTU4A	2	30-50	sandstone	5	fire-affected sandstone fragments
FTU4A	3	50-60	quartz	1	quartz fragment
FTU4A	3	50-60	sandstone	4	oxidized sandstone
FTU4A	4	60-70	chert	1	chert flake
FTU4A	5	70-80	chert	1	chert flake
FTU4A	5	70-80	chert	1	2-in piece of worked chert
FTU4B	1	0-10	chert/obsidian	4	3 small chert flakes, one small obsidian flake
FTU4B	3	20-30	flint/quartz	1	small triangular (shaped) piece
FTU4B	4	30-40	obsidian	1	small piece of obsidian, possibly worked
FTU4B	5	40-50	obsidian	1	small flake of obsidian, evidence of working.
FTU4B	7	60-70	groundstone	1	flat piece of groundstone- 3 1/2 x 4--vertical edges on three sides, curved edge on 4th side
FTU4B	7	60-70	groundstone	1	round stone, marks on one end suggest it may be hammerstone
FTU4C	1	0-30	groundstone	1	small groundstone fragment
FTU4C	1	0-30	obsidian	2	1 small possible obsidian flake, 1 chert flake, appears to be worked.
FTU4C	1	0-30	sandstone	2	fire-affected sandstone fragments
FTU4C	3	40-50	sandstone	2	fire-altered rock fragments
FTU4C	4	50-60	sandstone	3	small fragments of fire altered or oxidized sandstone
FTU4C	5	60-70	chert	3	1 chert frag, 2 unid
FTU4C	5	70-80	obsidian	3	1 obsidian point fragment, 1 obsidian flake, 1 chert flake.
FTU4C	5	60-70	sandstone	6	fire-affected rock fragments
FTU4C	6	70-80	chert	1	small chert flake
FTU4C	7	80-90	greywacke?	1	Possible limestone residue on cortex
FTU4C	7	80-90	shale	1	one black piece of shale, smooth
FTU4C	8	90-100	groundnstone	1	cylindrical piece of groundstone
FTU4D	1	0-30	ground stone	1	1 large piece of ground stone
FTU4D	1	0-10	Grnstone/chert	4	chert frag , groundstone frag, 2 unid
FTU4D	1	0-30	obsidian	4	4 pieces of broken obsidian
FTU4D	2	10-20	sandstone	1	possible foundation stone. Item 7 on level record.
FTU4D	3	20-30	Obsidian	3	3 small obsidian frags -some worked
FTU4D	3	20-30	Sandstone?	5	5 small Lithic frags: 1 may be heat-altered others may have lime on them
FTU4D	4	30-40	chert	1	Worked flake of banded chert

Table 8: Provenience and description of lithic materials

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU4D	4	30-40	groundstone	1	round groundstone
FTU5A	1	0-30	obsidian	4	four small shatter fragments
FTU5A	2	30-50	chert	1	flake
FTU5A	2	30-50	lithic	1	1 lithic
FTU5A	3	50-60	chert	1	one small percussion flake
FTU5A	4	60-70	chert	1	1 piece of chert
FTU5A	4	60-70	coal	3	3 pieces of coal
FTU5A	4	60-70	diabase	1	1 piece of diabase?
FTU5A'	1	0-30	chert	3	small fragments of worked chert
FTU5A'	1	0-30	chert	1	1 piece of white chert
FTU5A'	1	0-30	jade	3	3 pieces of jade?
FTU5A'	2	30-40	chert	1	1 piece of chert
FTU5A'	2	30-40	groundstone	1	portion of groundstone - possibly FCR
FTU5B	1	0-30	obsidian	1	small percussion flake
FTU5B	3	20-30	chert	1	1 piece of red chert
FTU5B	3	40-50	chert	1	1 piece of chert?
FTU5B	3	40-50	Lithic	2	2 small pieces of unusually shaped stone.
FTU5C	1	0-30	chert	1	worked chert flake
FTU5C	1	0-20	lime?	1	small lime fragment
FTU5C	2	20-30	groundstone	1	Oval shaped (possible) groundstone tool
FTU5C	3	30-40	groundstone	1	One broken groundstone fragment
FTU5C'	1	0-30	obsidian	3	1 partial obsidian projectile point; 2 obsidian waste flakes; 1 brown chert flake
FTU5D	3	30-40	chert?	1	1 flake of brown Franciscan chert?
FTU5D	3	30-40	lithic	2	2 pieces of lithic
FTU5D	4	40-50	obsidian	1	small obsidian flake
FTU5D	5	50-60	obsidian	2	small percussion flakes
FTU5D	5	50-60	sandstone	15	Sandstone, schist, quartz fragments, some possibly worked
FTU5E'	1	0-30	Chert	1	Chert core fragment(?)
FTU5G	1	0-20	chert	1	small chert core
FTU5G	2	20-30	chert	1	small chert flake
FTU5G	2	20-30	obsidian	1	1 small worked flake
FTU5G	3	30-50	chert	2	pieces of chert, possibly worked
FTU5I	1	0-30	sandstone	3	fire-altered rock fragments
FTU5K	1	0-30	chert	3	possible chert frags
FTU5K	1	0-30	sandstone	4	heavily oxidized sandstone, possibly fire-altered
FTU5K	1	0-30	sandstone	8	fire-altered sandstone fragments
FTU5K	2	30-50	chert	6	1 chert fragment, 5 unid rocks
FTU5K	2	30-50	sandstone	6	small oxidized sandstone fragments
FTU6	1	0-30	chert	1	small interior flake
FTU6	1	0-30	obsidian	2	small flakes, one interior, one shatter
FTU6	3	50-70	chert	6	chert shatter
FTU6	3	50-70	chert	1	possible chert core
FTU6	4	70-80	unident	2	small unidentified pieces of lithic, one cylindrical.
FTU7	2	30-50	chert	7	2 pieces of chert, 5 pieces of ground stone

Table 8: Provenience and description of lithic materials

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU7	4	60-70	chert	3	Pieces of modified chert -- waste flakes
FTU7C	1	0-30	chert	1	small chert flake
FTU9A	1	0-30	limestone	3	small pieces of limestone
FTU9A	1	0-30	obsidian	1	small waste flake
FTU9A	2	30-50	slate	1	flat, thick rock, possibly slate
FTU9A	2	30-50	slate	1	Pointed end and partial body of a slate pencil
FTU9A'	1	0-30	chert	1	possible percussion flake
FTU9A'	1	0-30	obsidian	1	small core fragment
FTU9A'	2	30-50	chalcedony	1	possible gun flint?
FTU9B	1	0-30	chert(?)	1	possible chert flake
FTU9B	1	0-30	slate	1	slate, balk side wall cleanup?
TU2	1	0-10	Chert	2	One black, one brown flake.
TU2	2	10-20	Obsidian	1	flake
TU2	5	40-50	Lithic	2	May be inscribed
TU2	6	50-60	chert	2	small chert frags, unworked.
TU2B	3	20-30	obsidian	1	small waste flake
TU2B	5	40-50	chert	1	Broken waste flake, evidence of working
TU2B	5	40-50	clay/lithic	1	small stone, coated with clay. appears to have been fired
TU2B	5	40-50	obsidian	1	small waste flake
TU2D	2	10-20	obsidian	1	small obsidian waste flake
TU2D	2	10-20	obsidian	1	small obsidian flake, possibly the tip of a point
TU2D	3	20-30	obsidian	1	small obsidian waste flake
TU2D	4	30-40	obsidian	4	2 obsidian waste flakes, 1 green chert, 1 brown chert
TU3	6	60	serpentine	1	triangular-shaped hammerstone. Recovered from N. wall @ 60cm BS, 50cm east of west wall.
TU3	8	70-80	chert	1	small chert fragment
TU3	8	70-80	groundstone	1	FCR-groundstone
TU3	8	70-80	groundstone	1	triangular shaped (in x-sect) groundstone burnishing tool.
TU3	8	70-80	lithic	1	chunk of burned sand
TU3	9	80-90	chert	2	small pieces of chert debitage
TU3	9	80-90	lithic	1	fire-altered fragment
TU4	4	40-50	obsidian	1	small obsidian flake
TU5	1	0-30	chert	2	2 pieces of chert
TU5	1	0-30	shale	1	1 piece of shale
TU6	1	0-30	chert	1	small, triangular-shaped percussion flake

