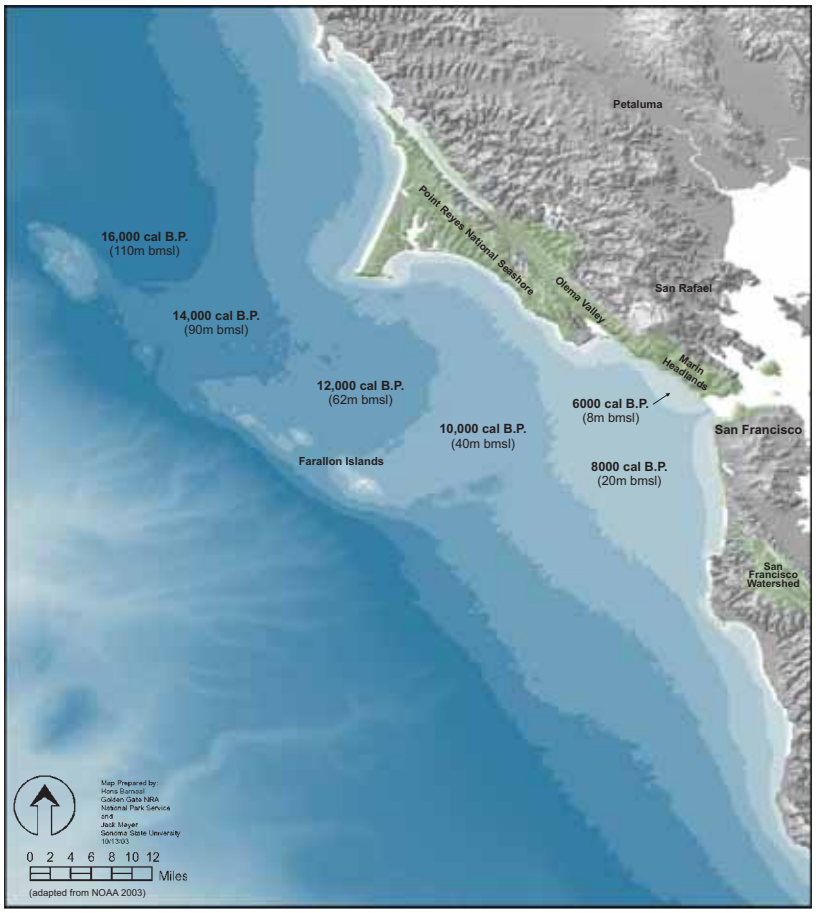
ARCHAEOLOGICAL RESEARCH ISSUES FOR THE POINT REYES NATIONAL SEASHORE – GOLDEN GATE NATIONAL RECREATION AREA



Prepared for the National Park Service Golden Gate National Recreation Area

ANTHROPOLOGICAL STUDIES CENTER
SONOMA STATE UNIVERSITY
ROHNERT PARK, CALIFORNIA 94928

cover: Timing and Extent of Sea-level Rise in the San Francisco Bay Area

ARCHAEOLOGICAL RESEARCH ISSUES FOR THE POINT REYES NATIONAL SEASHORE – GOLDEN GATE NATIONAL RECREATION AREA

for

Geoarchaeology
Indigenous Archaeology
Historical Archaeology
Maritime Archaeology

edited by

Suzanne Stewart and Adrian Praetzellis
Anthropological Studies Center
Sonoma State University
Rohnert Park, California

prepared for

National Park Service
Golden Gate National Recreation Area
San Francisco, California

November 2003

ARCHAEOLOGICAL RESEARCH ISSUES FOR THE POINT REYES NATIONAL SEASHORE – GOLDEN GATE NATIONAL RECREATION AREA

An Overview of Geoarchaeological Research Issues

by Jack Meyer

An Overview of Research Issues for Indigenous Archaeology

by Suzanne B. Stewart

An Overview of Research Issues for Historical Archaeology

by Annita Waghorn

An Overview of Research Issues for Maritime Resources

by Robert G. Douglass

Anthropological Studies Center
Sonoma State University
Rohnert Park, California

prepared for

Leo Barker, Park Archaeologist
Division of Cultural Resources and Museum Management
Golden Gate National Recreation Area
National Park Service
San Francisco, California

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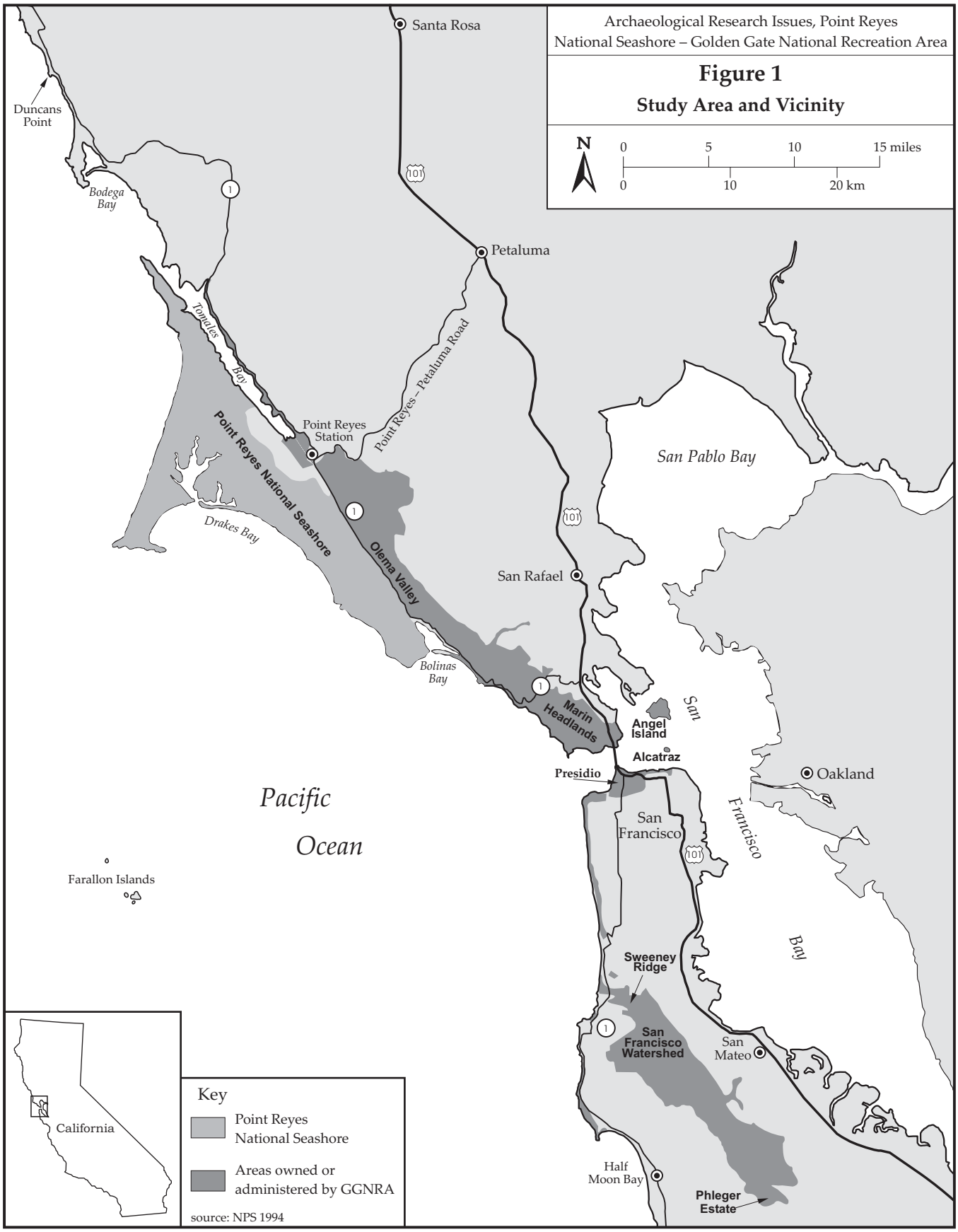

Archaeological Research Issues, Point Reyes National Seashore – Golden Gate National Recreation Area
Figure 1
Study Area and Vicinity
N
0 5 10 15 miles
0 10 20 km
Santa Rosa
Duncans Point
Bodega Bay
Petaluma
Tomales Bay
Point Reyes – Petaluma Road
Point Reyes Station
Point Reyes National Seashore
Drakes Bay
Olema Valley
San Rafael
San Pablo Bay
Bolinas Bay
Marin Headlands
Angel Island
Alcatraz
Presidio
Oakland
San Francisco
Pacific Ocean
Farallon Islands
Sweeney Ridge
San Francisco Watershed
San Mateo
Half Moon Bay
Phleger Estate
California
Key
Point Reyes National Seashore
Areas owned or administered by GGNRA
source: NPS 1994

FOREWORD

As a part of the Archaeological Overview and Assessment for the Point Reyes National Seashore and the Golden Gate National Recreation Area, under a cooperative agreement between Sonoma State University and the National Park Service, the Anthropological Studies Center (ASC) has produced several overviews of research issues—or general archaeological research designs—to aid in management of archaeological resources in the PRNS–GGNRA parklands. The geographic scope of the study area is relatively vast, extending over 108 miles of coastline—from northern Marin County in the north into northern San Mateo County in the south (Figure 1). These overviews are necessarily general, as they are intended for use with all known and anticipated archaeological resources in the PRNS and GGNRA, an area of approximately 182,496 acres, of which only 6,000 acres have been intensively surveyed. The presentation of research issues in these overviews will assist managers and archaeologists in developing specific research designs for individual properties or specific land units as the need arises. While these overviews are presented here as a single, edited volume, each is designed to be printed out separately as a standalone document if desired. Each overview is listed below, along with a general statement of the topic and the name and credentials of the author.

The first, *An Overview of Research Issues for Geoarchaeology in the PRNS-GGNRA*, is by ASC Staff Geoarchaeologist Jack Meyer (M.A. in Cultural Resources Management [CRM], Registered Professional Archaeologist [RPA]). It takes a geoarchaeological landscape approach that incorporates human ecology, landscape evolution, and soil formation. With a focus on landforms available to human beings in the past, including buried features, it offers a new perspective on the current archaeological database. Geoarchaeological research issues that can be addressed by parkland resources are provided, along with their data requirements.

An Overview of Research Issues for Indigenous Archaeology in the PRNS–GGNRA is by Suzanne B. Stewart, a Staff Archaeologist at the ASC (M.A. in CRM, RPA). The overview discusses the evolution of research designs for prehistoric archaeology in California, and reviews local research designs and their uses. It then describes and evaluates past indigenous (prehistoric and historic Native American) archaeological research on various topics—such as chronology, settlement, social organization, and culture change—offering a discussion of research issues and data requirements for each topic. The last section brings together the research issues and data requirements for all topics to aid in developing specific research designs. (The study for indigenous archaeology had a more ambitious scope of work than the other overviews, which were conducted under modifications to the original project statement—hence its greater size.)

An Overview of Research Issues for Historical Archaeology in the PRNS–GGNRA is by ASC Staff Archaeologist Annita Waghorn (M.A. in CRM, RPA). It describes the legal context for archaeological research and enumerates the property types that are known or anticipated in the study area. Research issues and data requirements are provided for selected research themes that pertain to Spanish-colonial/Mexican-period and American-period urban and rural archaeological resources. A review of property types and research efforts related to the dairy industry (a dominant theme in the late-19th and early- to mid-

20th century on the Point Reyes peninsula) is provided in an appendix prepared by Christina MacDonald, CRM graduate student and archaeological specialist at the ASC.

An Overview of Research Issues for Maritime Resources in the PRNS–GGNRA is by Robert G. Douglass (M.A. in CRM, RPA). This overview looks at the history of the study area as it relates to human interaction with the sea, and reviews the major archaeological studies that have been conducted over the years to increase our knowledge and understanding of these local maritime activities. In order to establish a context for research, it examines current general directions in maritime archaeology and presents some relevant examples of recent activities within the discipline. The overview also suggests an organizational framework for parkland maritime resources, consisting of a range of physical property types and historical contexts that can be combined to describe most maritime properties likely to be encountered in the GGNRA and PRNS. Finally, it proposes some research questions and areas for potential study, and makes specific recommendations for future treatment of the maritime properties of the parklands.

Maria Ribeiro, ASC specialist, provided editorial assistance and graphics and production expertise in organizing and producing this volume. Her skill and diligence are greatly appreciated.

Leo Barker, Park Archaeologist, Division of Cultural Resources and Museum Management, Golden Gate National Recreation Area, provided direction from the National Park Service.

Suzanne B. Stewart
ASC Staff Archaeologist

Adrian Praetzellis
ASC Director

PART II

AN OVERVIEW OF RESEARCH ISSUES FOR INDIGENOUS ARCHAEOLOGY FOR THE PRNS – GGNRA

by

Suzanne Stewart, M.A., RPA

Chapter 1 – An Introduction to Research Issues for Indigenous Archaeology

INDIGENOUS ARCHAEOLOGY RESEARCH OBJECTIVES

This document provides a review of research issues relevant to indigenous (prehistoric and Native American historic-era) archaeology in the Point Reyes National Seashore, the Golden Gate National Recreation Area, and associated areas, serving as a general research design for the study area. A *research design* is defined by the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation as follows:

> A statement of proposed identification, documentation, investigation, or other treatment of a historic property that identifies the project's goals, methods, and techniques, expected results, and the relationship of the expected results to other proposed activities or treatments [NPS 1983].

Research designs can be specific and prescriptive, outlining steps to be followed for a given inquiry at a specific resource. They can also perform a much more general role: providing guidance for assessing and managing a suite of archaeological resources, including those yet to be discovered, within a particular management or geographic framework. This broader approach—which amasses information that will be useful in developing specific research plans when they are needed—is the one taken by this document.

This research design has incorporated the guidance of the National Park Service's (2003) Revised Thematic Framework (developed under Public Law 101-628, Section 1209) and of Director's Order #28 (DO-28), the Cultural Resource Management Guideline (NPS 1998). Together with other elements of the Archaeological Overview and Assessment (AOA) prepared by and for NPS (including the accompanying *Overview of Geoarchaeological Research Issues* by Jack Meyer, *Overview of Research Issues for Historical Archaeology* by Annita Waghorn, and the *Maritime Resources General Research Design* by Robert Douglass), the research design for indigenous archaeology can be used to enhance the review of day-to-day operations, the design of specific projects, long-range planning, and interpretive and cooperative efforts in the study area.

While this research design will be of use to nonarchaeologists in the parks management program, it is also intended for use by archaeologists—those under contract with NPS to conduct identification, evaluation, and data-recovery investigations on parklands, and those working on research efforts for academic or independent scholarly purposes. Others with an interest in the prehistory and Indian lifeways of the historic period in the PRNS–GGNRA—such as members of the local Native American community or other individuals engaged in heritage preservation—may also find this research design useful. Because of the multiple audiences for this document, an attempt has been made to define unusual archaeological terms and concepts for both management and the public.

A few large-scale indigenous archaeological research designs have been developed and implemented over the past two decades in areas of California well outside the current study area. These have been useful as models for both content and design, offering examples of differing scales of approach and differing ways of stratifying the huge body of overlapping and interacting research topics and theoretical approaches. Three that have been particularly useful are Michael Moratto's *An Archaeological Research Design for Yosemite National Park, California*, produced by the National Park Service in 1981; the much more ambitious and up-dated *Archaeological Synthesis and Research Design, Yosemite National Park, California,* edited by Kathleen Hull and Michael Moratto (1999); and *Framework for Archaeological Research and Management, National Forests of the North-Central Sierra Nevada,* a recent, multi-volume work for the USDA Forest Service by BioSystems Analysis, Inc. (Jackson 1994). Outside California, a recent overview for Mt. Rainier National Park (Burtchard 1998) is another excellent NPS effort.

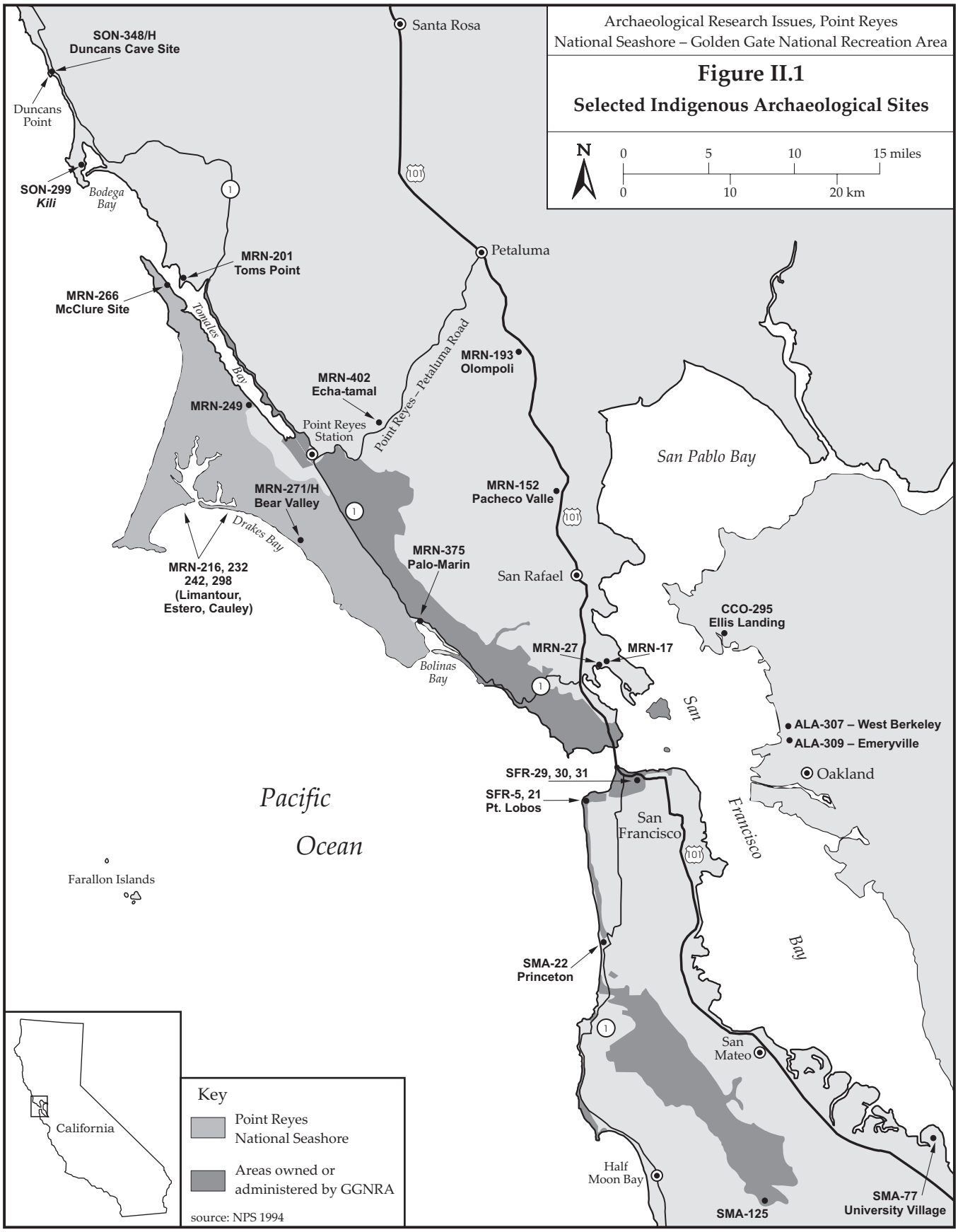
Unlike the more comprehensive approaches undertaken by the studies mentioned above, the current effort is intended to focus on pertinent research issues only. The AOA being developed by GGNRA archaeologists includes a broad-scale overview of archaeological survey coverage and prehistoric and historic archaeological site distribution and density, along with a variety of analytical studies articulated by a Geographic Information System. The NPS Cultural Resource Management Guideline, DO-28, lists the elements of an AOA; three of these comprise the topics of the current document:

- describes and evaluates past research in the area or region;
- outlines relevant research topics; and
- provides recommendations for future research [NPS 1998:Chapter 6].

While a general discussion of past research is one of the foci of this document, specific information regarding previous studies will be found in other elements of the AOA.