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
Aug10	1	0-100	slag	2	slag fragments
Aug10	3	120-140	copper	1	copper sheathing nail
Aug11	1	0-100	iron	1	small nail body fragment
Aug12	4	140-160	copper	1	tiny curved piece of copper
Aug19	1	0-100	slag	4	slag pieces, 3.5cm and smaller
Aug2	1	0-10	slag	1	Glossy slag fragment
Aug2	2	20-30	slag	1	metal slag. Level 2 = 20-30 cm.
Aug2	4	45-55	slag	1	Slag fragment. Level 4 = 45-55 cm.
Aug2	5	40-50	metal	3	Slag fragments
Aug2	5	55-60	slag	2	Slag fragments. Level 5 = 55-60 cm
Aug2	8	75-78	slag	1	metal slag. Level 9 = 75 -78 cm.
Aug2	11	105-110	metal	2	Oxidized metal fragments
Aug2	13	120-125	metal	2	Concreted metal (slag?)
Aug5	15	0-150	iron	1	iron nail fragment
Beach1	1	0	copper	1	copper sheathing w/rectangular cutout and perforations from sheathing nails.
Drainage	0	0	iron	1	Heavily concreted iron spike. Recovered from drainage below road-in hole created by water falling from culvert
FTU1	1	0-30	iron	5	fragments of barrel hoops recovered from barrel hoop excavation
FTU1	1	0-10	iron	9	fragments of barrel hoops recovered from hoop feature
FTU1	2	10-20	iron	9	nail fragments and small, flat pieces of iron
FTU1	2	10-20	iron	5	fragments of iron hoops
FTU1	2	10-20	iron	7	fragments of barrel hoop
FTU1	2	10-20	iron	9	fragment from barrel hoops
FTU1	2	10-20	iron	6	barrel hoop fragments
FTU1	2	0-30	iron	1	iron -- possibly the head of an iron spike
FTU1	3	20-30	iron	12	small iron fragments: some nail bodies, one possible crown cap
FTU1	3	20-30	iron	29	fragments of barrel hoops recovered from sw corner of unit extension
FTU1	3	20-30	iron/copper	3	1 large iron spike, less head. Heavily exfoliating. 2 copper sheathing nails.
FTU1	4	30-40	copper	3	on copper sheathing fragment. 1 whole sheathing nail, one nail body.
FTU1	4	30-40	iron	11	one rusted wire fragment, 3 concreted iron nail bodies, 7 unidentifiable iron lumps.
FTU1	4	30-40	iron	1	nail body
FTU1	4	30-40	iron	2	small fragments of flat iron
FTU1	4	30-40	slag	1	chunk of slag
FTU1	5	40-50	copper	5	copper sheathing nails and nail fragments
FTU1	5	50-60	copper	6	2 sheathing nails; 1 sheathing nail body; 2 sheathing nail heads; one nail head embedded in wood fragment.
FTU1	5	40-50	copper	1	copper sheathing nail

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU1	5	40-50	iron	68	iron fragments: some flat, some fastener fragments, some flat iron pieces.
FTU1	5	50-60	iron	1	possible slag or clinker
FTU1	5	50-60	iron	1	nail fragment
FTU1	5	40-50	iron	9	iron spike and fragments of flat iron, all heavily oxidized.
FTU1	5	40-50	iron	2	small fragments of iron
FTU1	5	40-50	iron	1	small iron spike, heavily oxidized.
FTU1	6	50-60	iron	1	heavily oxidized flat iron fragment
FTU1	6	50-60	slag	1	slag fragment
FTU1	7	60-70	lead	1	lead shot ~9mm
FTU1	8	70-80	iron	1	small, blade-like fragment
FTU1	8	70-80	lead	1	small lead ball, probably shot (missing)
FTU1A	1	0-20	brass	2	1 small iron fragment, 1 shell casing (.22.caliber?)
FTU1A	1	0-30	copper	1	copper sheathing nail
FTU1A	1	0-30	slag	5	five pieces of slag, 1 small iron nail frag
FTU1A	2	30-40	iron	1	small iron nail fragment
FTU1A	3	40-50	iron	3	2 small nail fragments, 1 flat, semi-circular fragment
FTU1A	4	50-60	iron	1	concreted spike head
FTU1A	5	70-80	copper	2	one copper sheathing nail; 1 iron nail, heavily corroded
FTU1A	5	50-60	copper	3	1 copper sheathing nail head, 2 small pieces of iron
FTU1B	2	20-30	iron	1	small nail fragment
FTU1B	2	20-30	iron	13	possible metal fragments from lid of jar catalogued as FTU1B-6/21/97-2-G-1
FTU1B	3	30-40	iron	7	iron fragments - 6 pieces of flat iron, 1 possible nail frag
FTU1B	3	30-40	iron	3	small, needle-like iron frags
FTU1B	5	50-60	iron	1	ring shaped, possible bearing or pulley, conserved
FTU1B	6	60-70	copper	1	small copper sheathing nail
FTU1B	6	60-70	copper	1	Small copper sheathing nail
FTU1B	6	60-70	lead	1	small lead fragment
FTU1B'	1	0-30	copper	1	copper sheathing nail head. small strip of copper
FTU1B'	1	0-30	slag	21	slag fragments 5cm and smaller
FTU1D	1	0-20	iron	3	Flat metal band frag. Curved oxidized exfoliation;oxidized nut
FTU1D	2	20-30	copper	1	small copper nail head
FTU1D	2	20-30	iron	4	Iron Barrel hoop frags
FTU2	1	0-20	iron	3	2 nail frags; one fishing hook
FTU2	1	0-20	metal	1	long (3-4 cm), thin metal, maybe needle, or corroded nail
FTU2	2	20-30	iron	2	nail fragments
FTU2	3	30-40	copper	1	nail