GEOGRAPHIC SCOPE

The study area consists of the Point Reyes National Seashore, the Golden Gate National Recreation Area, and associated administrative park units, totaling approximately 145,000 acres extending from northern Marin County into northern San Mateo County south of San Francisco Bay—an area referred to here as the Point Reyes and Golden Gate parklands, or simply PRNS–GGNRA, or the parklands (Figures 1 and II.1). There are more than two dozen GGNRA park units, including the Presidio of San Francisco, Fort Point National Historic Monument, Fort Mason, Forts Baker, Barry, and Cronkhite, and Muir Woods National Monument. An important attribute of the parklands is that they have a legislative boundary that is greater than the actual lands under NPS jurisdiction. In particular, there are a number of key state parks that are adjacent to the park bounds but are separately administered by the state: Angel Island, Mount Tamalpais, Samuel P. Taylor, and Tomales Bay State Parks. The parklands also include the Marin Municipal Water District and San Francisco Water District lands, administered by these districts.


Archaeological Research Issues, Point Reyes National Seashore – Golden Gate National Recreation Area
Figure II.1
Selected Indigenous Archaeological Sites
N
0 5 10 15 miles
0 10 20 km
SON-348/H
Duncans Cave Site
Duncans Point
SON-299
Kili
Bodega Bay
MRN-201
Toms Point
MRN-266
McClure Site
Tomales Bay
Santa Rosa
Petaluma
MRN-193
Olompoli
Point Reyes – Petaluma Road
MRN-402
Echa-tamal
MRN-249
Point Reyes Station
San Pablo Bay
MRN-152
Pacheco Valle
MRN-271/H
Bear Valley
Drakes Bay
MRN-216, 232
242, 298
(Limantour,
Estero, Cauley)
MRN-375
Palo-Marin
San Rafael
CCO-295
Ellis Landing
MRN-27
MRN-17
Bolinas Bay
San
ALA-307 – West Berkeley
ALA-309 – Emeryville
Oakland
SFR-29, 30, 31
SFR-5, 21
Pt. Lobos
Pacific
Ocean
San Francisco
Francisco
Bay
Farallon Islands
SMA-22
Princeton
San Mateo
Half Moon Bay
SMA-125
SMA-77
University Village
California
Key
Point Reyes National Seashore
Areas owned or administered by GGNRA
source: NPS 1994

The total park boundary is used in discussing "parkland" resources, although administrative distinctions are noted where appropriate.

The brief review below summarizes the geographic scope of the parklands and offers a qualitative statement regarding the level of archaeological investigations that have taken place in each area. In response to various legislative mandates, several assessments (both published and in-house) of the state of indigenous archaeology in the parklands were made in the late 1960s through the mid-1970s (Bohannon 1969; Kelly 1976; King 1970a; Moratto 1974). These overviews report only limited archaeological work in the study area, with some geographic zones virtually unstudied. Most of the observations in these three-decade-old evaluations still hold true: today, with only a handful of exceptions in the past few years, no systematic, research-driven, well-documented, indigenous-archaeological excavation has taken place within PRNS–GGNRA lands. In addition, only a small percentage of the study area has been formally surveyed for archaeological resources: in August 2001, only 6,000 acres had been intensively surveyed, while 139,000 acres are yet to be examined. At that date, 358 sites had been identified, of which 143 were prehistoric archaeological sites (Barker, pers. comm. 2001).

Selected archaeological sites are mentioned in the geographic review below.[1] For the purposes of this review, the dates given for some sites or site groups refer to the broad periods of Bay Area prehistory—beginning from about 3000 to 500 B.C. for the Early period, followed by the Middle period (500 B.C. to A.D. 1000) and the Late period (A.D. 1000 to historic contact). More information on this and alternative dating schemes is presented in Chapter 3, Chronology and Culture History. Few details are given below; more specifics on the sites and investigations mentioned can be found in Chapter 3 and subsequent sections of this report.

POINT REYES

Point Reyes National Seashore, which encompasses 71,086 acres in coastal Marin County, has received the greatest archaeological attention of any area within the parklands. Well over 100 archaeological sites have been recorded, beginning with Nelson's shoreline survey in the first decade of the 20th century; many of the sites could not be relocated by the 1960s, having been destroyed by human activities and natural conditions over the ensuing half-century (Edwards 1970), while vast areas remained unsurveyed. Most archaeological excavation was conducted prior to 1970, much of it in search of evidence of Sir Francis Drake's presence but some focused on prehistoric occupation. Substantial excavations took place at four sites in the 1940s: Mendoza (CA-MRN-275); Cauley (MRN-242); Estero (MRN-232); and McClure (MRN-266). Findings document a Middle-period occupation at the McClure site, continuing through to historic contact at all sites.

[1] The California Historical Resources Information System gives official trinomials to archaeological sites in the state, using state and county abbreviations (e.g., CA-MRN-123). Sites that have only prehistoric components have no suffix, sites with only historic components have an "H" appended (e.g., CA-MRN-123H), and sites with prehistoric and historic components have an "/H" appended (e.g., CA-MRN-123/H). Since historic components were generally not recognized until recent years, the database is always changing; sites are referred to in these chapters as they appear in the literature or other context under discussion.

The Point Reyes locality is a distinctive element in the regional chronological sequence (Beardsley 1948, 1954; Fredrickson 1973; Meighan 1955), has served as a laboratory for university thesis and dissertation work (Compas 1998; Duncan 1992; Jackson 1986; Origer 1987; Polansky 1998; Shultz 2003; Van Dyke 1972), and since the mid-1990s has undergone regular systematic survey through a cooperative agreement between NPS and Sonoma State University. Despite the archaeological attention, large areas have never been formally surveyed, no large-scale excavation has been guided by a research design, and dating of investigated sites has relied strictly on artifact crossdating, with only a single radiometric date acquired until recently, and only a handful of obsidian-hydration dates obtained. Thus the prehistory of Point Reyes remains poorly understood, with little information on how the PRNS sites fit into the settlement system of the greater region. Golden Gate parklands along the eastern shore of Tomales Bay, in the vicinity of Lagunitas Creek at Tocaloma, and the Olema Valley and Bolinas Ridge north of the head of Bolinas Lagoon are administered by Point Reyes because of that park's administrative propinquity to them. Portions of these locations have been subject to small-scale surveys occasioned by development, but only a few small-scale excavations have been conducted.

PRNS lands were in the control of the Coast Miwok at the time of contact; some names of Native American ethnographic sites were recorded (Barrett 1908a), but locations have not been verified. Ethnographic interviews with residents of the area took place well after American settlement (Kelly 1978), resulting in little information about pre-contact conditions, but providing a wealth of information on the historic period. Ethnohistorical work with mission records and other archival documents (Milliken 1995) provides the bulk of information on indigenous ways of life.

SOUTH MARIN COAST

To the south of Point Reyes are various Golden Gate park units: Bolinas Lagoon, Stinson Beach, and a few other coastal properties, and the inland Muir Woods National Historic Monument. At the mouth of gulches on the eastern margins of Bolinas Lagoon, Nelson identified three small occupation sites, while CA-MRN-333, the Muir Beach archaeological site on Redwood Creek, has been listed on the National Register since 1980. The Palo Marin site (CA-MRN-375) on the ocean front near Bolinas is one of the few sites to have been excavated on the South Marin coast, by Tom King in 1967. One of seven sites located on a survey of the area, MRN-375 yielded evidence of chert quarrying and *Haliotis* exploitation, along with other finds suggesting substantial socioeconomic distinctiveness and probable isolation for the Bolinas area (Moratto 1970a:103). MRN-383, a Late-period site overlooking Bolinas Lagoon, was excavated by Fredrickson in 1965 (Van Dyke 1972:83). Recent investigations of the Big Lagoon area near Muir Beach have identified three buried archaeological deposits (one previously recorded) found on older landforms (Meyer 2003).

Little is known ethnographically of the south Marin coast, which may have been occupied by a different Coast Miwok tribelet. The ethnographic site of *Bauli-n* was placed north of Bolinas by Kroeber (1925:274).

MARIN HEADLANDS

At the Marin Headlands, Forts Cronkhite and Barry have not been archaeologically studied. Fort Baker was systematically surveyed on the surface and by geoarchaeological trenching in 2000 (Stewart, Meyer, and Newland 2003). Much of the fort was found to have been so highly developed as a military base that only disturbed traces of earlier occupation—none dating to before contact—were uncovered on the surface; geoarchaeological trenching, however, identified the possibility of buried prehistoric deposits. In the summer of 2003, archaeological monitoring detected a buried prehistoric deposit at Fort Baker near the Coast Guard station; subsurface work will be necessary to fully record the site (Leo Barker, pers. comm. 2003).

Just north of Fort Baker, outside the Golden Gate jurisdiction but providing context for Fort Baker and Angel Island, Richardson Bay and the locations of the towns of Sausalito and Tiburon provided an exceptionally valuable setting for native people; large and complex sites are known for this area, and some important excavations have occurred (King 1970a, 1974b; McGeein and Mueller 1955).

Based on mission-record research, Milliken (1998) identifies the people occupying the Marin Headlands to be the Huimens, the same Coast Miwok group that occupied Sausalito and Tiburon. These people were not documented ethnographically.

ANGEL ISLAND

Among the study-area locations to receive archaeological attention in the 1960s, Angel Island was occupied in the Late period by groups who practiced fishing in shallow island waters and shellfish collecting, and buried their dead on the island. Nelson's four Angel Island sites (CA-MRN-42, -43, -44, and -45) were investigated by Adan Treganza of San Francisco State College and seven students in 1965. The work was poorly documented, according to Kelly (1976:39, 48), and at least one of the sites (and up to a dozen burials) were subjected to construction damage prior to State Parks' acquisition. Due to the island's proximity to the Headlands and Tiburon, the area would likely have been held by the same tribelet—the Huimens (Milliken 1998).

SAN FRANCISCO PRESIDIO AND ENVIRONS

South of the Golden Gate, development of the Presidio (beginning in 1776) and later the city of San Francisco has destroyed or buried all but a handful of archaeological sites. Excavations in the early 1900s conducted by U.C. Berkeley archaeologists—Nelson at 1910 at Hunter's Point (SFR-6, the Bayshore Mound) and Loud in 1912 near the Palace of Fine Arts (SFR-7)—were massive in scope but never fully analyzed or reported (Moratto 1984:267), although a manuscript is on file for the former (Nelson 1911). The findings from CA-SFR-6 and –7, both apparent long-term occupation sites, were used in Beardsley's (1948, 1954) regional chronology. (Records and collections from the latter site were later organized and analyzed by Rudo 1982.) A significant archaeological find was made in 1969, when deeply buried human bones were discovered during the construction of the Civic Center station on the Bay Area Rapid Transit System (BART), well outside the

parklands; radiocarbon dates from the organic matrix are the oldest for San Francisco—4900 ± 250 years ago, or 5640 calibrated years before present. Later, also outside the PRNS-GGNRA, other deeply buried sites have been identified during urban development, most of them dating to the Middle period (Pastron 1990; Pastron and Walsh 1988a, 1988b, 1988c).

Of the 23 sites that had been recorded in San Francisco by the mid-1970s, only 2 were known to be extant at that time: CA-SFR-5 and CA-SFR-21, listed (in 1976) as the Point Lobos Archaeological Sites on the National Register of Historic Places. In the first excavations to occur in San Francisco since L.L. Loud's work in 1910, the Point Lobos sites (within the Sutro Baths area of the GGNRA)—considered to be resource-processing locations—were investigated by Holman et al. (1976); a recently recovered radiocarbon date suggests some antiquity for CA-SFR-5. Since the mid-1970s, several more sites have been identified at San Francisco, some encountered accidentally and some found in connection with planned construction and development projects. The first and most extensive investigations were conducted by Suzanne Baker in 1978 at three previously unknown shell middens within the boundaries of the Park's Fort Mason, CA-SFR-29, -30, and –31. The sites contained artifacts and features suggesting they were permanent or semi-permanent habitation sites, rather than seasonal collecting stations; two radiocarbon dates (from SFR-29 and SFR-30) indicate use during the Middle-Late period transition and Late period (Moratto 1984:267; Rudo 1982:29-30). Other prehistoric finds located to date within the Presidio and other San Francisco GGNRA land include the CA-SFR-129, the Crissy Field site, the subject of a large-scale, systematic, modern investigation (Clark 2000), conducted to ensure the site's preservation and stabilization during the Crissy Field Restoration Project of 1999-2000. Also located along Crissy Field is CA-SFR-6, recently investigated by Giambastiani and Fitzgerald (2001) during exploratory trenching for the reconstruction of Doyle Drive.

Large occupation sites are present on the northern tip of the San Francisco peninsula, but most date to the Middle period or earlier. The environmental setting reported for the Presidio and environs during the historic period, with its barren hills and sparse water resources, suggests that occupation may have been focused elsewhere by the Late period—perhaps in the Mission Bay area, where there were ample water and food resources, and protection from prevailing winds.

The *Yelamu* tribelet, a group of Costanoan-speaking people living in small family bands, are known to have occupied the northern San Francisco peninsula based on mission-record data. A third group occupied the village of *Petlenuc,* which may have been located near the site of the Spanish presidio. The groups joined the mission beginning in 1777 (Milliken 1995:260).

SAN MATEO COUNTY

A few management areas of the Golden Gate parklands are within coastal San Mateo County, including Mori Point, Milagra Ridge, and other areas near Pacifica and Devil's Slide. In the uplands along the San Andreas Fault line are San Mateo Ridgelands, Sweeney Ridge, and Phleger Estate—all, in or adjacent to San Francisco Water District lands. This upland area is a distinctive environmental setting, containing plentiful water, abundant

food resources, and relatively gentle lands bounded by rugged, wooded slopes. The ridge's excellent acorn-deer environment, and its proximity to both bayshore and coastal resources, made it among the most desirable locations in the Bay Area. Some significant occupation sites are located here, in particular CA-SMA-125, a major village dating to the early Late period on the Filoli Estates, which was excavated on two occasions in the 1930s (Babal 1990:123). No other archaeological excavations have been conducted within lands in Golden Gate jurisdiction, but fairly extensive work just outside has been conducted by nearby Stanford University and Cabrillo College, and adjacent areas have been intensively studied for two San Francisco State University master's theses (Hylkema 1991; Salzman 1983). Near sea level on both sides of the ridge, important sites have been investigated: most significant is the University Village site, CA-SMA-77, which yielded one of the oldest radiocarbon dates on the Bay (3610 cal B.P.) and gave rise to some influential speculation on the development of San Francisco Bay Area prehistory (Gerow, with Force 1968; see Chapter 3). On the west side of the ridge, also outside of the Golden Gate parklands, some sites at Half Moon Bay were investigated but only minimally recorded. One fairly substantial living site (the Princeton Mound, SMA-22), excavated by Loud in 1915, dates to the Middle period. In contrast, all documented Late-period deposits in the area are small special-purpose sites, like most Late-period sites in San Francisco.

Milliken (1995) places the Costanoan (or Ohlone) tribelet of *Lamchin* in the vicinity of the San Mateo County parklands, although this group may have been focused on the bayshore. While archaeological evidence suggests that a population center was present in the area at least during portions of the Late period, no clear associations are available.

STRUCTURE OF THIS DOCUMENT

This document focuses on research concerns applicable to indigenous archaeological resources—known or not yet identified—in the PRNS-GGNRA. As mentioned above, the objective of the research design is to provide a range of information that will help to evaluate archaeological work in Point Reyes and the Golden Gate parklands and that can be used to assist in developing resource-specific research designs when needed.

Chapter 2, Archaeological Research Designs in California and the PRNS–GGNRA, provides background on the nature of archaeological research designs, beginning with the regulatory context and how research designs fit into the National Historic Preservation Act's Section 106 Process, the process of Section 110, and other pertinent federal mandates. The related concepts of historic context and property type are presented, accompanied by a table identifying property types in the PRNS-GGNRA. The history of regional and local research-design development, beginning with the 1980s attempt to develop a research design for the state of California as a whole, is presented, along with reviews of local research designs for the Point Reyes peninsula, Marin County, and other areas in or near the GGNRA. The changing dominant theoretical perspective among American archaeologists, and how the various stages in its evolution have affected research interests, is also addressed.

Chapter 3, Chronology and Culture History, begins with a review of dating techniques in use in coastal California archaeology, including artifact cross-dating, radiocarbon dating, and obsidian-hydration analysis. It turns to a discussion of chronology building, giving the history and methods behind some of the standard chronological sequences in use in and around the parklands today. A summary of the general culture history for the San Francisco Bay Area and environs completes the chapter.

Chapter 4, Patterns of Settlement and Subsistence, covers one of the broadest and most active research topics in coastal California archaeology. It begins with a discussion of site-formation processes and how they reflect and are molded by subsistence and settlement patterns; special attention is given to the shell midden—the dominant site type in much of the PRNS-GGNRA. A discussion of the value of coastal resources and what that suggests for initial occupation of the coast follows. Settlement studies that have been conducted for the PRNS and other areas of Marin are described. The relationship of settlement and subsistence and how this is reflected archaeologically considers how different models of human organization and mobility—such as the forager–collector spectrum—can result in different interpretations of the past. A section on subsistence and technology deals with various aspects of resource procurement and the technological adaptations required of them.

Chapter 5, Social Organization, Interaction, and Complexity, includes a variety of research topics that have been proposed in hunter-gatherer studies in general and investigations of San Francisco Bay Area prehistory and ethnography in particular. Included are such topics as analysis of social structure through mortuary analysis; the rise of status ascription; warfare, stress, and the role of exchange; interaction and exchange; and the operation of boundary culture.

Chapter 6, Culture Change: Historic-period Native American Archaeological Research, reviews some of the work that has been conducted to date on historic-period Indian sites, including the mercantile community of Fort Ross, a rancho setting at Petaluma Adobe, a mission setting in Santa Cruz, and a Coast Miwok village dating to the late 19th century. It also considers the research potential inherent in these kinds of sites for investigating how native people dealt with the influx of non-Indians on the California coast and the effects of such abrupt and intensive settlement on Native American lifeways.

At the end of each chapter, a discussion of research issues that can address these topics is given, along with a set of data needs that are required to address each topic. These issues are summarized in the final section, Chapter 7, Summary – Research Issues for Indigenous Archaeology in the PRNS-GGNRA.

Chapter 2 – History of the Archaeological Research Design in California and the PRNS–GGNRA

INTRODUCTION

While research designs play a powerful role in cultural resources management and historic preservation, as a consciously wrought plan for archaeological pursuits they are a relatively recent tool with a brief but interesting history. Furthermore, despite available state and federal guidance that tends to standardize the process, each research design reflects a unique historical setting, requiring a fresh approach. For this, a historical review of the regulatory context as it relates to research designs is of value. Included are discussions of some basic concepts in the structure of research designs, and the basis for site evaluation. Because it has long been recognized that archaeological work is strongly influenced by the theoretical approach of its practitioners, this chapter comments on some of the changes in the prevailing theoretical perspective of American archaeology in the past decades and demonstrates how some of these attitudes can affect what is learned about the past. After a discussion of some major paradigms in the social sciences, some research designs for the greater Bay Area and the Point Reyes National Seashore are reviewed. A brief outline of the recent Revised Thematic Framework for History and Prehistory (NPS 2003), which represents a dramatic change in historical scholarship and understanding, mirrors changes that are occurring in all levels of archaeology. The section concludes with a list of the purposes of a research design, compiled in the precedent-setting Airlie House Report of the 1970s.

MANDATES, STANDARDS, AND GUIDELINES

The management of indigenous archaeological resources in the PRNS–GGNRA parklands is mandated by law and policy, with the most directly applicable being the American Antiquities Act of 1906; the National Historic Preservation Act of 1966 (NHPA); the Archeological and Historic Preservation Act of 1974 (AHPA); the Archaeological Resources Protection Act (ARPA); and the Native American Graves Protection and Repatriation Act of 1979 (NAGPRA); along with their respective implementing regulations, standards, and guidelines. (See DO-28 [NPS 1998:Appendix B] for a brief overview of each law.)