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU2	3	30-40	iron	1	nail fragment
FTU2	5	50-60	copper	1	copper sheathing nail head
FTU2	5	50-60	iron	2	oxidized metal fragments, possibly one nail body
FTU2	6	50-60	iron	3	Corroded iron nail and 2 iron frags
FTU2	6	50-60	slag	1	Large piece of concreted slag
FTU2	7	70-80	metal	4	Copper sheathing nails: one complete, 2 heads, 1 frag
FTU2	7	70-80	metal	5	2 concreted nail frags, 3 chunks of concreted metal, possibly nail frags
FTU2	8	80-90	copper	7	Copper sheathing nails: 3 complete, 3 heads, 1 frag
FTU2	8	80-90	metal	9	metal fragments, heavily oxidized
FTU2	9	90-100	copper	1	long copper sheathing nail
FTU2	10	100-110	copper	1	copper sheathing nail
FTU2(+)	3	30	copper	6	2 whole, 1 body, 3 heads of copper sheathing nails
FTU2(+)	3	30	iron	1	heavily concreted iron nail frag
FTU2(+)	3	30	iron	1	concreted iron fragment
FTU2(+)	3	30	slag	1	small piece of slag
FTU2+		Slump	iron	3	Two iron spikes, 1 heavily oxidized spike head. Spikes conserved through electrolytic reduction. All three spikes recovered from slump of east side of test unit.
FTU3	0	0	copper	1	small copper strip
FTU3	0	0	lead	1	lead sprue fragment, recovered from slump area.
FTU3	3	20-30	iron	3	3 iron nail/spike fragments; one modern fish hook
FTU3	3	30-40	lead	1	thin strip of lead, 1/8 x 3/4'
FTU3	6	50-60	foil	1	small circular foil fragment
FTU3	6	50-60	iron	1	1 small iron fragment
FTU3	6	50-60	iron	20	small flat iron fragments
FTU3	6	50-60	iron	3	small iron fragments
FTU3	6	50-60	iron	10	large iron spike, one small iron spike, various spike fragments
FTU3	8	70-80	iron	1	small rectangular piece of iron with hole in center. Possible mold? Possible gun part?
FTU3	9	80-90	copper	1	sheathing nail
FTU3	9	80-90	iron	4	iron spike, 3 iron fragments
FTU3	9	80-90	iron	1	small rectangular piece of iron
FTU3	10	90-100	copper/iron	2	one copper nail head, one iron spike fragment
FTU3	11	110-120	iron	1	iron blade? - strip of iron, 3/4' x 6', triangular in cross-section.
FTU3	12	110-120	copper	2	one copper sheathing nail, one iron nail fragment
FTU3	13	120-130	copper	2	2 complete copper nails

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU3	14	130-140	copper	1	sheathing nail. 92 cm from n wall; 91 cm from west wall.
FTU3	14	130-140	iron	1	square copper nail head and partial shaft
FTU3	17	170-180	copper	1	sheathing nail head and partial body
FTU3(+)	3	30	copper	3	1 sheathing nail, 2 copper square nails
FTU3(+)	3	30	copper	1	thin, ribbon-like strip of copper
FTU3(+)	3	30	iron	2	nail fragments
FTU3(+)	3	30	iron	1	iron nail fragment
FTU3(+)	3	30	iron	5	1 washer, 2 spikes, 1 nail, 1, bent strip
FTU3(+)	3	0-30	iron/brass	5	2 iron nail frags; one bullet casing; 2 iron frags (emoved for conservation).
FTU3(+)	3	30	lead	1	U-shaped lead bracket(?)
FTU3(+)	3	0-30	slag	1	possible slag. May also be a piece of concrete aggregate or mortar. Recovered from slump.
FTU4	1	0-30	iron	1	iron nail fragment, recovered from cliff face beneath FTU4.
FTU4A	1	0-30	iron	6	Heavily oxidized iron nail fragments
FTU4A	1	0-30	iron	2	iron nail bodies, one with head
FTU4A	2	30-50	iron	9	4 nail frags, 4 flat fragments, 1 key handle(?)
FTU4A	2	30-50	iron	3	pieces of iron nail. Recovered from biodisturbance,
FTU4A	2	30-50	slag	10	slag pieces, two have copper inclusions*
FTU4A	2	30-50	slag	2	s slag pieces, porous: recovered from biodisturbance
FTU4A	3	50-60	iron	2	one nail frag, one possible piece of slag(?)
FTU4A	3	50-60	slag	11	small pieces of slag
FTU4A	4	60-70	iron	6	3 nail frags, three iron frags
FTU4A	4	70-80	slag	10	small to medium size slag fragments
FTU4A	4	60-70	slag	3	small pieces of slag
FTU4A	5	70-80	copper	1	small copper sheathing nail
FTU4A	5	70-80	iron	9	corroded iron fragments
FTU4A	5	70-80	iron	1	iron nail fragment
FTU4A	5	70-80	iron	1	possible iron spoke shave; possible bearing.
FTU4A	5	70-80	iron	1	iron spike from top of rock foundation.
FTU4A	5	70-80	iron	1	Round iron ball, approximately 2.75 cm in diameter
FTU4A	5	70-80	slag	12	slag fragments, ~3cm and smaller
FTU4A	5	70-80	slag	1	small slag frag
FTU4A	5	70-80	slag	1	1 piece of slag
FTU4A	5	70-80	slag	1	large slag fragment w/wood inclusion. Found on top of rock foundation
FTU4B	1	0-10	iron	1	square iron nail body fragment
FTU4B	1	0-10	slag	6	slag fragments (<1-in.)
FTU4B	2	10-20	iron	11	small fragments of iron nail bodies
FTU4B	3	20-30	copper	1	small, flattened cap? May be decorative-has embossed pattern of ridges

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU4B	3	20-30	iron	25	miscellaneous pieces of heavily oxidized iron, one fairly; thick and triangular in shape, appears to be tooth or point of a tool
FTU4B	3	20-30	iron	3	iron nail body fragments
FTU4B	3	20-30	iron	7	small nail body fragments
FTU4B	3	20-30	iron	1	nail body with partial head
FTU4B	3	20-30	iron	5	small iron fragments, nail bodies
FTU4B	3	20-30	slag	3	small (<1-in.) pieces of slag
FTU4B	4	30-40	slag	19	slag fragments, 2-in.and smaller
FTU4B	5	40-50	iron	2	small pieces (chunks) of flat iron, heavily oxidized
FTU4B	5	40-50	slag	8	small pieces of slag, <1/2-in.
FTU4B	7	60-70	iron	6	1 chunk of heavily oxidized iron, 5 nail body fragments
FTU4C	1	0-30	copper	2	one copper nail body fragment, one copper nail head.
FTU4C	1	0-30	copper	1	1 piece of copper sheet, triangular in shape. Appears to be small piece of cut scrap. 2.25-in. x 1.125-in.
FTU4C	1	0-30	iron	14	1 large iron spike, 1 triangular piece of flat iron, 3 iron nails
FTU4C	1	0-30	iron	23	Fragments of iron, including one nail fragment
FTU4C	1	0-30	lead	2	1 lead bullet(?); one unid. green metal (?) frag
FTU4C	1	0-30	lead	2	1 lead bale seal; 1 metal clasp (not lead)
FTU4C	1	0-30	slag	4	3 small pieces of slag, 1 medium-size
FTU4C	2	30-40	iron	61	iron fragments, 6 nail fragments, 1 angular, flat blade(?)
FTU4C	2	30-40	slag	10	8 slag fragments, one lead slag fragment, one small ball, composition unknown
FTU4C	3	40-50	slag	6	small to medium sized slag fragments; some iron fragments, including possible musket ball
FTU4C	4	50-60	slag	2	small slag fragments
FTU4C	5	60-70	iron	9	1 nail fragment, 8 pieces of flat iron -- possibly roofing material.
FTU4C	5	60-70	slag	15	slag pieces, some w/wood inclusions
FTU4C	6	70-80	copper	1	small, flat copper/brass(?) fragment
FTU4C	6	70-80	iron	174	small, flat iron fragments; possibly roofing material(?) Only one side is oxidized, thickness angles from 3.6mm to 3.5mm on one piece and 3.3 to 3.6mm on another, suggesting a type of shingle.
FTU4C	6	70-80	iron	21	1 iron nail frag; 20 small, flat iron fragments (roofing material?). Oxidized one side only. Thickness 3.2 to 3.4mm on measured samples.
FTU4C	6	70-80	slag	8	small slag fragments

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU4C	7	80-90	iron	75	Small, thin pieces of iron. Uniform thickness, much thinner than iron bands or fragments recovered elsewhere on site. Thickness of fragments (3.2-3.4mm) and oxidation on only one side suggests these are fragments of the iron roofing material recovered elsewhere in this unit.
FTU4C	8	90-100	iron	12	flat, iron flakes. Uniform thickness. Recovered from this level and above (in west sidewall)
FTU4C	8	90-100	iron	40	small iron fragments. Pieces of thin iron plate
FTU4C	8	90-100	iron	50	fragments of oxidized flat iron, all of uniform thickness. Does not appear to be hoop material, may be roofing?
FTU4C	8	90-100	iron	100	small fragments of oxidized flat iron
FTU4C	9	100-110	iron	15	small, thin pieces of iron.
FTU4D	1	0-10	copper	1	small copper nail head
FTU4D	1	0-10	iron	12	(4) nail frags, (2) concretion frags, (6) unid pieces
FTU4D	1	0-15	iron	8	Iron nail body frags. Recovered from 1st 15 cm of south balk.
FTU4D	1	0-15	lead	1	lead sprue -- recovered from south balk wall
FTU4D	1	0-30	lead & ?		small shot balls. Lead measures .348 diam (11/32). Other ball is of unidentified material -- looks ceramic.
FTU4D	1	0-10	slag	8	7 slag fragments
FTU4D	1	0-30	slag	1	1 piece of slag
FTU4D	1	0-15	slag	3	Small pieces of slag <1-in.
FTU4D	2	10-20	copper	2	1 small copper nail head & part. body; 1 small copper cap-possibly ammunition related
FTU4D	2	10-20	copper	1	square copper nail-1.5 inches long. (Not a sheathing nail)
FTU4D	2	10-20	iron	1	small iron nail body, Item #13 on site plan. 53 cm E of W, 15 cm S of N. 44 cm BD
FTU4D	2	10-20	iron	2	2 heavily concreted nail body frags. Item #14 on level record 69-74 E of W, 9 S of N. 48 cm BD
FTU4D	2	10-20	iron	25	22 corroded nail body frags. 3 flat iron pieces
FTU4D	2	10-20	iron	1	Flat Iron band fragment. Item #8 on level record; 63-67cm E of W , 2-7cm S of N, 30cm BD
FTU4D	2	10-20	iron	1	Fragment of flat iron frame with socket for pivot. May be stove part.
FTU4D	2	10-20	iron	4	iron nail body fragments
FTU4D	2	15-20	iron	2	iron nail frags. Recovered from south balk wall, 40cm below datum.

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU4D	2	10-20	iron	1	iron strap fragmen;1 in. x 2.5 in Item 9 on level record
FTU4D	2	10-20	iron	1	flat 'L'-shaped iron with cast pivot receptacle. Possible stove or firebox part. Item 6 in SRJC level record: 7-25cm E of W, 40-53cm S of N, 30cm BD. Put through electrolytic reduction for conservation.
FTU4D	2	10-20	slag	12	Small to medium sized slag fragments
FTU4D	2	15-20	slag	1	slag fragment ~4cm. Recovered from south balk
FTU4D	3	20-30	copper	1	copper sheathing nail
FTU4D	3	20-30	copper	1	1 small copper cap -ridged sides
FTU4D	3	20-30	copper	1	intact copper sheathing nail
FTU4D	3	20-30	copper	1	Flat strip of copper plate ~2' x 4' 25 cm E of W; 32 cm S of N. Item #5 on level record
FTU4D	3	20-30	copper	2	(1) copper tack head; (1) small, decorated copper band
FTU4D	3	0-30	iron	6	2 concreted iron nail body frags; 4 heavily rusted iron strips 1' x 2' and smaller.
FTU4D	3	20-30	iron	2	2 small iron nail frags, Found directly below Item #11, Level 2
FTU4D	3	20-30	iron	2	(Item #13) iron object- heavily concreted recovered from 10-18cm S of N, 60-65cm E of W, 48.5cm BD
FTU4D	3	20-30	iron	10	small fragments of iron nails recovered from south balk wall
FTU4D	3	20-30	iron	8	8 flat pieces of Iron. 3.4mm thick -- suggests this may be more of the roofing material found elsewhere in this unit.
FTU4D	3	20-30	iron	2	2 Iron nail frags
FTU4D	3	20-30	iron	5	heavily oxidized pieces of flat iron. 1.25-inches wide. Appear to be band or hoop fragments
FTU4D	3	20-30	iron	5	Flat iron fragment (#19 in level record), 3 small iron nails (#20 in level record), iron stake(?) is 21 in level record
FTU4D	3	20-30	iron	1	iron nail body frag. (item 14 on level record. 52 e of n; 3-8 s of n; 46-47 bd
FTU4D	3	20-30	iron	60	iron nail body fragments
FTU4D	3	20-30	iron	15	nail body frags
FTU4D	3	20-30	iron	~60	Small, heavily concreted iron nail fragments
FTU4D	3	20-30	iron	5	3 band fragments 1.25-inches wide x 1-inch long; 2 iron nail body fragments
FTU4D	3	20-30	lead	1	piece of lead sprue
FTU4D	3	20-30	lead	2	2 lead sprue frags
FTU4D	3	20-30	slag	9	various sized pieces of slag recovered from south balk wall
FTU4D	3	20-30	slag	1	slag frag approx 5 cm in length
FTU4D	3	20-30	slag	13	small slag fragments (<.75-in.)