While research designs are needed for nearly any action that will have an effect on a significant archaeological resource, they are most closely associated with Sections 106 and 110 of NHPA. Section 106 requires all federal land-managing agencies to consider the effects of their development and maintenance activities on historic properties, which include archaeological sites, so that they do not inadvertently disturb or destroy the archaeological sites under their care, while Section 110 of the Act requires federal agencies to inventory, evaluate, and manage historic properties under their jurisdiction, and to

nominate eligible properties to the National Register of Historic Places—"the preeminent reference for properties worthy of preservation in the United States" (NPS 1998:Chapter 1). The NHPA, then, is the primary regulation focused on in this document, although the requirements of other laws will be kept in mind.

For management purposes, the NPS recognizes several cultural resource types: archaeological resources, cultural landscapes, structures, museum objects, and ethnographic resources (NPS 1998:Chapter 1). Of the items in this list, this general research design concerns archaeological resources only. In contrast, the National Register has a different list, identifying significant properties as buildings, structures, objects, sites, and districts. Only the last two of these may be considered archaeological resources; a building that has lost its basic structural elements, or a structure that has lost its historic configuration or pattern of organization through deterioration of demolition, is considered to be a "ruin" and is therefore classified as a *site* (NPS 1991a:5). A *district* is a unified entity that may be composed of several similar resources or a wide variety of resources. Archaeological districts, however, consist of a grouping of archaeological sites related primarily by their common components; unlike other districts, the archaeological district often will not visually represent a specific historic environment. This document, then, focuses on recorded and yet-to-be-discovered indigenous archaeological sites and districts in the GGNRA/PRNS.

NATIONAL REGISTER CRITERIA FOR EVALUATION

Compliance with Section 106 of the NHPA involves specific steps in the preservation process: identification, evaluation, registration, and treatment of historic properties. Resource significance is a key to understanding the 106 Process: one first must identify sites; then evaluate them to determine their importance (i.e., their eligibility to the National Register); and finally treat those eligible resources that are threatened by development, destabilization, recreation, or other activities. Only eligible resources, called *historic properties*, "should be considered for protection from destruction or impairment" (36 CFR 60.2).

The significance of a cultural resource is measured against the National Register Criteria for Evaluation, which state that a historic property is a district, site, building, structure, or object

- that is associated with events that made a significant contribution to the broad patterns of our history (Criterion A);
- that is associated with the lives of persons significant to our past (Criterion B);
- that embodies the distinctive characteristics of a type, period, or method of construction, or that represents the work of a master, or that possesses high artistic values; or that represents a significant and distinguishable entity whose components may lack individual distinction (Criterion C); or
- that has yielded, or may be likely to yield, information important in prehistory or history (Criterion D).

While most historic buildings and many historic archaeological properties are significant because of their association with important events or people or styles (Criteria A, B, and C), the significance of prehistoric archaeological properties is usually assessed under Criterion D. This criterion stresses the importance of the information contained in an archaeological site, rather than its intrinsic value as a surviving example of a type or its historical association with an important person or event. To assess whether a property is likely to contain important information, the researcher must prepare an archaeological research design, which identifies the important issues that could be addressed by the kind of data that the property is likely to yield.

Although the definition of Criterion D portends a focus on a purely scientific approach to indigenous archaeological resources, there are additional values that may be addressed through research. As this research design will demonstrate, archaeological research explores a variety of sociocultural and even humanistic aspects of the human past. As the revised NPS Thematic Framework emphasizes, there is a close correspondence between scientific, historic, and heritage valuing systems (see below for more discussion). Furthermore, many of these values can be addressed through elements of a site's research potential. In addition, occasionally Native American historic-period sites—and even some prehistoric sites—can be linked to events, persons, or traditions covered by the first three NRHP criteria: an archaeological deposit that contains important evidence regarding the first human entrance into the New World, for example, or an indigenous archaeological deposit associated with the 1870s Ghost Dance (both might be eligible under Criterion A), or a site that can yield information on the evolution of the technical aspects of coiled vs. twined basketry (possibly eligible under Criterion C). Finally, some sites will be valued for their heritage association alone, which may be legally significant under certain circumstances.

Federal agencies are responsible for having adequate processes available not only for assessing and treating a full range of park site types, but also for evaluating them for all their recognized values—not only for their scientific values (information potential), but also for ethnographic, ancestral, historic, ecological, and other ways of valuing these resources. While some aspects of this goal can be recognized by attempting to go beyond information potential to apply other NRHP criteria, others might be addressed only by going beyond NRHP evaluation. This is outside the scope of this study, but examples will be noted where appropriate.

The Historic Context

A fundamental concept in the evaluation process is the *historic context.*

The National Register Bulletin, *How to Apply the National Register Criteria for Evaluation*, gives the concept a familiar face:

> The concept of historic context is not a new one; it has been fundamental to the study of history since the 18th century and, arguably, earlier than that. Its core premise is that resources, properties, or happenings in history do not occur in a vacuum but rather are part of larger trends or patterns [NPS 1991a:7].

The historic context organizes information based on a cultural theme and its geographical and chronological limits. The development of historic contexts is the foundation for decisions about identification, evaluation, registration, and treatment of historic properties. Having an appropriate historic context—one which illuminates essential qualities of the feature or site—can make the difference between dropping an archaeological resource from further consideration, or determining it to be eligible and according it treatment as appropriate. A pit dug into a prehistoric archaeological deposit, for example, can be seen as evidence of a loss of physical integrity for the older deposit, if the latter is the historic context of interest. On the other hand, if a historic context is developed that views the pit and other features uncovered at the site as elements of a later-period focus on subterranean food storage, which may have lead to an increase in sedentism and subsequent rise in social complexity, then the site may be given the opportunity to yield information on this important research issue.

Development of a historic context is not an arcane process: contexts "can be identified through consideration of the history of the property and the history of the surrounding area" (NPS 1991a:7). Identification involves various prefield studies that aid in predicting the locations of archaeological sites, followed by field survey that locates and records the resources. Without a historic context to indicate the potential for specific kinds of resources in the area, the survey can easily fail to recognize important resources. As noted above, effective evaluation of a resource relies first on identifying the historic context within which the resource's significance may be measured. Treatment of an NRHP-eligible resource (i.e., mitigating the effect of an undertaking on a site already found to be significant) relies on a more in-depth view of the historic context, identifying the specific scientific and other values inherent in the site, and determining how those values might best be enhanced or preserved.

Appropriate historic contexts for prehistoric and most historic-period Native American archaeological sites differ from those for most historic archaeological sites, in that the latter are often structured around historically documented events and persons, while the former usually focus instead on some process in the past. In this document, research themes are presented, under which appropriate historic contexts may be developed. The broad temporal and geographic scope of the current study does not allow development of specific historic contexts. A list of potential historic contexts that researchers may wish to pursue further is presented in the final chapter. This is the approach taken by at least two relatively recent, large-scale, federal-level research designs produced in California (Jackson 1994; Hull and Moratto 1995).

Focus on the concept of historic context derives in part from the new approaches to historic preservation that were guiding the development of the NHPA in the 1960s: the movement away from a Victorian and early-20th-century focus on Great Events and Famous Persons that continued to prevail into the 1950s, toward more inclusive perspectives. As noted in the Secretary of the Interior's Standards and Guidelines,

> The goal of preservation planning is to identify, evaluate, register and treat the full range of properties representing each historic context, rather than only one or two types of properties. . . . The use of historic contexts in organizing major preservation activities ensures that those activities

> result in the *preservation of the wide variety of properties that represent our history*, rather than only a small, biased sample of properties [1983, cited in NPS 1998:Appendix C; emphasis added].

The Importance of Property Types in Identification and Evaluation

Site-specific or project-specific research designs are geared toward known archaeological deposits and/or specified project impacts, and can therefore focus on a few relevant research issues and associated data requirements. In contrast, general research designs that will serve for a long time period in response to a variety of unforeseen impacts—and for areas in which the site universe is unknown or not well understood—must be geared toward the various property types that can be reasonably expected in the project area (based on partial sampling or on similarities with better-known nearby localities). Property types and historic contexts are associated concepts. According to the Secretary of the Interior's Guidelines, "Historic contexts, as theoretical constructs, are linked to actual historic properties through the concept of property type. Property types permit the development of plans for identification, evaluation and treatment even in the absence of complete knowledge of individual properties. Like the historic context, property types are artificial constructs which may be revised as necessary" (NPS 1983).

A list of Native American archaeological property types, known or anticipated to be present in portions of the PRNS–GGNRA study area, is presented in Table II.1. Unlike historic archaeological sites—which may be classified as to type through oral history, archival research, and analysis of relatively intact archaeological remains containing artifacts of known function—indigenous archaeological sites often lack readily apparent indicators of function or other association. The property types presented here constitute a broad generalization. This issue is further considered under the discussions of site-formation processes in Chapter 4. Another aspect of the prehistoric site-function dilemma is considered in that chapter, where there are discussions of the various settlement-subsistence strategies that appear to have occurred through time and space in the study area, and how these shifts give rise to different kinds of site types (e.g., forager residential bases vs. collector residential bases).

In addition to addressing the routine need to identify property types, Table II.1—with its relatively detailed descriptions of property-type characteristics—introduces the reader to the kinds of archaeological manifestations that are discussed in this study.

REGIONAL RESEARCH DESIGNS IN HISTORICAL PERSPECTIVE

As noted above in the discussion of National Register criteria, indigenous archaeological sites are generally evaluated in terms of their ability to contribute important information about prehistory (Criterion D). National Register Bulletin No.15, *How to Apply the National Register Criteria for Evaluation*, notes that "Information is considered 'important' when it is shown to have a significant bearing on a research design that addresses such areas as: 1) current data gaps or alternative theories that challenge existing ones or 2) priority areas identified under a State or Federal agency management plan" (NPS 1991a:21).

Table II.1. Indigenous Archaeological Property Types in the PRNS-GGNRA Study Area

Property Type	Constituents	Anticipated Locations	Some Known or Suspected Occurrences in the Point Reyes–Golden Gate Parklands and Environs
Multi-use Occupation Sites:			
Residential base, or Village site	Habitation debris (earth middens containing shell, bone, plant remains including charcoal, heat-affected rock); facility and structural remains (housepits [possibly including dancehouse and sweathouse remains], postholes, storage pits, hearths, earth ovens); food-processing and consumption artifacts (including milling equipment and other pounding and cutting tools) and artifacts reflecting a wide range of activities (e.g., flaked, ground, and battered stone tools for fishing and hunting, net-and basketry-making, shell-bead manufacturing, etc.); and other artifacts reflecting ceremonial activities (stone and shell pendants and beads, baked-clay effigies, charmstones); diversity of lithic debris from a range of sources and representing varied techniques. Human burials, some with associated grave goods, may be present. Site area extensive, suggesting sizable population.	Sheltered locations at coastal canyon mouths on terraces; inland on creek terraces or midslope terraces near springs; access to year-round fresh water, good outlook; near ecotones, with access to a variety of resources.	CA-SMA-125, SMA-206 (Sweeney Ridge); CA-SFR-29, -30, -31 (Fort Mason); CA-MRN-266, the McClure site; CA-MRN-242, the Cauley site; CA-MRN-232, the Estero site
Hamlet	Same intensity and diversity as above, but small size, supporting a few extended families; no evidence of large-scale community structures.	Same as above, but may be less central, on more restricted landforms, and on smaller watercourses.	Various throughout study area

Table II.1. Indigenous Archaeological Property Types in the PRNS-GGNRA Study Area (continued)

Property Type	Constituents	Anticipated Locations	Some Known or Suspected Occurrences in the Point Reyes–Golden Gate Parklands and Environs
Multi-use Occupation Sites (cont.):			
Camp site	Similar to above, but with less intensity, depth, areal distribution, and diversity. Features probably limited to hearths; flaked, ground, and battered stone tools for food-procuring, processing, consuming activities, but diversity moderate; little or no evidence of ceremonial use; lithic debris of more limited range; human remains rare. Site area varies, from small and relatively dense, to extensive but sparse deposits.	Variety of locations with access to at least seasonal fresh water.	Various throughout study area
Special-use Sites:			
Shell Midden	Deposit of shellfish remains, of one or a variety of species, with few artifacts.	On beaches or sand dunes adjacent to bays and estuaries; on terraces near mouths of creeks; on ocean terraces above open beaches.	Various throughout study area; includes CA-SFR-5, -21 (Sutro Baths)
Bedrock Milling Station	Bedrock outcrops or boulders with one or more mortar cups or other milling areas; small areas of adjacent organically darkened soil (midden) may be present; artifacts limited to pestles (and possibly handstones) and (less commonly) a few expedient tools.	At outcrops of suitable sedimentary, metamorphic, or igneous rock, near watercourses and plant resources	BRM distribution in PRNS-GGNRA poorly known

Table II.1. Indigenous Archaeological Property Types in the PRNS-GGNRA Study Area (continued)

Property Type	Constituents	Anticipated Locations	Some Known or Suspected Occurrences in the Point Reyes–Golden Gate Parklands and Environs
Special-use Sites (cont.):			
Lithic Scatter	Stone-tool making debris, which may be accompanied by battered-stone tools for flaking and abrading and broken or discarded flaked-stone tools.	On saddles, midslope terraces, and other locations that may have served as hunting and/or butchering locations	Few lithic sites on bay or estuaries; unsurveyed uplands may contain more lithic sites.
Quarries	Rock outcrops or boulders of chert, other cryptocrystalline rocks, or fine-grained volcanic or metamorphic rock, exhibiting quarrying scars; quarry shatter and lithic-reduction debris; hammerstones; may contain some discarded stone tools.	At appropriate outcrops near living sites or travel routes	Unknown
Rock Art	Bedrock outcrops or boulders containing scratched or pecked design elements; extensive stone alignments; tools related to manufacture or use.	At suitable outcrops; locations may be along ridgetop trails, in saddles.	Ring Mountain Petroglyphs in Tiburon (Marin Open Space)
Isolated Human Remains	Intentionally interred human remains, with few or no grave goods; isolated human bone.	Locations unpredictable	Unknown
Historic-period Native American Sites:			
Any or all of the above	Ethnographic sites may be identified through archival, oral-history, or other sources; artifacts may be primarily native items, with occasional historic-period pieces, or assemblages of non-native items used in traditional ways**. Special site types**: refuge sites, historic work camps.	Various, based on historical circumstances	Echatamal (Halleck Creek); Toms Point

In some areas of the country (e.g., Arizona, New Mexico), statewide archaeological research designs (often found within preservation plans) serve as guidelines to important regional research interests. They provide not only the admonition to undertake archaeological research where appropriate (as does the current California Plan, see below) and a basic theoretical approach for such efforts (as does the NPS [2003] Revised Thematic Framework), but they also offer relevant historic contexts and explicit research questions for evaluating and treating prehistoric archaeological properties. An attempt to develop such a guideline for California was a focus of activity two decades ago. In 1983 in accordance with the mandate to prepare a comprehensive statewide Historic Preservation Plan (Public Law 96-515, Section 101[c]), the California Office of Historic Preservation set out to develop the plan's prehistoric archaeological element. The Plan would provide for the collection and organization of information regarding cultural resources and the development of historic contexts and regional research designs to guide decisions about identification, evaluation, registration, and treatment of cultural properties (CA-OHP 1997:49). Two volumes were produced. One focused on the planning approach and one on a test case of work done with the Bureau of Land Management in northern California. The latter, conducted under an agreement between the California Department of Parks and Recreation and Sonoma State University's Anthropological Studies Center, under Principal Investigator David A. Fredrickson, was informed by a nationwide team of preservation experts. The intention was to incorporate other elements of the preservation process (e.g., architecture, history, ethnography) as the state continued its attempt to achieve a multidisciplinary plan in keeping with the Secretary of the Interior's Standards and Guidelines (NPS 1983).

These efforts were based on the Resource Protection Planning Process (RP3), which was adopted by the National Park Service's Division of Interagency Resource Management as a recommended means of implementing the state historic-preservation-planning process. Major goals of the RP3 were to integrate the various program elements; to assure that preservation concerns were considered in the planning process; and to reduce red-tape, simplify compliance, and assure timely resolution of administrative conflict (Fredrickson 1984b:8). The state plan was intended for CEQA-mandated projects, although the Secretary of Interior's guidelines recognized the need for regionally specific research designs for federal work; if implemented appropriately, the state plan would "contribute to the knowledge of regional prehistory and the development of cultural theory in a coherent and organized fashion" (Glassow n.d.:7). While a few states did adopt the RP3 and today have well-used state research designs for archaeology, the California Office of Historic Preservation (CA-OHP 1997:49) observed recently that funding was inadequate for the California project and no further work on the archaeological component of the state plan had been undertaken since 1985.

Beginning in the 1990s, a comprehensive statewide historic preservation plan was developed for California by a diverse team of historic-preservation experts. Recently published, the document (CA-OHP 1997) focuses on analyzing the historic-preservation process as a whole, describing the economic and cultural benefits of heritage resources and developing recommendations for all aspects of the process. No attempt is made, however, to provide a research design for archaeology in California. A revision of the plan is envisioned for 2005. (On the federal level, a number of context statements have

been issued by NPS for historic archaeological property types, but none are available for prehistoric sites.)

Thus prehistoric archaeologists working in the Point Reyes–Golden Gate parklands, as elsewhere in the state, have relied on a combination of their own ingenuity and an ever-growing data base of small-scale, usually site-specific, research designs found in academic and cultural resource management (CRM) documents, bolstered by theoretical discussions gleaned from a variety of contexts (including articles and papers in professional journals and meetings). This approach works well for some veteran professionals, but it provides no guidelines for less-seasoned archaeologists or those new to the geographical area, nor does it assist nonarchaeological agency personnel who must evaluate archaeological documents for regulatory compliance. In such a setting, there is a concern that archaeological sites may be missed on archaeological surveys, wrongly assessed as ineligible during evaluation, and carelessly treated in data-recovery work.

Although no explicit research design was developed for California, the Office of Historic Preservation did provide some guidance: a document entitled *Guidelines for Archaeological Research Designs* (Van Bueren 1991). This document guides state and federal agencies, as well as public- and private-sector archaeologists, in developing research designs that meet OHP's standards, suggesting form and content for project-specific designs for specific undertakings. (See below for some caveats about the use of this generally excellent document.)

RESEARCH DESIGNS AND SAMPLING STRATEGIES

Professionally responsible research designs are the most effective mechanism for assuring that an archaeological investigation is conducted at an adequate level of inquiry. They can help to anticipate what recovery is to be considered important and what is not. Determining the level of effort necessary is achieved, partly, through the notion of "redundancy." *Redundancy* has both a positive and negative connotation. First, redundancy refers to the need to learn more about single occurrences in the archaeological assemblage in an effort to seek out patterns in the record. If the archaeologist (or the historian or other researcher) continues to recover new material, with little or no redundant information, then methods should be altered to more appropriately sample the important characteristics of the deposit. Patterns can be discerned only when some level of redundancy is achieved.

The redundancy concept is useful when applying a research design that is based on a hypothetico-deductive model of enquiry. For this reason it is a good fit with OHP's "Guidelines for Archaeological Research Designs," which emphasizes archaeological sites as the repositories of discrete chunks of knowledge that can be extracted. In this model, definitive "answers" are constructed to historical "questions" that, consequently will not have to be revisited. There is a tension between this essentially positivistic approach to knowledge and the history-as-process approach advocated in National Register Bulletin 36, "Guidelines for Evaluation of Historic Archaeological Sites and Districts." In short, many archaeologists feel that the usefulness of the redundancy concept should be considered a direct outcome of the epistemological stance taken by the research design rather than a principle to be taken for granted.

In its less positive meaning, redundancy refers to the condition of having too much information on a resource or a resource type. This desire to avoid over-sampling (resulting in trivial conclusions, high costs, and overstocked curation facilities) must be balanced against the need for inclusiveness—that is, the acquisition of representative samples of all potentially important data on all levels of inquiry: from a feature, a site, or a region. Most importantly, the research design should provide the amount and type of information that will be required to address research objectives, reducing the amount of redundant or excessive information recovered, and thus limiting the damage to an archaeological resource.

Addressing the need to be inclusive while avoiding oversampling, the Office of Historic Preservation has developed the California Archaeological Resource Identification and Data Acquisition Program (CARIDAP), with its pilot study, the Sparse Lithic Scatter Program (Jackson et al. 1988), having successfully gone through a peer-reviewed draft and been in general use for some time. The intention of these programs is to actualize the research potential of important but internally redundant archaeological deposits (e.g., sparse lithic scatters, tin-can scatters, bedrock milling stations, certain mining features) as effectively as possible. The approach is used only on those resources that meet the program's criteria.