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU4D	3	20-30	slag	4	Pieces of iron slag. Largest is 5.5cm
FTU4D	4	30-40	copper	1	small fragment of small copper tack
FTU4D	4	30-40	iron	1	Curved iron hook
FTU4D	4	30-40	iron	30	12 iron nail body fragments; 17 small pieces of flat iron. all heavily oxidized
FTU4D	4	30-40	iron	20	16 nail body fragments, 4 flat iron fragments
FTU4D	4	30-40	iron	24	small nail body frags - heavily oxidized
FTU4D	4	30-40	slag	10	small (<2cm) pieces of slag
FTU4D	4	30-40	slag	2	slag, 1 approx. 2cm
FTU4D	4	30-40	slag	1	large (<4-in.) piece of slag
FTU4D	4	30-40	slag	1	Large slag fragment (<10 cm).
FTU5A	1	0-30	copper	4	1 small copper sheet frag; 1 sheathing nail; 1 wire fragment; 1 rim fire cartridge
FTU5A	1	0-30	copper	1	approx 1.5' x 6.5' strip of copper.
FTU5A	1	0-30	iron	37	1 complete spike; 1 large spike head; 32 nail and spike body frags; 2 wire frags; 1 handmade washer
FTU5A	1	0-30	iron	7	small, flat iron fragments
FTU5A	1	0-30	iron	2	large spike and spike head, recovered from west wall 50x50, feature 2.
FTU5A	1	0-30	iron	3	nail fragments. Recovered from feature 2 west wall 50x50
FTU5A	1	0-30	iron	18	(4) med. iron spikes, numerous smaller spike and nail fragments. all heavily oxidized
FTU5A	1	0-30	iron	1	heavily oxidized iron nail
FTU5A	1	0-30	lead	1	lead shot
FTU5A	1	0-30	slag	63	medium-to-small size pieces of slag
FTU5A	1	0-30	slag	4	recovered from feature 2, west wall 50x50
FTU5A	1	0-30	slag	10	pieces of slag. Largest is flat and round ~6cm in diameter
FTU5A	2	30-50	copper	2	small pieces of copper sheeting
FTU5A	2	30-50	copper	1	nail head
FTU5A	2	30-50	iron	6	3 nail frags; 3 small pieces of iron sheet
FTU5A	2	30-50	iron	3	3 pieces of iron
FTU5A	2	30-50	iron	1	iron nail body frag
FTU5A	2	30-50	iron	2	Iron nail body fragments
FTU5A	2	30-50	slag	17	some wood inclusions
FTU5A	2	30-50	slag	17	small-medium sized slag pieces
FTU5A	2	30-50	slag	5	medium-sized iron slag fragments
FTU5A	2	30-50	slag	1	small triangular piece of slag, 8mm x 8mm
FTU5A	2	30-50	slag	4	small slag fragments Largest is 1.5cm. One is round (shot-like) with cobalt inclusion
FTU5A	2	30-50	slag	2	Small pieces of slag, possibly clinker. Largest is ~1.5cm
FTU5A	3	0-30	copper	1	copper nail body fragment
FTU5A	3	50-60	iron	1	large iron fragment, heavily corroded
FTU5A	3	50-60	slag	37	Small to medium sized pieces, largest are ~5cm long x 3cm wide

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU5A	4	60-70	slag	4	small slag fragments
FTU5A	4	60-70	slag	1	1 piece of slag
FTU5A	4	50-60	slag	1	<1-in. in size
FTU5A'	1	0-30	iron	7	heavily-oxidized iron nail body fragments
FTU5A'	1	0-30	slag	2	2 pieces of slag
FTU5A'	1	0-30	slag	3	slag pieces; largest is 5cm
FTU5A'	2	30-40	iron	10	10 pieces of iron
FTU5A'	2	30-40	slag	4	4 pieces of slag
FTU5A'	2	30-40	slag	4	Pieces of slag. Largest = 3cm
FTU5A'	4	50-60	slag	8	8 pieces of slag, some appear to be oxidizing
FTU5A'	4	50-60	slag	3	Pieces of slag - largest = 3.5cm
FTU5A (feature)	1	UK	slag	3	3 pieces of slag (from south edge of feature)
FTU5A (IN)	2		iron	6	6 iron spikes and fragments
FTU5B	1	0-30	iron	4	nail and spike body fragments
FTU5B	1	0-30	iron	12	various pieces of iron nail body, iron strap fragments, an iron spike...
FTU5B	1	0-30	lead	1	small lead fishing weight -- appears to be modern, probably intrusive
FTU5B	1	0-30	slag	7	small to medium-sized pieces of slag
FTU5B	1	0-30	slag	5	Slag fragments
FTU5B	1	0-30	slag	41	Slag fragments =<2-in. Some with bits of plaster (lime? calcined shell?)
FTU5B	1	0-30	slag	8	Slag -- vitreous. Largest is ~4.5cm
FTU5B	2	30-40	iron	6	nail and spike body frags
FTU5B	2	30-40	slag	13	medium-sized slag pieces with iron-oxide inclusions
FTU5B	3	40-50	iron	4	spike and nail fragments
FTU5B	3	40-50	iron	4	4 pieces of iron
FTU5B	3	40-50	iron	2	2 pieces of oxidized iron
FTU5B	3	40-50	slag	1	medium-sized piece of slag
FTU5B	3	40-50	slag	3	3 pieces of slag
FTU5C	1	0-20	iron	4	Iron spike head, body, cap and ass't pieces of oxidized metal
FTU5C	1	0-30	iron	17	One heavily oxidized nail and several oxidized nail bodies
FTU5C	1	0-30	iron	6	iron nail body and nail head fragments, heavily corroded.
FTU5C	1	0-20	iron	1	iron nail body fragment
FTU5C	1	0-20	slag	4	4 medium-sized pieces of slag
FTU5C	1	0-20	slag	2	small slag fragment
FTU5C	1	0-30	slag	2	Two slag pieces. Largest = 3cm
FTU5C	2	20-30	slag	6	Six slag pieces. Largest = 4cm
FTU5C	3	30-40	copper	3	Small fragments of thin copper sheeting
FTU5C	3	40-50	copper	2	Fragment of copper tube; small rectangular piece of copper - not pierced. (~2 x 2.5 cm)
FTU5C	3	30-40	iron	4	fragments of highly oxidized iron
FTU5C	3	30-40	iron	1	Heavily oxidized iron nail and head