RESEARCH DESIGNS AND THEORETICAL ORIENTATION

Paradigm Shifts in the Past Half-Century

Merriam-Webster defines a paradigm as "a philosophical and theoretical framework of a scientific school or discipline within which theories, laws, and generalizations and the experiments performed in support of them are formulated." While contemporary scientists often operate under different paradigms, there is usually one dominant paradigm that is considered to be a standard by prominent senior scientists, universities, and professional associations.

American archaeology has undergone two major paradigm shifts in the past half century. From its inception in the late 1800s, archaeology operated as a primarily information-gathering discipline. Beginning in the 1960s, American archaeologists took up a call led by Walter Taylor 20 years earlier—exhorting his colleagues to abandon their fixation on time-space systematics (the cataloging of culture history according to the temporal and geographic occurrence of certain stylistic artifacts) and instead focus on recovering "cultural contexts that are as full-bodied as possible," that is, "to make more and better use of their data" (Watson 1983:x). Watson summarizes the conjunctive approach taken by Taylor, stating that he "anticipates nearly everything that has come to be expected in good archaeological reports":

> The importance of understanding and working in terms of the natural stratigraphy; the importance of exact proveniences; the importance of biological data, of the entire paleoenvironment, and of investigating the natural resources potentially available to prehistoric human populations; the importance of prompt and full publication; and the need for archaeological field schools to train students in recovery techniques and in documentation procedures [Watson 1983:xi].

At the helm in the 1960s, however, was Lewis Binford (1962, 1980), from the University of Michigan and later University of New Mexico, who called for a more scientific approach—one that dealt with uncovering the scientific processes involved in human behavior. Steeped in a positivism that anticipated that all questions would ultimately be answered by a scientific approach, the new outlook was also called *processualism*, for its focus on underlying laws. This school of archaeology was hailed as the "new archeology," and is often so-called today, even after many of its tenets have been discarded. It was also the prevailing mode when federal legislation prompted the development of cultural resources management, and much of the work in California archaeology from the late 1960s carries its mark.

The OHP's *Guidelines for Archaeological Research Designs* (Van Bueren 1991) provides a series of core elements that are considered necessary for research-design development. These are (1) a theoretical orientation; (2) a cultural context; (3) a definition of hypotheses, using the hypothetico-deductive model; (4) test implications; (5) data requirements; (6) study methods; and (7) research priorities. This sequence is generally followed today. The guidelines also propose a specific structure for presenting and testing hypotheses that requires the definition of null hypotheses and specific test implications. The guidelines have not met with general acceptance by the archaeological community. "This emphasis on rigor," according to Jackson, in the northern Sierra National Forest research design, "may be a reaction to 'explanations' of archaeological data based on imaginative reconstruction, appeals to authority, or hearsay" (1994:9-2). In addition, the emphasis on a rigorous scientific approach is reflective of NHPA's overall theoretical orientation, which Jackson recognizes as being that of the processualist school, wherein "archaeological research is prescribed to include the formulation and testing of hypotheses as part of the process of supporting or refuting theories" (1994:9-2).

Several objections have been waged against the hypothetico-deductive (H-D) format for investigations proposed in the OHP guidelines:

- The approach is inappropriate for testing probable or statistical hypotheses, because it is not possible to deduce statements concerning individuals from a statistical statement. Given the variability in human behavior, however, statistical reporting of patterning appears to be the only option.
- *Replicability*, which aids in confirming hypotheses, is not possible in "time-like sciences" such as biology and archaeology, which are "historical in the sense that previous conditions affect future manifestations" (Dunnell 1982, cited in VanPool and VanPool 1999:47).
- The H-D method provides no guidance in distinguishing between trivial and important hypotheses—in fact, trivial questions are the ones most easily addressed through the H-D method (Jackson 1994:9-3; Salmon 1982:39).
- The HD approach does not allow the discovery and prediction of new facts on the basis of old ones.

The arguments outlined above, which have been shared by researchers for over a decade, support a conclusion that research designs for properties in the Pt. Reyes–GGNRA area need not be constrained by hypothesis generation. Writing at the time of the height

of the H-D method's popularity, Moratto explicitly called for the approach at Point Reyes National Seashore, stating that "future research design should demand hypothesis generation and empirical validation as the *sine qua non* for fieldwork" (Moratto 1970b:267). While Moratto's other recommendations (see below) remain current, this one is considered no longer valid.

Some of the criticisms of the RP3 approach to preservation planning identified it as out of step with then-current research aims of the "new archaeology."

By treating historic contexts as spatio-temporal entities, Santa Barbara archaeologist Michael Glassow noted that "this approach implies that the ultimate objective of archaeology is the reconstruction of culture history and that research is therefore aimed at filling gaps in culture historical knowledge." He contrasts this view with the approach he considers to be the norm, in which " archaeologists . . . address research questions that concern how and why particular aspects of cultural systems varied through time or space" [Glassow n.d.:6-7]. As answers to these questions are obtained, Glassow acknowledges that elements of culture history might be reconstructed, but he argues for a more significant goal:

> the development of a body of theory which accounts for aspects of cultural development or geographic variation: Thus data from a wide range of time periods and geographic settings would be more relevant than a focus on the local setting [n.d.:7].

Postmodernism and Multiple Ways of Knowing the Past

It is interesting to observe the evolution of the prevailing theoretical perspective by looking at various editions of an influential textbook: *Archaeology* by David Hurst Thomas. In the first edition written in the late 1970s, Thomas noted that there was "remarkable agreement" among contemporary archaeologists regarding the ultimate aims of archaeology:

> Archaeology's initial object is to construct *cultural chronologies* to order past material culture into meaningful cultural segments. The intermediate objective is to breathe life into these chronologies by reconstructing past *lifeways*. The ultimate objective of contemporary archaeology is to determine the *cultural processes* that underlie human behavior, past and present. These processes are expressed as *lawlike statements and consist of timeless, spaceless universals* [1979:137-138; emphasis added].

By the third edition of Thomas's (1998) textbook, much of the discussion is centering on the very lack of agreement among American archaeologists today. Certainly the goal of "lawlike statements" that "consist of timeless, spaceless universals" has been rejected by many and tempered by most others. What had occurred by 1998 was the assimilation into the mainstream of American archaeology of the "postprocessual critique," an intellectual attack headed by Ian Hodder (1986) and others that had begun to influence the discipline beginning in the 1970s.

Below are some of the most important elements of postprocessualism that have gained at least some currency among most practicing archaeologists today, followed by a few

statements on how these approaches might benefit the indigenous archaeological study in the PRNS-GGNRA:

- the recognition that archaeologists' perceived views structure their reconstructions of the past;
- the rejection of the search for universal truths, to be replaced by a focus on variability and historical diversity;
- a greater interest in the qualitative aspects of the human condition;
- an acceptance of the individual as an active agent in culture change and a worthy subject of archaeological study; and
- a postmodern sensibility that insists that indigenous peoples have a stake in the management of their ancestral remains, and that the values bound up in those remains, sites, landscapes, etc., are not exclusively scientific.

At this point, postprocessual approaches and issues have entered the mainstream of archaeological practice and theory. The emphasis on postmodern praxis, such as the involvement of indigenous peoples in archaeology, is no longer considered notable or meritorious but simply how the work is done.

A similar revolution has occurred in American history, which according to NPS historians has been "remade" in the past two decades. One of the primary revisions has been to expand the boundaries of historical inquiry to encompass not only "great men and events," but also ordinary people and everyday life (NPS 2003)—to focus, as the postprocessualists have also described it, on diversity and historical context.

The postmodern/processual debate is not over, but several successful attempts have been made toward examining the differences for the purpose of educating one or both sides to the issues of the other (e.g., Knapp 1996; Van Pool and Van Pool 1999). As the inferred extremism of postmodernism becomes more familiar, many more conservative researchers have come to acknowledge some value in taking a postprocessual approach. Despite this reduced debate at the turn of the 21st century, researchers continue to hold a wide range of views—partly encouraged by postmodernism itself, which contends that there are multiple views of the past and hence multiple pasts.

SPECIFIC RESEARCH DESIGNS, PAST AND PRESENT

Designs for the Greater Bay Area

The history of archaeological research in central California and the development of a cultural chronology to organize the past are described in some detail in Chapter 3, Chronology and Culture History. While U.C. Berkeley investigators looked briefly at San Francisco peninsula and bayshore Marin County in the first decade of the 20th century, no further work was done in either locale until the 1940s. In Marin, graduate students Robert Heizer and Richard Beardsley conducted the first investigations of coastal Marin sites, which Beardsley followed out in his dissertation. That work, which was primarily descriptive, focused on geographic differences between the coast and the Sacramento–San Joaquin Delta, a contrast that ultimately led to questions of differential culture change.

His final chapter, Speculations and Problems, groups the most vexing questions under three areas of concern: typological change, culture change, and time relationships and absolute dating (Beardsley 1954:103-107). Thus as a framework for future research, this discussion appears to qualify as the first explicit research design to cover the Pt. Reyes–GGNRA study area. (Some of Beardsley's concerns are discussed under the various domains below.)

As a part of the early-1980s effort to address the need for a state plan (see discussion above), pilot archaeological overviews were developed by Sonoma State University under contract with the Office of Historic Preservation for several counties under the jurisdiction of the Northwest Information Center of the California Historic Resources Information System. One of these documents was produced for the central Bay Area counties: Marin, Contra Costa, and Alameda (Stewart 1982). While not intended explicitly as a research design or management plan, the overview did include an extensive list of research questions or concerns for the area, along with information about all excavations and all large-scale surveys that had been conducted up to 1980. A few other institutions in the state also produced pilot overviews for their areas, but none were developed for San Francisco or San Mateo—the counties in the southern portion of the GGNRA.

Moratto's (1984) *California Archaeology*, in a review of the state's prehistory and archaeology, features work at Point Reyes and bayshore Marin County, and also provides brief descriptions of the less-studied San Francisco and San Mateo areas. A large portion of the volume is devoted to explication of various culture-history scenarios (linguistic movements and their environmental and social causes), providing a sort of informal, but relatively detailed, historic context on a statewide level.

Research Designs for Point Reyes National Seashore

The quest for Sir Francis Drake's landfall dominated most of the archaeological activity on the Point Reyes Peninsula and Tomales Bay for the first half of the 20th century. When Robert Heizer's 1940 U.C. Berkeley excavation on Drakes Estero (CA-MRN-232) uncovered iron spikes and Chinese Ming dynasty porcelain sherds dating to just prior to Cermeño's voyage, there followed a nearly feverish search—for Sir Francis Drake's landfall, as well as of evidence of the known Spanish explorers. The establishment of the Drake Navigators Guild (DNG) and the many investigations it fostered are discussed further in Chapter 6, Culture Change, and in the Maritime Research Design (Douglass, this volume). Native American sites around the Estero and adjacent coast were excavated in the 1950s and 1960s. Approximately 800 artifacts of 16th-century Asian or European origin were recovered from Estero-area Native American sites (Kelly 1984:14-16; Moratto 1974:61).

The numerous excavations carried out at Point Reyes indigenous archaeological sites, beginning in the 1930s and continuing through the late 1960s, were conducted in a virtual research vacuum according to King and Upson (1970) and Moratto (1974), with often considerable damage resulting to both prehistoric and contact-period deposits. There was no formal regionwide explication of research concerns in place, and no site-specific design that linked theory, method, and data requirements. Even when investigations were focused solely on the recovery of prehistoric archaeological remains, the sites suffered. Tom King, one of the graduate students who worked at Pt. Reyes in the 1960s (and who is now a leading figure in CRM), characterized the situation:

> Traditional Bay Area archaeology had focused almost exclusively upon the demonstration of change in artifact styles through time, fossilized in the stratified deposits of deep, long-term middens or their equivalents. On Limantour Spit [at Pt. Reyes] we were faced with the need to dig small, shallow, single-component sites; neither our technical repertoire nor our conceptual framework was ready for the challenge. We had no specific goal toward whose realization the collection of this or that kind of data would contribute, so the kinds of data collected varied almost whimsically [in King and Upson 1970:118].

At the same time, Moratto noted that despite 30 years of investigations, "no one has ever developed an integrated research and management design for all of Point Reyes Peninsula" (1970b:258).

While the work that was undertaken at Point Reyes in the 1960s may have suffered from a lack of research rigor, two of the chapters that reported on the investigations achieved some new balance by addressing the problem and clarifying issues. Published in the 1970 compendium honoring the recently deceased San Francisco State University professor Adan Treganza, these included "A Prospectus for the Archaeological Future of Point Reyes Peninsula" (Moratto 1970b) and "Archaeological Problems and Research in the Coast Miwok Area" (King 1970a). Moratto (1970b:258-259) provided recommendations for an integrated research/management plan driven by several prominent archaeological goals, paraphrased below:

1. Safeguarding of all historic and prehistoric sites within the Seashore.
2. Designing and conducting research into native community patterning, subsistence and trade economies, social structures, and seasonal variations in residence and economy, as well as further investigating the limelighted historic topics.
3. Developing interpretive programs for the edification and enjoyment of park visitors, while incorporating the concerns and interests of contemporary Native Americans.

Prehistoric research problems appropriate to Point Reyes identified by Moratto (1970b:261-265) include:

> Control of Time and Space in Sampling
>
> Paleo-demography
>
> Culture Ecology

Tom King (1970a:278-286) grouped his concerns for the Coast Miwok area as a whole (including interior and bayshore Marin and southern Sonoma County) under the following topics:

> Duration of Local Occupation
>
> Time Depth of Local Ethnographic Groups
>
> Settlement/Subsistence Systems
>
> The Clam Disc Bead Horizon (a wide-ranging topic discussed under Exchange).

At the time of King's and Moratto's writing, cultural ecology and settlement and subsistence systems had only recently gained primacy as fundamental research topics in archaeology. In fact, only a few years later, King, Moratto, and Rob Edwards (all Point Reyes researchers in 1970) were contributors to the Airlie House Report, a compilation of findings from a set of groundbreaking seminars held at a Virginia conference center to determine the direction of the relatively new field of cultural resources management (McGimsey and Davis 1977). At the time, the research analysis and proposed strategies for Point Reyes archaeology represented the latest in American archaeology.

In his "Prospectus for the Archaeological Future of Point Reyes Peninsula," Moratto (1970b) envisioned new directions away from the indiscriminant gathering of archaeological materials from Pt. Reyes sites to more problem-oriented themes with an explicitly environmental approach. He summarized his proposed remedies as follows:

> New classificatory procedures will have to be developed—procedures which will stress adaptive functions of artifact assemblages rather than descriptive categorization of beads and ornaments; procedures which will weight economic microconstituents on a par with artifacts for classificatory purposes; and procedures which will emphasize recently devised means for reconstructing archaeological social organization at the expense of traditional ethnographic analogy. And, throughout, future research design should demand hypothesis generation and empirical validation as the *sine qua non* for fieldwork [Moratto 1970b:267].

The revisions Moratto was calling for (new classificatory procedures focusing on functional assemblages) were in fact being developed in California at that time in the form of Fredrickson and Bennyhoff's cultural sequence for the San Francisco Bay Area and the North Coast Ranges, a organizing framework that is in general use by many researchers today (Fredrickson 1973, 1974; Hughes, ed. 1993). A focus on functional assemblages (viewing artifacts as elements of a functional toolkit, rather than as stylistic entities) and microconstituents (the byproducts of human activity, such as tool-making debris, shellfish remains, and heat-affected rock) is now standard procedure. However, the practice of hypothesis generation, as noted above, has fallen into disfavor since the 1970s and 1980s, as more researchers eschew the tenets of positivism and adopt a greater interest in diversity.

Despite a wealth of investigations and the incorporation of new dating techniques and other methodological advances over the past 30 years, none of the research issues and methods outlined by King and Moratto (other than the H-D approach) has been dropped as irrelevant or considered resolved. Thus the issues and much of the approach advocated by these researchers are closely considered in this research design, along with new issues and new perspectives that have gained importance in recent years. One of the most important new perspectives is a change in expectations; buoyed up by the positivism of the 1960s and 1970s, earlier researchers felt certain that all questions might ultimately be answered through a scientific approach. In its place, by the end of the 20th century, archaeologists had come to the "sober realization that archaeological data are more intractable than was appreciated during the first decades of the processual agenda" (Thomas 1998:416-417). This reorientation of expectations, spurred by a revolution in technology, has promoted a renewed appreciation for data collection and the ambiguity

of the archaeological record. It has not, however, set the discipline back to a fixation on particularism. In fact, far-reaching but well-grounded research questions, coupled with meticulous data collection, seem to be the ideal at the opening of the 21st century.

NPS REVISED RESEARCH THEMES

Archaeologists are generally constrained to focus on behavior (actions that can result in the creation and disposal of cultural materials) rather than attempt to enter the symbolic world of past actors. Nonetheless, as some of the discussions in this chapter have demonstrated, the predominant approach today encourages efforts to seek archaeological correlates of various aspects of culture and individual agency. These issues, when appropriate, are included under the general research domains chosen for this study. The research domains also compare well with the humanistically described themes of the National Park Service Revised Thematic Framework. The themes from the thematic framework (NPS 2003), which center around three major building blocks—people, time, and place—are the following:

I. Peopling Places

II. Creating Social Institutions and Movements

III. Expressing Cultural Values

IV. Shaping the Political Landscape

V. Developing the American Economy

VI. Expanding Science and Technology

VII. Transforming the Environment

VIII. Changing Role of the United States in the World Community.

While the list appears to focus on the historic period, an online document that describes the revised framework (*History in the National Park Service: Themes & Concepts*, [NPS 2003]) details how the approach might be used for the "Earliest Americans" theme study. The research domains chosen for this document are made up of those that have been used, in slightly varying ways, by California archaeologists for the past two decades. They are listed below, with the roman numerals demonstrating how they intersect with elements of the revised NPS Thematic Framework.

- Landscape Evolution and Human Occupation—presented in Part I, Geoarchaeology (I, VII)
- Chronology and Culture History (I, II, III, IV)
- Patterns of Settlement and Subsistence (I, VI, VII)
- Social Organization and Complexity (II, IV)
- Interaction and Exchange (II, IV, VI)
- Native American Historic-period Archaeology (all of the above, including VIII)

PURPOSES OF A RESEARCH DESIGN

One of the pivotal statements on the fledgling practice of cultural resources management, the Airlie House Report provided a section on research designs and their many uses in cultural resources management. This document's list of the purposes of a research design is especially wide-ranging and well-stated:

1. To provide the research with a vehicle to express and to develop explicitly the rationale behind the proposed research, giving the theoretical orientation, justification for problem selection, logic, specific criteria or archeological significance, and procedures for the research strategy.
2. To define the universe of study and realistic minimal expectations of research.
3. To permit the sponsor and professional reviewers to identify and assess the reasoning and validity of the design in the perspective of current professional capabilities and standards.
4. To provide a realistic, logically developed, and adequate schedule of research.
5. To provide for the productive efficient and justifiable recovery of archeological data.
6. To permit comparison of the proposed research with actual accomplishments and reduce the discrepancies between research expectations and results by coordinating research goals with procedures [McGimsey and Davis 1977:72].

The list constitutes a fitting conclusion to this chapter, outlining the several ways in which a conscious approach to archaeological research can enhance both research and management goals.

Chapter 3 – Chronology and Culture History

INTRODUCTION

Fundamental information on time, space, and form—addressing the questions when, where, and what—must be recovered before an archaeological site's research potential can be addressed. Steps toward this goal include the following:

- determining site structure (the temporal and functional relationship of discrete site layers), both vertically and horizontally;
- dating the site or its *components* (discrete portions of an archaeological site, representing a specific time period or function); and
- identifying a sufficient sample of the site's contents (artifacts, features, dietary remains) to discern the nature of the site and what kind of research issues it might address.

This information is then compared with the area's chronological sequence to see where the site confirms, augments, or refutes the prevailing scheme. Traditionally, a *chronological sequence,* or *cultural chronology,* "documents a temporal and spatial change in selected artifacts" (Thomas 1998:259). The chronology also represents a dynamic process in archaeology; culture chronology can be seen as "the collective results of the body of methods used to define artifact assemblages and order them in time and space" (White and Meyer 1998:100). While the chronology is artifact-based, the shifts in material culture serve to document changes in adaptive mode or various kinds of human behavior. *Culture history*, in contrast, "documents what people actually did" (Thomas 1998:259). It is an interpretive model that proposes dynamic historical relationships based on similarities and differences in stylistic and technological traits and, by extension, general lifeways. Although the two concepts are envisioned as separate, Willey and Phillips argued for their integration:

> The procedural objectives of culture-historical integration have tended to be divided, in theoretical writings on American archaeology, between the reconstruction of spatial-temporal relationships, on the one hand, and what may be called contextual relationships, on the other. Operationally, neither is attainable without the other. The reconstruction of meaningful human history needs both structure and content [1958:1].

For many archaeologists, especially those who were active in the 1940s and 1950s, arriving at an area's culture history has been a goal in itself; indeed, Willey and Phillips referred to it as "the primary task of archaeology on the descriptive level of organization" (1958:12). This approach was later rejected in the 1960s through the 1980s by advocates of processual archaeology with its new focus on discovering scientific laws. With the greater interest in variability at the beginning of the 21st century, improving on the quantity and quality of cultural historical data—aided by technological advances of every kind—engages many archaeologists today. Interpreting archaeological data in this integrated manner is a necessity, whatever the ultimate research goals of the archaeologist.

This chapter is made up of three major topics related to chronology and culture history:

1. Dating techniques in use in coastal California archaeology;
2. The evolution of chronological sequences for north-central California; and
3. A culture historical outline of coastal north-central California and its environs, based on current data.

ARCHAEOLOGICAL DATING TECHNIQUES

Archaeological dating involves one or more of the following techniques:

- *chronometrics*, which provide quantitatively comparable results (i.e., radiocarbon dating, obsidian-hydration dating, and other less-commonly used approaches);
- *cross-dating* of temporally diagnostic artifacts (using certain projectile points, shell-bead types, and other artifacts that have become recognized as time-markers);
- *stratigraphic analysis* of site layers.

Many stumbling blocks or irresolvable inconsistencies are inherent in the use of most archaeological dating techniques, resulting in considerable professional debate and the need to constantly reassess and often revise approaches. Some of these issues are described below.

STRATIGRAPHY AND TEMPORALLY DIAGNOSTIC ARTIFACTS

The oldest methods for archaeological dating continue to be the primary ones in use today. When Bay Area archaeology was launched in the first decade of the 20th century with excavations at the Emeryville and Ellis Landing shellmounds (Nelson 1996 [1906], 1910; Uhle 1907), there were only two primary dating techniques available: stratigraphy and temporally diagnostic artifacts. Stratigraphic analysis, which is based on the principle that overlying strata or objects are more recent than underlying ones (barring subsequent disturbance), was the most important tool, since specific time-markers for Bay Area prehistory had not yet been worked out. As archaeologists always do, however, they did bring with them some understanding of other archaeological sequences in the New and Old World. Digging in deep stratified mounds, they employed the technique of seriation, in which the waxing and waning of the popularity of artifact types is tracked. Ideally, what is revealed is a variety of artifact types and subtypes that co-occur to form an assemblage; further, other assemblages are revealed above and below, to form the cultural sequence of the site. In actual practice, the strata are often highly disturbed, and stylistically distinctive artifacts may be poorly represented or completely absent in some site types. Archaeological interest moved to the Sacramento–San Joaquin Delta (see discussion of the evolution of California chronology below), where greater progress was made in deeply

stratified sites with abundant grave goods that formed both a datable and stylistic sequence. In those contexts, however, artifacts found buried with human remains are often difficult to associate with artifacts found in middens that represent day-to-day life. For this reason, the cultural sequence identified in early investigations in the Delta have often been described as more a sequence of burial practices than a documentation of lifeways.

The most valuable time-markers found in large, residential sites of California are beads and ornaments, primarily shell beads of *Olivella* (the marine snail) and clam, but also ornaments of abalone shell and stone beads and ornaments of steatite, schist, slate, magnesite, and other materials [Figure II.2]. The glass trade beads of the historic period became the ultimate time-markers, capable of tightly dating burials and other features. Painstaking analysis of shell beads has resulted in a highly detailed sequence of changing bead types, in which a slight shift in the location of a bead's perforation, for example, can signal a new time period. The precision with which shell beads can be tracked, coupled with radiocarbon dating of various bead associations, has led to revisions in the primary cultural sequences for central California (Bennyhoff and Hughes 1987; Milliken and Bennyhoff 1993; see discussion below). Despite their effective use in some areas, shell beads are not found in many localities and site types. When present, they do not always afford precise dating: Van Dyke noted that "shell bead types, while providing ideal landmarks elsewhere, just do not seem to work in Marin County" (1972:129-130). The reasons for this, of course, warrant further study.

The other primary time-markers in California archaeology are projectile points—the stone tips hafted onto spears, darts, and arrowshafts. Alterations in size (partly indicating the shift from dart to bow and arrow), changes in the shape of point bases, and differences in blade angles, widths, and finishing touches all served to create a range of types that gained and lost popularity over time. Some types, however, such as the ubiquitous leaf-shaped point, can be found throughout the human occupation of the area. To identify time-markers among a region's projectile points, (1) individual artifacts are grouped into morphological types based on formal criteria—all that matters is that they share visual characteristics; (2) the morphological types are then tested against totally independent evidence—ideally both stratigraphy and radiocarbon dating; and (3) the types that are found to be significantly restricted in time are elevated to time-markers (Thomas 1998:244). The projectile-point typology for Monitor Valley in Nevada's Great Basin—one of the most stringently tested, with 400 points and 47 radiocarbon dates—remains in use (Thomas 1981), being generally applicable in the central Sierra Nevada and the adjacent Central Valley. A common error made in the early years of California archaeology was to equate artifacts found in coastal valleys with the Great Basin types, when morphological traits were only generally similar. Even with identical traits, there can be no assurance that projectile-point types enjoyed the same periods of use in widely separated regions.

No rigorously tested regional projectile-point typologies have been developed for the north-central California coast or the Bay Area, although Origer's (1987) study of obsidian-hydration and radiocarbon dating for projectile points in Sonoma and Marin counties is valuable for the North Bay, and in fact incorporated some PRNS–GGNRA specimens in its development (see Obsidian-hydration Analysis below).

More loosely constructed typologies, based primarily on morphology, have been devised for some large archaeological excavations, particularly in the North Coast Ranges and other areas where an apparently greater emphasis on terrestrial hunting resulted in an elaboration of point types (e.g., Hildebrandt and Hayes 1984; White 1984; White et al. 2002). Beardsley (1954) presents a typology of projectile points for the Marin coast and San Francisco Bay (see Figure II.3); while many of these points are restricted to certain time periods, there has been no testing of the types and they remain unnamed, bearing only Beardsley's descriptive labels (e.g., N1 – Non-stemmed - Large blade; or S1a – Stemmed, long-proportioned, frequently serrated). A problem with most projectile-point typologies is that they fail to account for the extensive reworking that occurs on the blade of the artifact over a period of use; after several such alterations most points bear little resemblance to their original form.

A variety of other distinctive artifact types also serve to date assemblages. Frequently these distinctive pieces occur sparingly, and it is only when a region has been extensively investigated that the temporal significance of some types is understood.

RADIOCARBON DATING

The Basics

Radiocarbon (^{14}C) is produced primarily by the interaction of cosmic radiation with nitrogen in the earth's atmosphere. After mixing with carbon dioxide (CO_2), ^{14}C is readily assimilated by plants and other living organisms. When plants and animals die, however, ^{14}C levels start to decrease because new carbon is no longer absorbed. Since ^{14}C is known to decay at a rate that approaches a half-life of 5,730 years, the amount of decay reflects the age of biogenic carbon as compared to modern levels of ^{14}C activity (Geyh and Schleicher 1990). For historical reasons, the half-life of ^{14}C as developed by radiocarbon pioneer Willard Libby, 5,568 years, is the one used by international convention (Bowman 1990:11).

Radiocarbon-dating was developed and presented to the public in 1949, but it was not in regular use in archaeology until the mid-1950s. (Obsidian-hydration dating, described below, is an even more recent tool.) Therefore, the basic chronological schemes of California prehistory (outlined in this chapter below) were postulated well before there was any means available for absolute dating. Radiocarbon dating has traditionally involved relatively large samples of charcoal samples (containing 300 milligrams to 4 grams of final carbon), usually from hearths or similar cultural features. While radiocarbon dating is readily accepted in some areas, archaeologists from the North Coast Ranges down into Marin County have traditionally been cautious regarding the technique; this is primarily because of the poor conditions for charcoal preservation in the area, and the perceived lack of other reliable sources of datable carbon. In addition, the occasionally uncritical use of poorly associated radiocarbon samples has tended to discourage the use of radiocarbon dating in the region. Relatively few radiocarbon assays have been made in San Francisco because of the paucity of archaeological work there. South of the GGNRA, a more aggressive approach to radiocarbon-dating is apparent (Breschini, Haversat, and Erlandson 2003; Dietz, Hildebrandt, and Jones 1988).

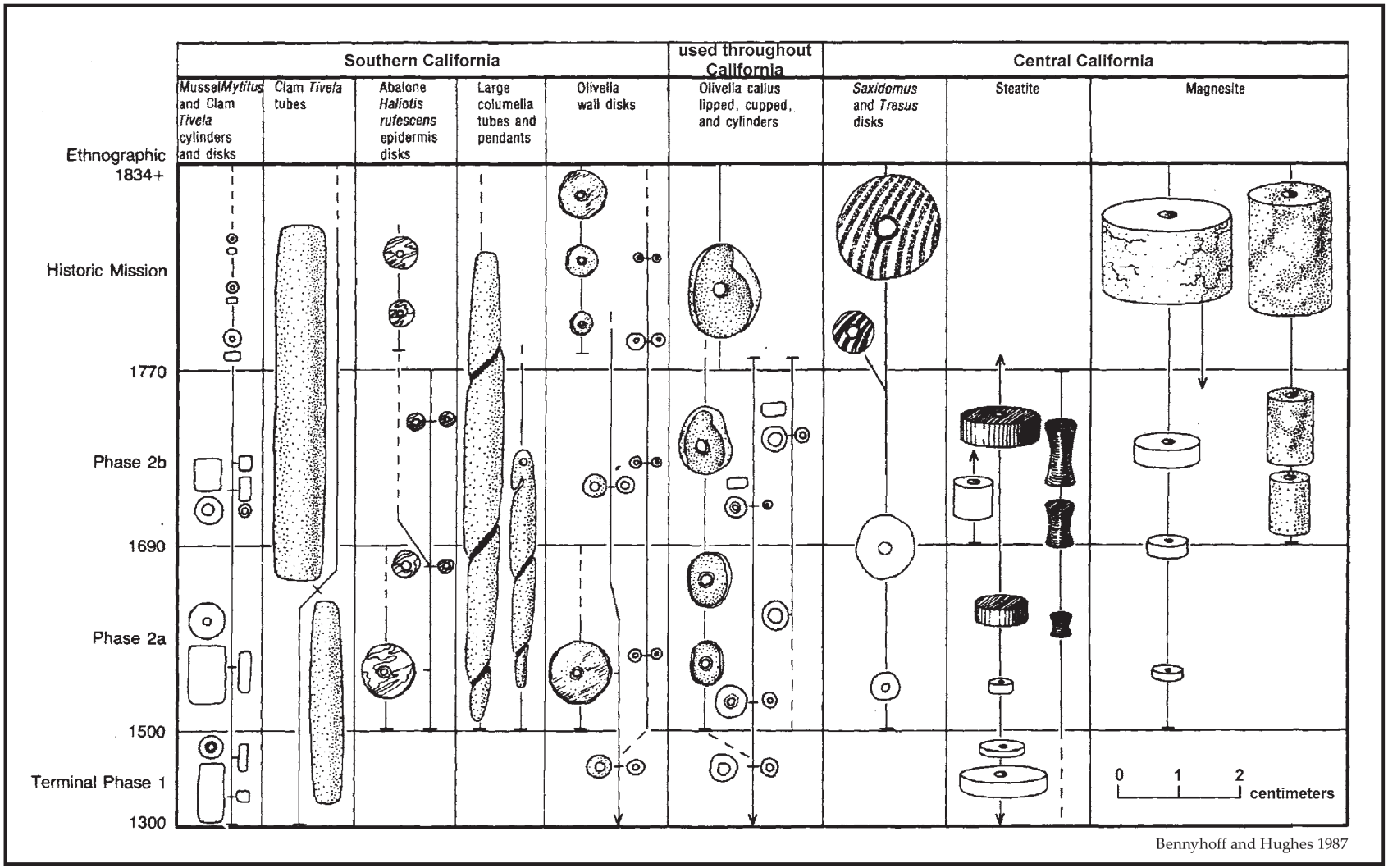


Figure II.2. Distribution of Late-period Shell and Stone Bead Styles in California

Radiocarbon dates are reported with a range of error, or standard deviation, attached: thus the date for the "BART skeleton," discovered in deeply buried strata in San Francisco, was expressed as 4900 ± 250 B.P. (before present); this standard deviation, expressed as the 1-sigma level, indicates that there is a 2-in-3 chance (67 percent) that the true age of the skeleton lies between 4650 and 5150 B.P. (Present, by international convention, is figured at A.D. 1950.) To improve the chances of accuracy, some archaeologists work with the 2-sigma level, which estimates that there is a 95 percent chance that the true date falls within the range; thus the 2-sigma date for the BART skeleton would be between 4400 and 5500 B.P. While acceptable for a general assessment of antiquity, for most analytical purposes, this is an unacceptably wide range; fortunately, many radiocarbon assays yield much smaller ranges of error.

Two revolutions have been identified in radiocarbon dating. The first is dendrochronology, or tree-ring dating, which serves to correct for variations in radiocarbon level worldwide; the resulting dates are said to be *calibrated*. For the BART skeleton, the calibrated date is 5640 cal B.P., a considerably older date than the conventional one. Use of calibrated dates reversed many of the then-established dates for world prehistory. Calibrated dates are generally older than their conventional counterparts, an effect that becomes especially exaggerated in California's oldest dates, which may be more than 1,000 years too early before calibration. The second revolution in radiocarbon dating is the development of the accelerator mass spectrometric (AMS) technique, which directly counts the proportion of carbon isotopes, rather than using a Geiger counter. While AMS dating is more costly and takes longer than conventional methods, the technique has allowed dating tiny carbon samples (from 100 to 300 milligrams of total carbon), as well as relatively minute samples of human bone or important datable artifacts, for which more destructive processes are undesirable. This technique, along with new approaches to dating other materials such as organic soil (see below), has brought considerably greater interest in radiocarbon dating in north-central California in recent years.

Soil Dating

Soils and sediments can be dated if they contain biogenic carbon in the form of organic matter, or humates (i.e., soil organic matter, or SOM). The differential decomposition, humification, and translocation of biogenic carbon in a given deposit determine the type and amount of SOM available for dating. The accuracy of soil dates depends on the researcher's ability to select samples that will minimize potential contaminants (Scharpenseel 1979) and to properly interpret the context of the sample (Matthews 1985). The ^{14}C age of a soil or sediment reflects the apparent mean residence time (AMRT) of the total organic content of the analyzed material. Since soil formation is time-transgressive (with new sediments overlapping the old), AMRT dates are usually younger than the true age of the soil. Understood in this way, the ^{14}C age of a soil does not mark a single time or event, but reflects the influence of multiple processes that have affected the soil carbon system over time; maintaining this perspective will improve both the utility of soil dating and the accuracy of its interpretation.

Shell Dating

Coastal sites have an especially important source of datable material, shell. Dating of shell is recognized as problematic because of the potential for contamination from

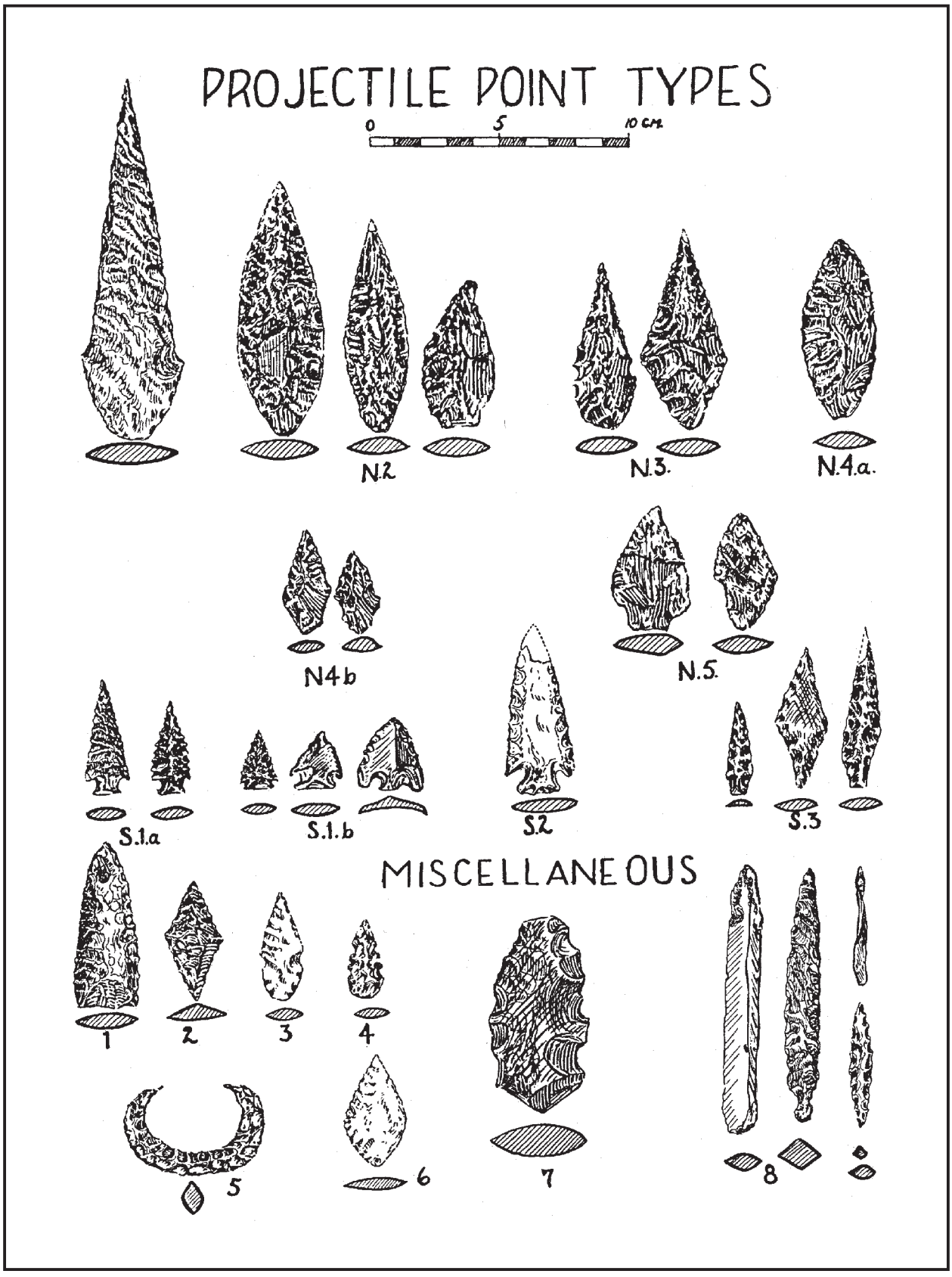


Figure II.3. Projectile-point Typology for the San Francisco Bay Area (Beardsley 1954)

several agents, resulting in changes in the $^{12}C/^{13}C/^{14}C$ ratio that do not relate to the passage of time. Although all organisms are susceptible to these changes, which result in older or younger dates than the actual age of the sample, shell—especially marine shell—is the most vulnerable. Researchers have established some successful approaches to controlling the variables that affect shell dating, the two most important being secular variation and the reservoir effect. A leading coastal archaeologist contends that "Marine shell continues to be the material most frequently used by California archaeologists for radiocarbon dating, despite the established folklore that charcoal or wood samples produce more reliable dates" (Erlandson 2002:n.p.).