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU5C	3	30-40	slag	29	Two types of slag: glassy, vitreous and pitted (volcanic-looking). Largest piece is ~3-inches.
FTU5C	3	30-40	slag	3	three small (<3cm) pieces of slag
FTU5C	4	40-50	slag	10	Slag fragments =<2.75-in. One piece with embedded wood, one piece with (possible) calcined abalone shell attached.
FTU5C	4	40-50	slag	2	Two slag pieces. Heavily encrusted with dirt. Largest is ~5cm
FTU5C'	1	0-30	copper	1	small copper nail.
FTU5C'	1	0-30	iron	37	iron spike fragments, iron nail bodies; 2 iron spike heads; one iron washer--all heavily oxidized.
FTU5C'	2	30-40	slag	7	7 pieces of slag
FTU5C"	1	0-30	slag	26	slag pieces. Largest is ~5.5cm
FTU5D	1	0-20	slag	1	Small piece of slag (1.5cm)
FTU5D	1	0-20	slag	8	slag pieces; largest is 5 cm
FTU5D	2	20-30	iron	3	oxidized iron fragments
FTU5D	2	20-30	iron	1	Small fragment of an iron nail
FTU5D	2	20-30	iron	1	metal washer--may be modern
FTU5D	2	20-30	slag	1	small slag fragment
FTU5D	2	20-30	slag	5	Slag pieces, largest piece is 5cm
FTU5D	3	30-40	copper	2	2 copper nails
FTU5D	3	30-40	iron	5	5 pieces of iron
FTU5D	3	30-40	metal	2	2 bottle caps, intrusive?
FTU5D	3	30-40	slag	33	33 pieces of slag
FTU5D	4	40-50	iron	11	iron nail frags, 1 iron spike head and partial body, heavily oxidized.
FTU5D	4	40-50	slag	10	slag pieces, 5 cm and smaller
FTU5D	5	50-60	iron	5	iron nail fragments
FTU5D	5	50-60	iron	1	heavily oxidized iron spike -6 inches long
FTU5D	5	50-60	slag	2	slag fragments
FTU5D	6	60-70	slag	1	Very small slag fragment (~1cm)
FTU5E	1	0-30	iron	1	large iron spike, bent
FTU5E	1	0-30	iron	1	Large iron spike, bent at 90-degrees. Conserved through electrolytic reduction
FTU5E'	1	0-30	brass(?)	1	brass(?) grommet
FTU5E'	1	0-30	iron	24	iron nail and small spike body fragments. heavily oxidized.
FTU5E'	1	0-30	slag	13	Pieces of slag. Largest = ~6cm
FTU5E'	2	30-50	iron	18	nail fragments and misc. iron pieces
FTU5E'	2	30-50	lead	2	small lead fragments
FTU5E'	2	30-50	slag	24	small-to-medium sized slag
FTU5E'	2	30-50	slag	3	three pieces of slag, ~`1-inch.
FTU5G	1	0-20	iron	4	iron nail fragments
FTU5G	1	0-20	iron	2	small iron cut nail; large iron spike body and head
FTU5G	1	0-20	slag	3	small to medium pieces of slag

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU5G	2	20-30	copper	1	copper sheathing nail
FTU5G	2	20-30	iron	18	iron nail and spike fragments
FTU5G	2	20-30	slag	20	approx 20 pieces of slag, mostly small pieces.
FTU5G	2	20-30	slag	1	medium-sized piece of slag
FTU5G	2	20-30	slag	8	small-to-medium size slag pieces
FTU5G	3	30-40	copper	1	copper sheathing nail
FTU5G	3	30-40	iron	8	flat & round iron fragments, possible nail fragments
FTU5G	3	30-50	iron	4	iron nail fragments
FTU5G	3	30-40	slag	21	(2) large, (3) medium and 16 small fragments of porous slag.
FTU5G	3	30-50	slag	34	small pieces of slag
FTU5G'	2	10-20	iron	6	small nail body frags; one possible latch or lock receiver
FTU5G'	2	10-20	slag	2	medium-sized pieces of slag
FTU5G'	2	10-20	slag	1	Small piece of slag (2cm)
FTU5G'	3	20-30	iron	1	Thick (1/2") chunk of flat iron
FTU5I	1	0-30	copper	2	copper sheathing nail, nail head
FTU5I	1	0-30	iron	3	small nail body fragments
FTU5I	1	0-30	iron	1	horseshoe; recovered 3 cm below surface
FTU5I	1	0-30	iron	10	small nail frags, 1 hinge portion(?), 1 bolt fragment, 1 iron staple
FTU5I	1	0-30	iron	1	flat iron fragment, ~1 x 3.5 cm. Recovered from beneath wood plank fragment at 24cm
FTU5I	1	0-30	iron	1	heavily oxidized iron spike
FTU5I	1	0-30	slag	40	various sized pieces of slag
FTU5I	1	0-30	slag	2	slag pieces- largest is 8.5cm
FTU5I	2	30-50	copper	1	copper sheathing nail
FTU5I	2	30-50	slag	22	various sized pieces of slag
FTU5K	1	0-30	copper	2	copper sheathing nail frag, sheathing nail head
FTU5K	1	0-30	copper	6	small copper fragments
FTU5K	1	0-30	iron	28	spike and nail fragments, heavily oxidized.
FTU5K	1	0-30	slag	29	medium pieces of slag
FTU5K	2	30-50	copper	10	2 sheathing nails, 8 sheathing nail heads
FTU5K	2	30-50	iron	7	oxidized iron nails, one through mortar
FTU5K	2	30-50	iron	5	pieces of oxidized metal fragments
FTU5K	2	30-50	slag	6	pieces of slag
FTU6	1	0-30	copper	1	small fragment
FTU6	1	0-30	iron	16	iron nail and spike fragments
FTU6	1	0-30	iron	4	1 spike head, 1 flat blade, 1 oxide concretion, 1 nail body.
FTU6	1	0-30	lead	1	lead tube
FTU6	1	0-30	slag	1	Large piece of slag
FTU6	1	0-30	slag	20	slag of assorted sizes
FTU6	1	0-30	slag	1	large piece of slag
FTU6	1	0-30	slag	2	2 large pieces of slag
FTU6	2	30-50	iron	1	heavily oxidized iron spike

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU6	2	30-60	slag	9	medium-size slag; 2 possible nail frags
FTU6	3	50-70	iron	3	nail fragments
FTU6	3	50-60	iron	1	iron nail
FTU6	3	50-70	slag	3	small slag fragments
FTU6	3	50-70	slag	3	medium-size slag fragments
FTU7	1	0-30	iron	1	iron nil body fragment
FTU7	1	0-30	iron	25	25 assorted, oxidized pieces of iron including 2 nails
FTU7	1	0-30	iron	1	1 large fragment of iron (a pipe?)
FTU7	1	0-30	slag	3	slag fragments - some with wood inclusions.
FTU7	1	0-30	slag	8	small-to-medium size pieces of slag
FTU7	1	0-30	slag	8	8 pieces of iron slag
FTU7	1	30-Jun	slag (iron)	2	2 pieces of iron slag
FTU7	2	30-50	iron	2	iron fragments
FTU7	2	30-50	iron	1	1 frag of iron, possibly a spike
FTU7	2	30-50	iron slag	4	4 pieces of iron slag
FTU7	2	30-50	metal	1	1 piece of copper nail?
FTU7	2	30-50	metal (iron)	2	2 small highly oxidized pieces of iron, 2 large iron 1 small nail frag.
FTU7	2	0-30	slag	2	small (2cm) pieces of slag
FTU7	2	30-50	slag	1	1 small piece of slag (iron)
FTU7	2	30-50	slag	1	Large piece of slag approximately 7cm in length
FTU7	3	50-70	copper	1	1 copper nail
FTU7	3	50-70	slag	1	1 large piece of slag
FTU7A	1	0-30	slag	2	small pieces of slag. Largest is 1cm
FTU7A	2	30-50	iron	26	Assorted flat iron fragments
FTU7A	2	30-50	iron	4	slag pieces - largest = 8cm
FTU7A	4	60-70	iron	2	nail fragments
FTU7A	4	60-70	iron	49	flat iron fragments -- possibly roofing tiles/shingles
FTU7A	4	40-50	slag	3	slag pieces. Largest ~5cm in length
FTU7A	4	60-70	slag	3	Pieces of slag -- largest=4cm
FTU7A'	1	30-40	slag	1	1 piece of slag
FTU7C	1	0-30	copper	2	Copper sheathing nails
FTU7C	1	0-30	iron	6	iron nail fragments
FTU7C	1	0-30	slag	3	slag pieces, largest = 4.5cm
FTU7C	2	30-40	iron	1	1 iron piece (nail?)
FTU7C	2	30-40	slag	3	3 pieces of slag
FTU9A	1	0-30	iron	17	Pieces of oxidized iron, including nail bodies and the head and upper body of a square spike
FTU9A	1	0-30	slag	19	small pieces of slag, largest =3cm
FTU9A	1	0-30	slag	32	Pieces of slag, the largest is ~3cm
FTU9A	2	30-50	iron	2	Small pieces of iron nail
FTU9A	2	30-50	iron	12	Pieces of heavily oxidized iron, including 3 nails and a 1"x3" piece of flat iron?
FTU9A	2	30-50	iron	3	Small iron nail body fragments
FTU9A	2	30-50	slag	1	round slag droplet with cylindrical tail