Secular Variation

Also affecting non-shell radiocarbon samples, *secular variation* refers to the fact that while the rate of decay of ^{14}C is constant, the rate of production is subject to various influences, including cosmic-ray vacillation, solar activity, and variations in the earth's magnetic field. The effects have been largely documented—at least for the past 8,000 years—using sedimentary deposits, dendrochronology, and historically dated materials. The resulting correction table (Stuiver, Reimer, and Reimer 2003) allows archaeologists to adjust for secular variation within given margins of error. Another variable, the industrial or nuclear effect, involves the results of the increased large-scale burning of carbon-rich fossil fuels and testing of thermonuclear devices; the instability of dating samples from the past few hundred years has led Taylor (1987) to advise that dates of less than 200 or 300 years should be reported as "modern" (Waechter 1993:71).

Reservoir Effect

One of the most important variables in marine-shell dating is known as the *environmental* or *reservoir effect*, by which organisms draw older carbon from the reservoir in which they are formed. Very deep ocean waters of today, because of their relative isolation from surface cosmic radiation, may show a radiocarbon age of a few thousand years. While the incoming carbon dioxide is constantly being mixed with the upwelling, carbon-dioxide-depleted deep waters, the process is slow, and the surface water exhibits a relative age of a few hundred years. The degree to which upwelling occurs is latitude-dependent, affected by coastline shape, local climate and wind, and ocean topography (Bowman 1990:24). The effect is generally strongest on west-facing coasts, including the coast of California, and in the polar regions (Waechter 1993:72).

Archaeological radiocarbon dates from marine shells, therefore, are consistently older than their terrestrial counterparts. Working under the assumption that there has been no change through time, researchers have attempted to quantify this effect by dating modern specimens of known age (and species); this is done on relatively recent specimens collected prior to the nuclear weapons testing of the 1950s (Bowman 1990:24). While the mean surface-water age has been found to be approximately 400 years B.P. or more along the central California coast (Bowman 1990:24), modern samples from this area date to between ca. 550 and 650 years old. Thus a figure can be arrived at, based on location and shell species, to use in correcting radiocarbon dates (Stuiver, Reimer, and Reimer 2003); when the appropriate information is submitted, the calibration is done by the radiocarbon laboratory. This correction results in dates that many California coastal researchers find acceptable (Erlandson 2002; T. Jones 1992), and marine-shell dating is considered

fundamental to California midden analysis in central and southern California. It has been noted, however, that modern specimens in the same general area have yielded dates differing by a few centuries, a range that Bowman (1990:25) suggests might be acceptable for oceanographers but not for archaeologists dating material in shell middens.

Currently, Michael Kennedy (U.C. Davis, Anthropology) is working in collaboration with Ann Russell (U.C. Davis, Geology) and Tom Guilderson (Lawrence Livermore National Laboratory) to investigate Holocene changes in the reservoir age along the Sonoma Coast by radiocarbon dating (AMS) shell–charcoal pairs from archaeological components. This includes shell and charcoal from the Duncans Cave column sample excavated in 1989, and more recent materials recovered by the U.C. Davis archaeological field school in the open midden area east of the cave in 1996. They are also using materials from several other sites along the coast, including a few components in the dunes along Salmon Creek Beach that date to between ca. 4000 to 5000 B.P. (Kennedy 2001, pers. comm. to Jack Meyer).

Enumerating the strides that have been made in marine-shell dating, Erlandson concludes with a caveat:

> These and other studies suggest that marine shell samples, when properly treated, pretreated, analyzed, and corrected, may provide radiocarbon dates that are as (or more) reliable than those derived from wood and charcoal. Ultimately, however, many large radiocarbon series produce one or more "anomalous" dates that do not fit our expectations or preconceptions. This fact provides a strong argument for what should be a fundamental tenet in modern archaeology: *don't rely on a single 14C date unless you have strong corroboration from independent lines of evidence* (2002:n.p.; emphasis added).

PRNS–GGNRA Radiocarbon Dates

Only one radiocarbon date is known to have been recovered from an archaeological context in Point Reyes before 2001—a date of about 200 cal B.P. from materials recovered from a submerged archaeological site at White Gulch on Tomales Bay in 1972 (see Meyer, this volume); and only two have been recovered from the GGNRA—from Fort Mason sites SFR-29 and -30. Since that time, Madeline Solomon of the U.C. Berkeley Anthropology Department has run a number of dates from surface samples at Point Reyes and the Sutro Baths area (see below).

A call was recently made to expand the role of shell-dating in coastal sites: rather than restricting radiocarbon dating to archaeologically excavated material found in relatively pristine associations, Erlandson and Moss advocated sampling datable material from eroding sites, "systematically incorporating it into surveys in coastal, lacustrine, riverine, and other environments where erosional exposure often provide access to extensive stratigraphic profile" (1999:431). The authors characterize the practice as essentially salvage archaeology, recovering at least some basic information about a site's age and contents before its impending destruction by natural forces; it might be more appropriately considered contemporary triage, as programs of site stabilization are being reconsidered from the 1970s and 1980s. Solomon of U.C. Berkeley has worked with PRNS–

GGNRA archaeologists on a similar approach to the study area. Her results are on file at the GGNRA but are not yet published

OBSIDIAN-HYDRATION ANALYSIS

Obsidian-hydration dating is based on the phenomenon that a newly exposed surface of obsidian begins to absorb water, resulting in a small but measurable layer—called a hydration band—that increases in thickness with time. Once the variables affecting the formation of this band are controlled, the rate of hydration is predictable. Thus the thickness of the hydration band, measured in microns, can be used to temporally order obsidian specimens (see Figure II.4). The measurements serve as a form of relative dating. Several attempts have been made to correlate hydration measurements with absolute dates (see below); other researchers consider it more prudent to identify hydration spans that correlate with temporal periods.

Several variables affect the rate of hydration, including geochemical source, temperature, humidity, exposure to the elements, and exposure to fire. Weathered specimens can be identified macroscopically and excluded from the study sample, while burned specimens usually exhibit a diffuse hydration band that results in no usable reading. The effects of temperature, however, are more subtle: while increased temperatures speed up the rate of hydration and decreased temperatures retard the process, the effects of microclimates (e.g., a shady canyon in an otherwise hot region) or of long-term climatic fluctuations are problems that have not been resolved.

Sourcing Obsidian

Obsidian was of major importance in prehistoric technology, and it is assumed that peoples who held obsidian quarries within their territories would have controlled the distribution of this resource carefully (Bouey and Basgall 1984; Jackson 1986). Geographic obsidian source information therefore promotes a range of investigations into exchange networks and intergroup interaction—activities that are directly datable via the hydration method (see Exchange, in Chapter 5). Because specimens can be traced to their parent sources, the archaeological distribution of source-specific obsidian is an indicator of interaction among prehistoric groups, while use of the obsidian-hydration dating method can identify the timing of shifts in social interaction. Comparisons of hydration values from temporally diagnostic artifacts and from obsidian specimens from the same discrete feature have shown that hydration readings for apparently contemporaneous artifacts from different central California sources may vary by as much as 20 percent (White 1984:116), resulting in several hundred to more than 1,000 years' discrepancy. This fact highlights the most critical reason for identifying obsidian source: the role that geochemistry plays in the rate of hydration.

The geochemical source of obsidian is no doubt the most controllable variable in the rate of hydration (although see the discussion of *source* below). The source is most reliably determined by X-ray fluorescence (XRF), a process that can be used to distinguish one glass from another, and sometimes individual flows within a parent source. This analysis subjects the obsidian specimens to X-ray energy and records selected trace elements (zinc,

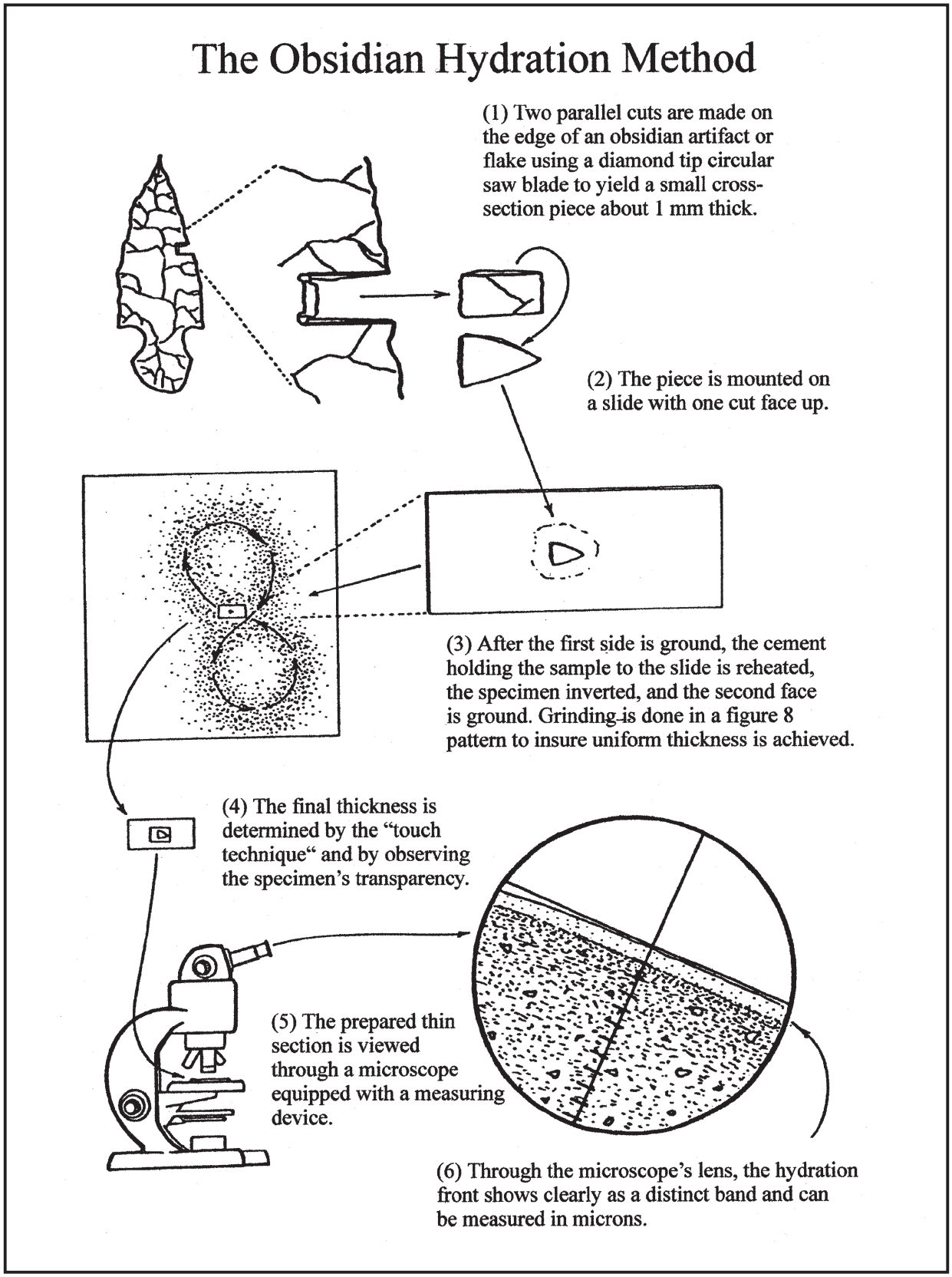


Figure II.4. Measuring Obsidian Hydration (adapted from an original drawing by Greg White)

rubidium, zirconium, strontium, and barium). This signature, or footprint, is compared to those previously identified for a region, and the glass source is identified.

During the early years of obsidian research, an *obsidian source* was defined as "a single event such as an obsidian-perlite dome, flow, aerial bomb scatter or sedimentary stratum containing obsidian" (Ericson et al. 1976:218, cited in Hughes 1998:3). Recent research, however, has revealed the situation to be more complicated. In the North Coast Ranges, Tom Jackson (1989) reported on the several new obsidian quarries in Napa Valley; while Sunshine Psota (1994) has focused on the distribution and use of non-quarry obsidian ("float") in northern Sonoma County. Richard Hughes points out that obsidians of different chemical types can sometimes be found together, redistributed far from their original eruptive home(s), while "geological processes involved in the formation of obsidians in ash-flow sheets may result in the distribution of multiple *primary sources* across vast geographic space" (1998:3). He concludes that "as a consequence of improved sampling and quantitative analysis, some of yesterday's sources have become today's *source areas*" (Hughes 1998:6). Although more accurate, this recognition has resulted in complicating the utility of some older analyses and requiring a change in the kinds of research questions that might be answered by obsidian source information.

Visual sourcing of obsidian items on the basis of a specimen's physical characteristics (e.g., gloss, color, degree of translucency, and presence/absence of inclusions) has become an effective and inexpensive alternative to XRF. Using trained personnel, visual-sourcing accuracy rates for the obsidians in north-central California are typically 90 percent or better. In practice at the ASC, obsidian items are visually sourced by two experienced researchers; a sample of the items that they cannot agree on is sent off for geochemical analysis (Psota 2002:15-3). While Hughes's observations about sources vs. source areas, above, are cause for concern, they echo other revelations in recent years, arguing for more cautious interpretation of study results.

The most important sources of obsidian for the PRNS-GGNRA are those in the North Coast Ranges: Annadel, just east of Santa Rosa; Napa Valley, at several locations in central Napa County; Mt. Konocti, at the southwest end of Clear Lake; and Borax Lake, in southeastern Clear Lake. Within the study area, obsidian materials are generally found to be from the Napa and Annadel sources.

Occasionally obsidian items from eastern Sierra sources, such as Bodie Hills and Casa Diablo, are found in Central Valley sites, with a few traveling on to the coast; the division between Bodie Hills and Casa Diablo obsidian is a latitudinal one, running from Mono Lake, with Bodie Hills restricted to the north and Casa Diablo to the south (Hildebrandt and Mikkelsen 1993:52-53).

Hydration Rate: Annadel and Napa Valley Obsidians

Many researchers today use obsidian-hydration analysis primarily as a relative dating method, but others have developed and employed various hydration rates—formulae that convert micron readings to absolute dates. One of the first and most widely used schemes is Origer's (1987) rate for Annadel and Napa Valley obsidians. Napa obsidian is prized by flintknappers today, as it apparently was prehistorically. Napa obsidian was once attributed only to Napa Glass Mountain in the east-central portion of the valley.

Materials that are visually and chemically identical or similar to the Glass Mountain materials have been discovered at flows further north along the valley, beginning in the 1980s (Jackson 1989). Due at least in part to its excellent quality, Napa obsidian had a broad distribution: It is abundant in many archaeological sites throughout the southern North Coast Ranges (during some periods, even at sites adjacent to the Annadel source, in eastern Santa Rosa), and became the dominant obsidian in the late period in the Delta and in the San Joaquin and Sacramento valleys. It is the primary source recovered from coastal Marin County and San Francisco Bay, although Annadel is not uncommon. The distribution of Annadel over time suggests that it was most widely used when Napa was not available due to political control or some other restriction. (This topic is discussed below under Exchange in Chapter 5.)

Using paired radiocarbon dates and hydration readings from stylistically distinctive projectile points found in conjunction with datable organic material—as well as dozens of readings from diagnostic points alone—Origer (1987) developed the hydration rates for these two sources and a correlation coefficient for comparing the two. Origer uses the diffusion formula as described by Friedman and Smith (1960), which states

$$T = kx^2$$

where: x = hydration band thickness in microns

k = constant

t = time in years before present.

The constants for Annadel and Napa Valley obsidian are

Annadel = 184.6

Napa Valley = 153.4

while the correlation coefficients are the following:

Napa x 0.77 = Annadel

Annadel x 1.30 = Napa

Intersource comparability was further served with the induced-hydration experiments by Kim Tremaine (1989), undertaken to develop comparison constants that could be used to convert one source to another. She concluded that Napa and Konocti hydrated at a virtually identical rate, while Annadel and Borax Lake are relatively slower and faster. Her comparison constants are presented below.

Napa Valley (NV) x 1.27 = Borax Lake (BL)	BL x 0.79 = NV
Konocti (K) x 1.27 = BL	K x 0.79 = BL
Annadel (A) x 1.61 = BL	BL x 0.62 = A
A x 1.30 = NV	NV x 0.77 = A

While these comparison constants are valuable for making general assumptions about a particular assemblage, they should be used with caution, the most serious criticism being "the need for comprehensive rate verification against archaeological materials of known (or indirectly well-established) age" (Hall and Jackson 1989:32).

In addition to intersource comparability, environmental variables have an important effect on the rate of hydration, especially temperature, which is assumed to be the most critical (although some researchers have argued that humidity is equally significant [Stevenson, Gottesman, and Macko 2000]). To control for temperature, Origer based his rates on net effective temperature (NET), which has come to be referred to as the effective hydration temperature (EHT). The EHT for Santa Rosa (17.1 degrees C) is considerably greater than that surmised for the coast. As no weather stations are present on the Pacific Coast near the Marin coastal sites that yielded materials for Origer's (1987) study, he used figures from stations at Fort Ross (12.4 degrees C) and Half Moon Bay (also 12.4 degrees C). Origer (1987:48) found that hydration rims on temporally diagnostic coastal specimens of Napa obsidian averaged about 15 percent smaller than their interior counterparts from the Santa Rosa Plain in Sonoma County. Thus, when using Origer's rate for obtaining absolute dates, or when simply bracketing the inferred cultural periods with micron readings, it is necessary to reduce the Santa Rosa readings by 15 percent for comparison with coastal specimens. Given the possibly greater than recognized influence of humidity, it may be that greater fog levels along the coast would reverse the trend somewhat, but this variable has not been well-studied.

The 15-percent correction factor noted above is based on a variety of observations made on obsidian collections from the eastern Sierra and central California sites. Origer (1987) and Basgall (1990) have argued that a 6-percent hydration rate correction factor should be used for each degree Celsius. As an example of the significant influence of temperature variation, Milliken notes that "according to the EHT correction theory, Casa Diablo obsidian would hydrate 32% faster in Santa Rosa than it does in Long Valley" (1997:48), a difference of more than 2,000 years for a 10-micron reading.

Some researchers question the value of correcting for EHT differences at all, when so many other variables are left uncontrolled. Jones and Waugh, for example, argue that the use of any rate does not reflect nonlinear, large-scale fluctuations in Holocene climate, "which can be considered for hydration studies as the equivalent of secular variation in ^{14}C" (1995:35). In addition, employing EHT corrections does not take into account microenvironmental conditions, which are believed to have considerable influence, particularly surface versus subsurface contexts. Although hydration-band development on the surface would clearly differ from that in subsurface settings, Jones and Waugh note that "there is no way of determining the length of time that any given specimen has spent above ground" (1995:35). They conclude, "Ultimately, there is little justification for considering obsidian hydration as reliable and precise as radiocarbon dating. Although the latter is not without its own problems, more of the variability associated with ^{14}C dating can be controlled than with hydration dating" (Jones and Waugh 1995:37). Nonetheless, many obsidian-hydration proponents disagree with this view and have continued their attempts to refine rates and model relevant variables.

Effects of Fire

The degree to which fire affects obsidian-hydration readings has been of interest for more than two decades, with a variety of studies run by private practitioners and personnel of state and federal landholding agencies. A major effort to amass research results on the topic was the 1999 symposium at the Society for California Archaeology's annual meetings

in Sacramento. The collected papers are presented in a recent volume subsidized by the Bureau of Land Management, Sonoma State University, and Origer & Associates (Loyd, Origer, and Fredrickson 2002). A number of management issues about the effects of fire are considered, including an overview of obsidian studies within Western United States parks, including the PRNS–GGNRA, by Roger Kelly (2002). Studies of rehydration after burning have been conducted over the years, the most notable being Sonoma State University's study of archaeological specimens from the Salt Point Fire on the northern Sonoma County coast of 1993, which burned over many archaeological sites. While measurable hydration was recovered from all 23 specimens collected before the fire, good readings were recovered from only 3 of the 21 specimens collected during the 1994 post-fire survey. These results reinforced the body of data showing the exposure to fire/heat removes visible hydration from obsidian specimens. Loyd's (2002) paper describes more recent laboratory studies on rehydration of burned obsidian, confirming that fire removes existing hydration bands, and that obsidian rehydrates after it has been burned. How many aberrantly young obsidian-hydration readings on morphologically older artifacts, or on nondiagnostic obsidian flaking debris, are in fact the result of rehydration in the past? How often has the clock been reset for some assemblages?

These findings point out a significant need to research the fire history of a study area and to consider rehydration as a possible explanation for aberrant hydration results. Re-analysis of previously tested collections may be warranted in some cases. NPS recently contracted with Sonoma State University to produce a document on fire management for the PRNS. See Shultz (2003) for discussion on these and other effects of fire on archaeological sites.

For a variety of discussions and information on obsidian-hydration dating, see the International Association for Obsidian Studies Web site (IAOS 2003) and two valuable compendia of obsidian research studies (Hughes, ed. 1984 and 1989).

CHRONOLOGY BUILDING: ISSUES OF TIME AND SPACE

As noted above, two aspects of chronology are sometimes treated as overlapping but are in fact distinct inquiries into the past: *cultural chronology* and *culture history*. Building chronologies for specific localities or regions is a major cooperative research effort that involves all practicing archaeologists in an area, either explicitly or indirectly. Various chronologies have been decried as stifling pigeonholing by some, have been blindly accepted by others, or have been patiently used as tools that need refinement as new data and new techniques arise. Chronologies are always necessary, since artifacts from a site or features within an archaeological deposit—such as hearths or housepits—are little more than curios without at least some ability to anchor them to a recognized time period.

Below is a brief history of chronology-building efforts that led to the development of the Central California Taxonomic System (CCTS) in north-central California in order to demonstrate the prevalent mood of the archaeological community at the time of the initial work at Point Reyes and to provide background for later developments that influence archaeology in the 21st century. As the only portion of the study area to give rise to formal

elements of the area's chronological sequence, the Point Reyes area will be focused on. The revisions to the CCTS by David Fredrickson and James Bennyhoff are summarized, followed by a culture-historical review of prehistoric times in the PRNS-GGNRA and environs.

A BRIEF HISTORY OF CALIFORNIA CHRONOLOGY BUILDING

Early Central California Work

Some of the first scientific archaeological explorations in California took place on the eastern shore of San Francisco Bay, when Max Uhle of U.C. Berkeley investigated the 30-foot-high Emeryville shellmound (CA-ALA-309) in 1902, in an attempt to identify cultural change in central California prehistory. While Uhle was able to identify two components with distinctive assemblages, his findings failed to impress Alfred Kroeber, chairman of the U.C. Berkeley Anthropology Department. Kroeber concluded that efforts should be shifted to ethnographic study of the remaining Indian elders rather than additional excavation. A few years later, Berkeley graduate student Nels C. Nelson conducted excavations at the shellmound in 1906 (Nelson 1996 [1906]) and salvage operations in 1907 at the even larger, well-stratified Ellis Landing site (CA-CCO-295), east of San Rafael in the Pt. Richmond area. The mound was of interest to university researchers because of the evidence of considerable bayshore subsidence since the first prehistoric occupation (Nelson 1910:358). Nelson found that artifact recovery was essentially the same "from the bottom of the refuse heap to the top" (1910:402) and concluded that there that there was cultural continuity throughout the Ellis Landing mound. The investigations were the first to document microconstituent change: a shift from an early dominance of mussel shell to a later dominance of clam, which Nelson attributed to environmental change. Also in this first decade of study, limited excavations were conducted at the West Berkeley site (ALA-307), which was more productively investigated later (Wallace and Lathrap 1975).

Between 1906 and 1909, during the same period as the Emeryville and Ellis Landing excavations and analysis, Nelson conducted his extensive survey of the entire San Francisco bayshore, as well as a short strip of the Marin coastline north of the bay and the San Francisco–San Mateo coastline south to Half Moon Bay, locating a total of 425 shellmounds. The shellmounds, ranging in height from a few inches to more than 30 feet and covering up to several acres, formed a ring around the bay. Dozens of sites were identified in Marin County at that time, whereas only a handful were found in San Francisco and the lower peninsula. Reporting on his shellmound survey at the end of the decade, Nelson noted that only 3 of the 425 known shell heaps had been carefully excavated, "and those three [West Berkeley (CA-ALA-307), Emeryville (ALA-309), and Ellis Landing (CA-CCO-295)] were unfortunately on the same side of the bay and not very far apart" (1909:311). By the following year, Nelson had doubled that figure and rectified the geographic bias, putting trenches in three Marin bayshore sites: MRN-3 at Sausalito, on the southern end of the peninsula; MRN-76 at Greenbrae; and MRN-315, known as the San Rafael mound, a few miles to the north. During the same period, a few sites were investigated in San Francisco—most notably the Bayshore Mound (CA-SFR-7) by Nelson in 1910 and, in the GGNRA, the Presidio Mound (SFR-6) near Crissy Field by Loud in 1912. To the south, near Half Moon

Bay in San Mateo, the Princeton Mound (CA-SMA-22) and other sites were investigated by Loud (1912, 1915). No reports of these investigations were published, and the prehistory of the West Bay and the southern ocean coast was to remain essentially unexplored for three decades, while archaeologists turned their attention to the interior.

Some surveys did continue on the Marin coast: Jesse Peter (1923), who later served as a naturalist at the Santa Rosa Junior College Museum, conducted surveys on Tomales Bay and elsewhere in Marin and Sonoma counties during 1911-1913. Commander S.F. Bryant, a retired Navy officer, surveyed the west shore of Tomales Bay by boat from the late 1920s into the 1930s. Neither of these surveys were published, although field notes and maps are on file at the Phoebe Hearst Museum at U.C. Berkeley (Bryant 1934; Moratto 1970a:98). Bryant also excavated a burial at the McClure site during this period, according to Duncan (1992).

The CCTS

Excavation did not continue in the Bay Area, where Kroeber discouraged further archaeological fieldwork by his students. Instead, the focus shifted to the San Joaquin–Sacramento Delta, where scholarly avocationalists had been amassing data from deep, stratified sites; subsequent work was conducted by junior college instructors and students, with only minimal involvement from the university. The most important site investigated was CA-SAC-107, the Windmiller site and the type site for the Early period, which yielded evidence of three cultural layers with contrasting assemblages, but several other sites along the Mokelumne and Cosumnes rivers were also excavated. By the late 1930s, the basic three-part sequence that was to form the Central California Taxonomic System (CCTS)—comprised of the Early, Transitional (later termed Middle), and Late periods—had been detailed in print (Lillard, Heizer, and Fenenga 1939; Lillard and Purves 1936).

These early excavations had no temporal framework against which to compare discoveries, and few guiding principles other than information gathering. As the sequence was based on a shell-bead typology devised by seriating beads from burial lots, the researchers acknowledged that the central California time periods were more a sequence of burial complexes than a sequence of prehistoric cultures (Lillard, Heizer, and Fenenga 1939:61). The main hypothesis being tested was Uhle's theory of evolutionary change on San Francisco Bay; because major evolutionary change, rather than incremental cultural change, was being sought, the proposition found little support.

BEARDSLEY'S REVISION OF THE CCTS

Richard Beardsley's U.C. Berkeley dissertation and subsequent monographs constituted the first major synthesis and organization of the central California database and the first focus on study-area archaeological sites in terms of their indigenous research values. His coastal information comes from investigations he and Robert Heizer conducted in 1940, prior to a hiatus during World War II (see below). Beardsley focused on the Marin peninsula in order to extend knowledge of culture horizons to a new area of central California. He also attempted to explore relationships (the extent and direction of the flow of information and materials) between provinces—the coastal (Marin), bayshore (Alameda), and interior valley. Referring to the Sacramento Valley area as "the kingpin of

Key for Figure II.5

Chart by J. A. Bennyhoff, 1972.

Fig. 3. Middle Horizon, Alameda District: Significant artifact types and temporal changes, from Patterson (Early-Middle Horizon Transition) facies to Sobrante facies (Late Middle Horizon), taken from representative sites. Olivella beads shown approximately actual size; relative scale attempted for remainder within related groups but not among different classes. Position of specimens shown within facies has no chronological significance. Bead typology from Lillard, Heizer, and Fenenga 1939. A, appliqué in asphalt decoration; C, *Haliotis cracherodii;* Ch, chert; E, trait persists from Early Horizon; F, "fishtail" charmstone; I, double-line facial incision; L, trait persists into Late Horizon; MA, Meganos Aspect (hybrid expression of Early and Middle Horizon cultures) trait; O, obsidian; Q, quartzite; R, *Haliotis rufescens;* U, haliotis unidentified. References to oyster, mussel, and clam indicate frequency of these mollusks in midden deposits through time.

1-12, olivella beads: 1,2. Split-drilled, Type 3b1; 3. Small spire-lopped, Type 1a; 4. Spire-lopped, Types 1a, 1b; 5. Modified "saddle," Type 3b2; 6. Small "saddle," Type 3b2; 7. Round "saddle," Type 3b; 8. Full "saddle," Type 3b; 9,10. "saucer," Type 3c; 11. Ring, Type 3c; 12. Tiny disk, Type 3d. 13. *Mytilus* disk bead. 14-16, haliotis beads: 14. Large amorphous beads, Type H4b; 15. Nacreous disk, Type H3a; 16. Large disk, Type H3b2. 17-21, haliotis ornaments. 22. Earspool with haliotis appliqué at one end. 23. Mica ornament. 24. Slate pendant. 25. Slate ring with olivella appliqué. 26. Slate pendant. 27. Steatite "constricted" beads. 28. Bone tubes, beads (often with olivella appliqué). 29. Antler pendant. 30. Perforated bone hairpin. 31. Flat bone pin. 32,33. Bone pendants. 34. Incised bone (pendant). 35. Long bipointed pin. 36. Bear tooth pendant. 37. Canid tooth pendant. 38-41. Bone, antler spatulae. 42. Perforated head scratcher (bone). 43. Forked head scratcher (bone). 44. Split rib strigil. 45. Long bird-bone whistle, central stop. 46. Short bird-bone whistle, central stop. 47. Human (?) tibia whistle. 48. Bird-bone whistle, end stop. 49. Slate bar with olivella appliqué. 50. Whole, fractured, quartz crystals. 51. Steatite or marble "cloud blower" (?), often with olivella appliqué. 52-56. Charmstones (52-54 with asphalted ends). 57-60. Chipped stone spear, dart points. 61. Obsidian knife. 62. Bone (ulna) flaker. 63. Antler tine flaker. 64-67. Bone atlatl spurs. 68. Antler wedge. 69. Sting ray spine. 70. Barbed bone fish spears. 71,72. Unbarbed bone fish spears (?). 73. Ground beaver incisor. 74. Bone (ulna) awl. 75. Cannonbone awl or punch. 76. Ground bone awl. 77. Serrated rib. 78. Serrated fish bone. 79. Serrated mammal scapula. 80. Bone fiber-stripper. 81. Shaped stone mortar. 82. Incised (decorated) stone mortar. 83. Boulder mortar. 84. Cobble pestle. 85-93, Mortuary complex (available data not precise—emphasis is on variable flexed and semiflexed positions, with presumed local or no fixed orientation): 85. Flexed, with orientation to NW and NE quadrants; 86. Ventral extension, a marker for Meganos Aspect, significant at site CCo-151, orientation to SW, NW, and NE quadrants; 87. Dorsal extension, of rare and scattered occurrence; 88. Orientation to SW and NW quadrants; 89. Orientation to all points except NE quadrant; 90. Orientation to all quadrants, varying site to site within facies; 91. Dorsal extension, rare; 92. Orientation to NW quadrant; 93. Cremation, confined to Patterson (Early-Middle Horizon Transition) facies.

culture sequence," he maintained that, "to work from the Valley toward the Coast is to progress from abundance and variety to rarity and simplicity" (Beardsley 1954:63). The apparent poverty of the coastal assemblages was, in part, a function of the formation processes inherent in shell middens—the high proportion of dietary debris (in contrast to that in soil middens) tended to dwarf the occurrence of formed artifacts. (See discussion of site-formation processes, Chapter 4.)

As a part of his effort to better define cultural difference over time and space, Beardsley reanalyzed burial data from 33 sites within a 100-mile radius of the bay. He divided the area into *facies* (a series of closely related, contemporaneous settlements), which were grouped on the basis of cultural resemblance to form *provinces.* Beardsley identified two facies for San Francisco Bay: Ellis Landing (CCO-295), typifying the Middle horizon, and Fernandez (CCO-259), the Late horizon. On the Marin coast at Point Reyes, he identified an undifferentiated Middle-horizon facies, McClure, and two distinct facies in the Late horizon: Mendoza and Estero. Although he surmised that coastal areas were inhabited contemporaneously with the known cultures of the Sacramento Valley (Beardsley 1954:2), he found no evidence in Marin of a culture coeval with the Early period. On the San Francisco Bay, however, he identified five sites that had yielded suggestions of the Early horizon on the bay: the Ponce, Newark, and Ellis Landing sites with their ventrally extended sub-mound burials, and the Emeryville and West Berkeley sites with Early-period Haliotis beads (Beardsley 1954:84).

Using Beardsley's scheme, Bennyhoff created a painstakingly detailed schematic of the cultural chronology for a number of major districts in central California; the chronology for Marin, San Francisco, and San Mateo was too poorly known for this treatment, but one of the Alameda district schemes (Figure II.5) demonstrates some of the artifact chronology for the study area.

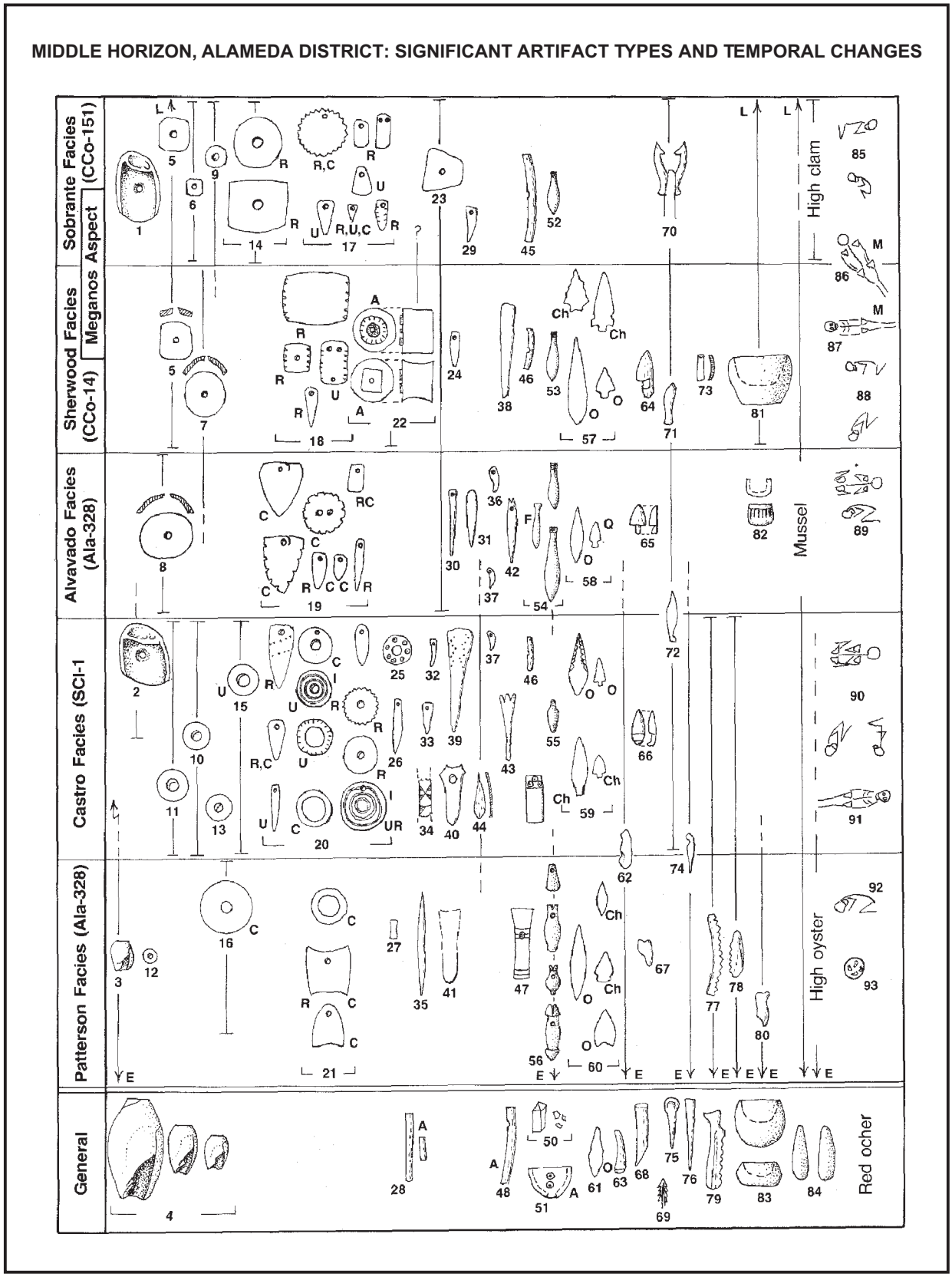


Figure II.5. A Cultural Sequence Diagram for the Alameda District by James Bennyhoff (in Elsasser 1978:38-39)

The PRNS and Beardsley's Scheme

The new data Beardsley reported resulted from investigations that he and Berkeley's Robert Heizer had conducted since 1940 with university field crews. Four Point Reyes sites received the most intensive investigations (Figure II.1). These were the Mendoza site, MRN-275—a shell deposit resting on a terrace that flanks either side of the mouth of an intermittent stream, in a sheltered area on Drakes Bay; the Cauley site, MRN-242—a rich shell-midden deposit on the top of a 40-ft. cliff, overlooking the Drakes Estero bayshore; the Estero site, MRN-232—in a similar cliff-side setting on the eastern shore of Limantour Estero (Beardsley 1954:22); and McClure, MRN-266, an unusual site in both setting and content. The only one of the four extensively excavated sites that is on Tomales Bay, MRN-266 is 12 miles overland north from the mouth of Drakes Estero, in a well-sheltered cove opposite Toms Point. It was set apart by its favored setting, its deep deposits, and its indications of antiquity.

At the same time, limited testing was undertaken at nine other sites. These included minor excavations in 1940-1941 at three sites that were of special interest, and are described in his monograph (Beardsley 1954:24-25): the Hall site (MRN-301, a small midden on a stream terrace at the western edge of Drakes Estero, which yielded a human burial; and the Bear Valley site (MRN-271/H) and Hidden site (MRN-274), both slightly south of Drakes Bay proper, near the outlet of streams. The former site is a large site of special interest because it is linked with the head of Tomales Bay by its stream valley and a low pass northeast into the Tomales Bay drainage. Also mentioned is MRN-278 near Kehoe Beach (Beardsley 1954:22); and the Toms Point site (MRN-201), which Van Dyke (1972:68) states is Late period, and which Compas (1998) identifies as an important historic-period location. There is also MRN-235, which Duncan (1992) reports was excavated at the same time.

From six of the excavated sites (CA-MRN-232, 301, 271, 236, 242, 274) Heizer and Beardsley recovered 69 fragments of Chinese porcelain and 38 bent iron spikes (Moratto 1974:56), confirming the contact between Coast Miwok and 16th-century Europeans. Initially, the European and Asian artifacts were seen as providing "a precise chronological datum 350 years in the past for the cultural assemblages of these settlements" (Beardsley 1954:54). Together with glass trade beads dating to after 1850, the 16th-century bracketed the historic period at Point Reyes. By the 1960s, however, the goal had changed from a focus on indigenous archaeology to an effort to distinguish between artifacts from the Drake and Cermeño expeditions, and to the activities of the Drake Navigators Guild. (See Douglass, this volume, for more on this maritime focus at PRNS.)

Beardsley was primarily interested in the pre-contact deposits at Point Reyes. Of the four main sites intensively excavated, all but the Mendoza were found to have at least two components, which Beardsley identified as A and B (Table II.2). The B components were representatives of Beardsley's McClure facies, whose type site was at CA-MRN-266 on Tomales Bay. They shared the basic traits of the Ellis Landing site (CA-CCO-295) in Richmond and the Morse site in the Delta, the Middle-period type site. Because relatively few burials (only 41) had been recovered from the Marin sites, Beardsley included an analysis of the 137 burial lots at CA-SON-299 (Kelly's ethnographic *Kili)* on Bodega, which he attributed to the McClure facies.