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
FTU9A	2	30-50	slag	9	medium pieces of slag
FTU9A	2	30-50	slag	3	Pieces of slag. Largest is ~4cm
FTU9A	2	30-50	slag	30	Pieces of slag, largest is ~4cm
FTU9A	3	50-60	iron	1	iron nail fragment
FTU9A	3	50-60	slag	13	slag
FTU9A	3	50-60	slag	8	medium to small size slag
FTU9A'	1	0-30	copper	1	copper sheathing nail
FTU9A'	1	0-30	copper/brass	1	center-fire cartridge fragment.
FTU9A'	1	0-30	iron	12	iron nail fragments
FTU9A'	1	0-30	iron	5	oxidized iron fragments
FTU9A'	1	0-30	slag	25	slag fragments, various size
FTU9A'	1	0-30	slag	19	small to medium-size slag fragments
FTU9A'	1	0-30	slag	2	small slag fragments
FTU9A'	2	30-50	iron	1	oxidized iron fragment, concreted onto small rock
FTU9A'	2	30-40	iron	4	small iron frags, possible nail fragment. all heavily oxidized
FTU9A'	2	30-40	iron	1	small iron nail body fragment
FTU9A'	2	30-40	slag	58	medium to small size slag fragments
FTU9A'	3	40-50	slag	6	Slag pieces, the largest is 4cm
FTU9B	1	0-30	copper	1	copper sheathing nail
FTU9B	1	0-30	iron	25	oxidized iron nail pieces and small iron fragments. recovered from balk wall cleanup
FTU9B	1	0-30	metal	1	center-fire bullet casing. '.44 W C F WRA Co' embossed on head. Indicates Winchester Repeating Arms Co. Winchester Center fire (1908-on) per Berge:1980:Simpson Springs Station
FTU9B	1	0-30	slag	2	slag, balk side wall clean up
FTU9B	1	0-30	slag	26	small pieces of slag
FTU9B	1	0-30	slag	26	small pieces of slag <1.5 in.
FTU9B	2	0-30	iron	13	oxidized nail body fragments
FTU9B	2	30-40	iron	4	fragments of oxidized iron
FTU9B	2	30-40	iron	1	Iron spike, ~6-inches long
FTU9B	2	30-40	iron	4	Slag pieces, the largest is ~3cm
FTU9B	2	30-40	slag	3	small (.75 cm) slag fragments
FTU9B	3	0-30	copper	1	nail body fragment
FTUB'	1	0-30	iron	29	large iron spike, iron nail, and numerous small pieces of heavily oxidized iron
TU2	0	0-60	iron	1	Iron fragment. Recovered from wall-straightening.
TU2	0	Sur	slag	1	Slag
TU2	0	0-60	slag	6	Slag fragments
TU2	1	0-10	iron	4	Iron nail fragments
TU2	1	0-10	slag	15	Misc. pieces in various states
TU2	1	0-10	slag	3	Slag fragments: .5' to 1.5' in diameter
TU2	2	10-20	iron	2	Nail frag, metal lump

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
TU2	2	10-20	slag	4	pieces of slag 4cm and smaller
TU2	2	10-20	slag	32	Slag fragments
TU2	3	20-30	iron	8	2 crown cap fragments, 1 strip, 5 lumps.
TU2	3	20-30	slag	52	small slag fragments. 1 large fragment mapped as artifact #2 @ 1.47 cm
TU2	4	30-40	slag	1	Small, vitrified slag with wood and iron oxide inclusions
TU2	4	30-40	slag	15	Slag fragments
TU2	4	30-40	slag	3	2 slag fragments, 1 iron or slag fragment
TU2	4	30-40	slag	3	2 small, i medium lumps with iron oxide/wood inclusions
TU2	4	30-40	slag	1	small slag fragment
TU2	5	40-50	iron	2	Iron fragments. Possible bent nail
TU2	5	40-50	slag	11	Slag fragments
TU2	6	50-60	copper	1	Small, rectangular, piece of copper sheathing?
TU2	6	50-60	iron	1	small iron bar fragment. 74 cm S; 57 cm E; elev 78.5.
TU2	6	50-60	slag	8	slag
TU2	7	60-70	slag	1	Slag fragment
TU2	7	60-70	slag	6	slag fragments. 5 small, 1 medium.
TU2	8	70-80	slag	1	Slag fragment. Found on wood from center of unit that had been pedestalled.
TU2A	3	20-30	iron	1	horseshoe
TU2B	1	0-10	slag	10	small pieces of slag, 4 cm and smaller
TU2B	2	10-20	iron	1	iron fragment
TU2B	2	10-20	lead	1	small bird shot
TU2B	2	10-20	slag	10	slag pieces; 7 cm; 5 cm. and smaller
TU2B	3	20-30	copper	1	small copper strip (.5 cm x 2 cm)
TU2B	3	20-30	lead	1	small, bent piece of lead
TU2B	3	20-30	slag	10	pieces of slag, 4 cm. and smaller
TU2B	4	30-40	iron	1	long, complete iron nail, conserved
TU2B	4	30-40	steel	1	small round 'pin' (~.4cm x 1.8)
TU2B	5	40-50	slag	4	4 slag pieces; 5 cm and smaller
TU2B	5	40-50	slag	1	piece of slag 6 cm in size
TU2B	6	50-60	iron	3	heavily oxidized iron nail heads
TU2B	6	50-60	slag	10	slag pieces, 4 cm. and smaller
TU2B	7	60-70	iron	1	1 large iron triangle, conserved
TU2B	7	60-70	iron	5	Iron spikes, approximately 6-inches long. Intact but oxidized.
TU2B	7	60-70	slag	3	small pieces of slag
TU2B`	4	30-40	slag	8	slag pieces, largest is 7cm, next is 2 cm.
TU2C	1	0-10	iron	2	two small iron nail fragments
TU2C	1	0-10	slag	10	medium to small pieces of slag
TU2C	3	20-30	slag	3	small pieces of slag
TU2C	4	30-40	iron	3	heavily oxidized iron spike head and fragmenSSZt
TU2C	4	30-40	slag	6	pieces of slag, 2cm and smaller
TU2C	4	30-40	slag	1	small (1cm) piece of slag

Table 9: Provenience and description of metal artifacts

Unit	*Level*	*Depth*	*Material*	*Qty*	*Description*
TU2C	4	30-40	slag	1	small slag fragment
TU2C	5	40-50	slag	1	small piece of slag 2 cm.
TU2C	5	40-50	slag	5	5 pieces of slag
TU2C	6	50-60	slag	2	2 pieces of slag
TU2D	2	10-20	slag	6	small pieces of slag; 1.5cm and smaller
TU2D	2	10-20	slag	14	slag pieces; 3 cm and smaller
TU2D	4	30-40	copper	1	small copper strip (.8 x3 cm)
TU2D	4	30-40	slag	6	Slag pieces, 5cm and smaller
TU2D	4	30-40	slag	14	small pieces of slag; 3cm and smaller
TU2D	4	30-40	slag	15	slag pieces; 5 cm. and smaller
TU2D	5	40-50	slag	3	small pieces of slag (2cm.)
TU2D	6	50-60	iron	1	nail body
TU2D	6	50-60	slag	10	small pieces of slag (2.5mm and smaller)
TU3	7	60-70	iron	23	iron fragments, mostly flat iron
TU3	7	60-70	slag	1	small slag fragment
TU3	9	80-90	copper	1	nail head
TU4	1	0-20	slag	1	slag fragment ~5cm
TU4	2	20-30	iron	3	2 flat iron fragments, one iron nail body (round)
TU4	2	20-30	iron	8	heavily oxidized iron nail bodies
TU4	2	20-30	iron	4	2 pieces of flat iron, 2 iron nail body fragments, the largest conserved through electrolytic reduction .
TU4	2	20-30	slag	16	slag fragments =<4cm.
TU4	3	30-40	metal	1	rusted metal, piece resembling a hook, conserved
TU4	3	30-40	slag	12	small slag fragments =<4cm
TU4	4	40-50	slag	3	small pieces of slag, =<4cm
TU5	1	0-30	copper	1	1 copper nail
TU5	1	0-30	iron	33	33 pieces of iron, including 1 nail
TU5	1	0-30	slag	60	about 60 pieces of slag
TU5	2	30-40	slag	7	small to medium-sized pieces of slag
TU5A	1	0-30	slag	8	Slag pieces, largest is ~8cm
TU6	1	0-30	copper	3	copper sheathing nails
TU6	1	0-30	iron	1	Strip of iron strap, about 3" long
TU6	1	0-30	iron	1	Small iron spike, approximately 2 1/2" long
TU6	1	0-30	slag	50	Approximate count 50 pieces of slag, largest ~4cm
TU6	1	0-30	slag	30	Approximate count 30 pieces of slag, largest ~6cm
TU6	2	30-40	slag	7	Medium-sized to large pieces of slag. Largest is 6cm
TU6	2	30-40	slag	18	Slag pieces, largest ~5cm
TU6	2	30-40	slag	2	Pieces of slag, largest ~9cm
TU6	2	30-40	slag	2	Pieces of slag, largest ~12cm
TU6	3	40-50	slag	2	small pieces of slag, largest is ~1 1/2cm
TU6	3	40-50	slag	2	Slag pieces, largest is ~2cm

Appendix B

Artifact Catalog

Provenience for recovered artifacts was determined by unit level, and the data was recorded on each artifact bag in the field. This included the unit designation, the date of recovery, the level from which the artifact was recovered, and the name of the person who recovered it. The provenience designation, in turn, became the basis for the number assigned to each artifact as it was entered into the project's database.

When the artifact bags were processed in the project's lab, volunteers and students sorted each bag's contents, separating the different artifacts by artifact categories, and assigning each artifact, or group of similar artifacts, a unique catalog number. The artifact categories used in the sorting were: bead (Be), button (Bu), brick (Br), charcoal (Ch), clay (Cl), faunal (F), floral (Fl), glass (G), historic ceramic (HC), lithic (L), leather (Le), metal (Me), mollusk (Mo), unknown (Un), and wood (W).

The catalog number for each artifact (or group of similar artifacts) was derived by using the unit number, the date of recovery, the level from which the artifact was recovered, the artifact category, and a trailing control number used to separate similar artifacts recovered on the same day from the same unit and level. A typical catalog number, for example, might read "FTU1-6/29/97-3-Me-1," which would indicate the first bag of metal artifacts recovered from level 3 of FTU1 on June 29, 1997. If the quantity of metal artifacts comprising this number required more than one archive bag, or if other metal artifacts were recovered from the same unit and level on June 29th, the trailing control number would change incrementally so that each bag would have a unique number (i.e.) FTU1-6/29/3-Me-1; FTU1-6/29/93-Me-2, etc.

An index card was prepared and inserted into each archive bag. Shown on the card are the catalog number, the name of the excavator, the date of recovery, the unit number, the excavation level (recorded by level number as well as depth below surface), the artifact category, the material from which the artifact(s) was made, the quantity, and a description of the bag's contents. These data were subsequently entered into a Filemaker Pro (v 5.0) database, a copy of which follows.

Appendix C

Table of Distances and Bearings from Datum 0/0 to All Units

Table 10: Distances and Bearings from Datum 0/0 to all Units			
Unit	*Corner*	*Bearing (true)*	*Distance (meters)*
TU2A	NW	350	10
TU2A	NE	355	10.5
TU2A	SE	357.5	9.5
TU2A	SW	352	9
TU3	NE	321	8.5
TU3	SW	317.75	6.5
TU3	SE	323.25	6.5
TU4	NE	339	11
TU4	NW	336	11
TU4	SE	323.25	6.5
TU4	SW	335.5	9
FTU1	N	42.25	3.9
FTU1	S	73.5	2.15
FTU2	N	33	8
FTU2	S	41	7
FTU3	N	40	12
FTU3	S	42	9.75
FTU5A	NW	47	30
FTU5B	SE	49	27.5
FTU6	N	49.5	31.5
FTU6	E	51	32
FTU6	S	52	31
FTU6	W	50	30.5
FTU7A	N	57.5	34
FTU7A	S	58.5	33
FTU9	NW	40.5	30
FTU9	SE	42.5	28.5
FTU9	NE	42.5	30
FTU9	SW	42	28.5
Aug2		355.5	10
Aug7		339	4
Aug8		21	6.5

Table 10: Distances and Bearings from Datum 0/0 to all Units			
Aug9		3.5	7.5
Aug11		24	10.5
Aug12		14.5	12
Aug13		24	15.5
Aug14		51.25	36
From Datum $0^4/0^4$ (Datum $0^4/0^4$ is 38.5 degrees/20m from 0/0)			
FTU4	NW	71	2.63
FTU4	SE	173	2.81
From Datum $0^3/0^3$ (Datum $0^3/0^3$ is 344 degrees/11.75m from 0/0)			
TU5	NE	60	23.5
TU5	SW	62	22
TU6	NE	62	25
TU6	SE	64	24.5
TU6	SW	63	24
TU6	NW	61	24.5
Aug15		54	28.5
Aug16		51	38.5
Aug17		49	48
Aug18		50	47.5
Aug19		34	38.5