Table II.2. Archaeological Sites Excavated by Beardsley/Heizer (1940-41) at Point Reyes

Site	Location/Setting	Description	Assignment
***MRN-232, Estero site	top of 25 ft. cliff on Limantour Estero (nearest creek 1 mile)	rich shell midden	A - Estero facies (Phase 2) site type B – McClure facies
***MRN-242, Cauley site	top of 44-ft. cliff overlooking Drakes Estero	rich shell midden	A – Estero facies B – McClure facies
***MRN-266, McClure site	in well-sheltered cove on west side of Tomales Bay	rich shell midden	A – Estero facies B – McClure facies (Middle period) site type
***MRN-275, Mendoza site	Both sides of sheltered intermittent stream on Drakes Bay		A – Mendoza facies (Phase 1) site type
**MRN-301, Hall site	stream terrace, estern edge Drakes Estero	small midden (human burial)	none noted
**MRN-271/H, Bear Valley site	south of Drakes Bay, near outlet of stream	large site (at head of Tomales Bay drainage) – human burial	Late period
**MRN-274, Hidden site	south of Drakes Bay, near outlet of stream	not noted	none noted
**MRN-278, no name	ocean coast near Kehoe Beach	small, hardpacked, ith hammerstones and choppers	Possibly McClure facies
*MRN-201, Toms Point	east side of Tomales Bay	not noted	Late period (from Van Dyke 1972)

*Minimal tests
**Minimal tests of special interest
***Intensively excavated

There is some vagueness about the role of the next phase, the Mendoza facies that is the equivalent of Phase 1 of the Late period, with its site type on the bay at Emeryville (ALA-307). Beardsley considered Mendoza to be "contemporaneous with or earlier than Estero Facies; if it is earlier, the evidence suggests that it terminated before the seventeenth century. But on the evidence in hand, Mendoza Facies remains a partly hewn block which we are ready to fit near the top of the culture column but for which we find no ready made niche" (1954:62). In his analysis of Marin County settlement, Van Dyke comments on the confusion: "In usage, the Mendoza Phase has consistently been applied to any component demonstrably deficient in McClure traits and not young enough to be sufficient in Estero Phase materials" (1972:88). Van Dyke concluded that there might be two phases

of the Mendoza phase, "the earlier of which is not documented for the coast, but which is postulated on the basis of the late occurrence of the Mendoza Phase at that locality" (1972:91). Mendoza is treated below as a distinct entity, but an important research question that is raised here for the Pt. Reyes area is the nature of the transition between the McClure and Estero occupations and what this means for culture change and/or land use in the period just before contact.

The Estero phase is the most recent (equivalent to Phase 2 of the Late period), known by a complex of well-defined traits that make up the "clamshell disc-bead complex"; Van Dyke (1972:131) notes that there were no bayshore expressions of the Estero phase at the time of Beardsley's work (a fact that gave rise to speculations about the abandonment of the bayshore in the protohistoric period), but that such sites are well documented today. Phase 2 is considered to be protohistoric, representing the lifeways that could still be evidenced at the time of first Spanish settlement. On the Marin coast, this begins with the 16th-century English and Spanish visits and ends around the early 19th century, when mission influence began to have its effect. The diagnostic traits of the various facies in Beardsley's coastal Marin scheme are presented in Table II.3.

REVISIONS TO THE CCTS

Some New Approaches

Revisions to Beardsley's scheme began soon after its publication. In the North Coast Ranges, Clement Meighan (1955)—who had excavated at the Estero site (MRN-232) and nearby MRN-307 in 1949-1950, focusing on Chinese porcelain and other 16th-century artifacts—developed a cursory scheme incorporating data from Mendocino and Napa counties and the McClure site from Marin. The phrase "McClure complex," which is found in the older literature, dates to this effort.

Meanwhile, in the late 1950s, archaeological work was revitalized in the San Francisco Bay area. Bert Gerow of Stanford University (who has been credited with the label CCTS [Hughes 1993:1]), excavated the University Village site (CA-SMA-77) in bayshore San Mateo, where a mortuary complex that he termed the Early Bay Culture—contemporary with the Windmiller phase of the Early horizon—was found to date between 2000 and 1000 B.C. (Gerow with Force 1968:99). Gerow then identified other Early Bay Culture sites on the basis of archived field notes and manuscripts: West Berkeley and possibly the lower unexamined levels of Ellis Landing. More recent studies have established human presence on the bayshore beginning at 3000 B.C. or earlier (Bickel 1978a:10, 1978b; Henn, Jackson, and Schockler 1972:209; Moratto 1984:266-267, 274). Bennyhoff (1982 pers. comm.; 1994:Figure 8.1) has proposed that the lower, unexamined levels of the McClure site at Point Reyes may also represent an Early-period component.

Additional excavation occurred at Point Reyes in accordance with the proposed National Seashore, after the First NPS contract for archaeological investigations at Point Reyes was made with Adan Treganaza of San Francisco State University in December 1963. Treganza was to excavate three sites: MRN-216 and -298 on Limantour Spit, and –222 on Marshall Beach. At the same time, he proposed to conduct a survey of all historic and prehistoric remains in the proposed seashore. Although the survey could not be

Table II.3 – Diagnostic Traits of Coastal Marin County Facies

(Moratto 1970b:263, after Beardsley 1954)

	McClure Facies	*Mendoza Facies*	*Estero Facies*
Central California Concordance	**Middle Horizon**	**Late Horizon: Phase 1**	**Late Horizon: Phase 2**
Disposal Pattern	Primary interment; high frequency of funerary offerings; beds of red ochre	Primary inhumation and cremation; numerous "killed" show mortars	Mostly cremations; associations are frequent
Artifacts	1. Infrequent round-bottom mortars	Flat-based show mortars	Flat-based show mortars
	2. Shaped pestles	Shaped pestles	Rare flanged pestles
	3. Numerous crude stone sinkers		
	4. Net mesh gauges		
	5. Long, heavy projectile points; use of atlatl?	Small projectile points of obsidian; triangular body	Small obsidian projectile points with square serrations
	6. Some points with slight shoulder		Points often triangular with corner notches
	7. Finely chipped stone drills		
	8. Quartz crystals with pitch		
	9. Abundant bone artifacts: tubes, head scratchers, needles, awls, chisels, daggers, etc.	Relatively few bone artifacts; hairpins, awls, needles	Tubular bird-bone artifacts are common: pyro-incised tubes, bird-bone whistles, bone beads
	10. *Olivella* A1, F3a, G1, G2a	*Olivella* A1, G2a, E1	*Olivella* E2
	11. –		*Tivela* tubular beads; great numbers of clam disk beads; steatite and magnesite beads.
	12. Rectangular *Haliotis* ornaments		Banjo-shaped and triangular *Haliotis* pendants.
	13. Baked-earth steaming ovens		Historic spikes, porcelain, trade beads, glass.

conducted due to Treganza's failing health, the Limantour sites were extensively excavated, in conjunction with Santa Rosa Junior College investigations. While the studies resulted in a compendium of archaeological, environmental, and ethnographic findings at the PRNS (Schenk 1970), including the results of investigations at Limantour Spit, there was no attempt made to revise or otherwise contribute to the prevailing cultural chronology.

Fredrickson's Chronological Sequence

During the 1960s, archaeologists broadly applied the CCTS, with its Early, Middle, and Late horizons, noting the extreme variability that was revealed as archaeological investigations accelerated. During informal debates that took place at U.C. Davis in the late 1960s, a more extensive and integrated revision of the CCTS was developed and later documented by James Bennyhoff and David Fredrickson (1969). One of the most influential writings in archaeology at the time, Willey and Phillips's (1958) *Method and Theory in American Archaeology,* served as an inspiration and guidance on culture-historical integration. The new scheme was an attempt to dispense with the restrictive temporal labels of Early, Middle, and Late (since earlier occupations were known to occur outside the Bay Area), and to ameliorate the confusion caused by the use of terms that could not be integrated into a larger, more general framework (Bennyhoff and Fredrickson 1969:16). The revised scheme (see Figure II.6) had much greater flexibility, including an ability to look at inter- and extra-regional interaction, and to incorporate non-artifactual variables, including behavioral and adaptational ones—such as the degree of sedentism and the presence/absence of individual specialization (Fredrickson 1994:95, 99). Their scheme was devised for central California as a whole. Because it was first presented in Fredrickson's (1973a) dissertation, which focused on the North Coast Ranges, and immediately revised the following year (Fredrickson 1974), the scheme has gained more widespread acceptance in that region and the North Bay than in the central and southern Bay Area. While known as Fredrickson's chronological sequence, and referred to that way below, Bennyhoff's significant input has long been credited by Fredrickson and is now formally recognized (Hughes ed., 1994).

Of vital importance to chronology is the theoretical basis of its divisions. In their analysis of chronologies in the Yosemite region, Hull and Moratto characterized some of the confusion that has stemmed from problems with nomenclature: "Arrayed in time (and space) are the archaeological manifestations of human behavior, including artifacts, features, assemblages, components, and other taxonomic entities. Unfortunately, these terms are often misapplied, resulting not only in conceptual and methodological confusion but also misinterpretation of the archaeological record" (1999:68). The nomenclature employed in the Fredrickson and Bennyhoff scheme is described below to help avoid such confusions.

The Time Dimension—The Period

The first organizing element of the Willey and Philips scheme is the stage, which Fredrickson replaced with the *period.* California's prehistory was divided into four major chronological periods, with each named for the dominant adaptive mode, each with its distinctive social, technological, and material traits (see Figure II.7): the Paleo-Indian period, the Archaic period—with its Lower, Middle, and Upper sub-periods, and the Emergent period. The division of California prehistory into major periods functions much the same

			GEOGRAPHIC PROVINCE					
PERIOD	**DATE B.C.**	**PATTERN** (boundary = ▬)	**LAKE COUNTY**	**CENTRAL SONOMA COUNTY**	**SONOMA AND MARIN COAST**	**Nnapa COUNTY**	**SAN FRANCISCO BAY AREA**	
EMERGENT	PHASE II PHASE I A.D. 1000	AUGUSTINE PATTERN	Clear Lake Aspect	Gables Aspect Rincon Aspect	Estero Aspect Mendoza Aspect	St. Helena Aspect	Emeryville Aspect	
UPPER ARCHAIC	**A.D.** **B.C.** 500	BERKELEY PATTERN	Houx Aspect	Laguna Culture	McClure Aspect	Houx Aspect	UPPER BERKELEY PATTERN	Ellis Landing Aspect Berkeley Aspect
MIDDLE ARCHAIC	3000	MENDOCINO PATTERN	Mendocino Aspect	Black Hill Culture	?	Hultman Aspect	LOWER BERKELEY PATTERN	University Village (CA-SMA-77)
LOWER ARCHAIC	6000	BORAX LAKE PATTERN	Borax Lake Aspect	Spring Lake Culture	?	?	Blood Alley (CA-SCL-64)	
PALEO-INDIAN		WESTERN PLUVIAL LAKES TRADITION	Post Pattern	Laguna de Santa Rosa?	Duncan's Landing (CA-SON-348)	?	?	

Figure II.6. Cultural Sequences in the Southern North Coast Ranges and the San Francisco Bay Area

as the traditional horizon framework of the CCTS, except for the crucial difference that the temporal dimension is kept separate from the cultural one. The Middle Archaic roughly corresponds to the Sacramento Valley's Early horizon, the Upper Archaic to central California's Middle horizon, and the Emergent period to the Late horizon. Two additional terms are proposed: protohistoric and historic, the former referring to the cultural period immediately prior to historic contact, coterminous with the Upper Emergent (Fredrickson 1973b:39-40). Two major criticisms of the period concept have been levied: (1) that the concept implies "evolutionary directionality"—that is, that periods are seen as inevitable steps toward some ultimate goal (Fredrickson 1994:99-101; Jones and Hayes 1993:202); and (2) that it confounds time with culture, thus eliminating the possibility of synchronic variability (that is more than one co-occurring cultural mode in a given location]e.g., White and Fredrickson 1992]). It should be noted, however, that it is the *dominant* stage that is of interest; it is quite possible, for example, for a group with an Archaic-type economy to exist side-by-side with an Emergent-period culture (see Modeling Variability below).

Analytical Units

Because the concept of the period refers primarily to time, another integrative unit was necessary to fulfill the cultural dimension of the horizon concept. This is the *pattern*, the archaeological unit out of which various phases and aspects are abstracted. "Inherent in the concept are a number of separate, coexisting societies, each of which possess to a greater or lesser extent similar characteristics. The pattern, then, is a way of life shared by a number of different peoples residing in a particular geographic space" (Fredrickson 1973b:40). Reflecting the variability among ethnographic groups at the time of contact, a number of separate but interrelated archaeological patterns exist within the central California subarea (see Figure II.6).

A pattern is characterized by

- similar technological skills and devices (specific cultural items);
- similar economic modes (production, distribution, consumption), including especially participation in trade networks and practices surrounding wealth; and
- similar mortuary and ceremonial practices.

The geographic scope can be quite broad: the Berkeley pattern, occurring at a time of inferred Miwokan expansion, was the most extensive identified for central California, prevailing from the Sacramento–San Joaquin Valley, through the Delta, up to Clear Lake and Lake Sonoma in the southern North Coast Ranges, and throughout Marin County and the rest of the Bay Area. The pattern is defined as generally as possible; it is the unit—along with the period—that is most readily identifiable by the archaeologist in the field (Fredrickson 1973b:43). As more is understood about a location's prehistory, the more distinctive smaller units (first aspect, then phase) can be identified. (Note that Fredrickson replaces Beardsley's "facies" with "aspect," thus the PRNS sequence consists of the McClure aspect, the Mendoza aspect, and the Estero aspect.) The *phase* is the smallest unit and is identifiable on a district level (see below). "To a large degree, phase distinctions involve recognition of cultural differences comparable to those made between two adjacent societies within a common environmental setting" (Fredrickson 1973a:101); put another

		Period Characteristics
1800	Emergent Period Upper	Clam disk bead money economy appears. More and more goods moving farther and father. Growth of local specializations re. production and exchange. Interpenetration of south and central exchange systems.
1500	Emergent Period Lower	Bow and arrow introduced, replace dart and atlatl; south coast maritime adaptation flowers. Territorial boundaries well established. Evidence of distinctions in social status linked to wealth increasingly common. Regularized exchanges between groups continue with more material put into the network of exchanges.
1000	Upper Archaic Period	Growth of sociopolitical complexity; development of status distinctions based on wealth. Shell beads gain importance, possibly indicators of both exchange and status. Emergence of group-oriented religious organizations; possible origins of Kuksu religious system at end of period. Greater complexity of exchange systems; evidence of regular, sustained exchanges between groups; territorial boundaries not firmly established.
A.D. / B.C.		
500	Middle Archaic Period	Climate more benign during this interval. Mortars and pestles and inferred acorn economy introduced. Hunting important. Diversification of economy; sedentism begins to develop, accompanied by population growth and expansion. Technological and environmental factors provide dominant themes. Changes in exchange or in social relations appear to have little impact.
3000	Lower Archaic Period	Ancient lakes dry up as a result of climatic changes; milling stones found in abundance; plant food emphasis, little hunting. Most artifacts manufactured of local materials; exchange similar to previous period. Little emphasis on wealth. Social unit remains the extended family.
6000	Paleo-Indian Period	First demonstrated entry and spread of humans into California; lakeside sites with a probably but not clearly demonstrated hunting emphasis. No evidence of a developed milling technology although cultures with such technology may exist in state at this time depth. Exchange probably ad hoc on one-to-one basis. Social unit (the extended family) not heavily dependent on exchange; resources acquired by changing habitat.
8000		

Figure II.7. Hypothesized Characteristics of Prehistoric Cultural Periods in California (from Fredrickson 1994:100)

way, the phase can be seen as the archaeological equivalent of the tribelet. Note that in practice, "*the pattern is not built up of aspects, but that aspects and their constituent phases are analyzed out of the more general pattern" (*Fredrickson 1973b:43; emphasis in original).

The Spatial Dimension—Districts, Localities, and Sites

The spatial dimension also takes a nested, three-part form. The *district* is the geographic space that is larger than a locality but smaller than a region. "In ethnographic terms in California the unit exhibited within districts is possibly related to the ease of linguistic communication plus factors such as a dance and ceremonial exchanges documented for the Kuksu and Ghost Dance" (Fredrickson 1973a:95). The *locality* nests in between; while some have defined it as the space that might be occupied by a single community or local group (Willey and Phillips 1958:18), Bennyhoff and Fredrickson (1969, in Fredrickson 1973a:94) suggest that the locality usually reflects cooperating groups of tribelets. Within each locality are a number of archaeological sites. Simply defined, a *site* is "a discrete area fairly continuously covered by remains of former human occupation or providing evidence of human activity" (Bennyhoff and Fredrickson 1969, cited in Fredrickson 1973a:94).

Patterns and periods are discernible in the field: by noting the kinds of artifacts and features present, the archaeologist will propose, for example, that a particular deposit is a Berkeley pattern site. The other elements of chronology building take place at the level of the laboratory and the desk, and can occur only after a great deal of groundwork has been laid. They involve the identification, definition, and dating of site components. Each archaeological site—a three-dimensional physical deposit—contains one or more *components*, which have been defined as "the physical (and inferred cultural) association of a temporally related aggregate of artifacts, features, and residues found in a (relatively) stratigraphically discrete context" (White and Meyer 1998:100). Integrity—both a site's physical condition, as well as its ability to express its significance—is therefore essential to a site's research potential. To be taxonomically useful, each component must be composed of the material remains representing a discrete time span of residence or other use at a specific location, defined either vertically or horizontally. The *component assemblage* is a fundamental archaeological building block (Willey and Phillips 1958:21-22), being a *unit of contemporaneity* (Fredrickscon 1994b). Once a series of component assemblages has been defined and the elements reliably dated, then assemblages can be assigned to discrete cultural groups—from largest to smallest: patterns, aspects, and phases.

SOME PROBLEMS WITH CHRONOLOGY USE

Some Misapplications

Cultural chronologies, in both their development and their use, can be laden with problems. Because such fundamental devices are mandatory for all higher-order interpretation, it is important to recognize the pitfalls inherent in their use. In Framework for Archaeological Research and Management, the general research design devised for the north-central Sierra Nevada U.S. Forests, Jackson (1994:10-12) has identified the following as some of the sources of confusion in that region:

1. taxonomic systems used to develop cultural chronologies and the varying intents or goals of those systems;
2. acceptance and application of temporal types [that were] developed in adjacent regions to the north-central Sierra;
3. uncritical use and acceptance of purported associations between radiometric and other archaeological data;
4. limitations of the chronological information sources; and
5. embedding of tentative or poorly supported dates in the archaeological literature [1994:10-12].

All of these problems are apparent in coastal and Bay Area archaeology as well, although outside influences are less likely to occur along the coast, with its circumscribed western boundary. Embedding of tentative or poorly supported dates in the literature is rampant throughout California, partly a function of the relatively long period of avocational work in the state, followed by a bustling period of earnest but uncoordinated activity up until the early 1970s, much of it conducted under processual archaeology's early optimism.

A local example is Van Dyke's use of Beardsley's coastal terminology for the Coast Miwok territory on the bay. He applies the name McClure phase to the Berkeley pattern sites in Tiburon (Van Dyke 1972:96), an association that may have no genetic reality. Many researchers have concluded that until sufficient excavation, interpretation, and comparative analysis have been done in a given area, more general terms (such as Beardsley's Middle horizon or Fredrickson's Berkeley pattern) are more appropriate. The fact that two sites possess assemblages with a few shared traits may simply be a function of contemporaneity (sharing in the material culture available at that time—that is, belonging to the same pattern) rather than a cultural or biological relationship. Indeed, many archaeologists today are skirting the issue of precise names, particularly in the San Francisco Bay Area (see below).

Modeling Diversity – Some Changes

From the diagrams above, it is clear that cultural sequences are often presented as though they were unvarying, unilinear steps on a course to the future. Suddenly in the 1980s, in a series of new discoveries that constituted a small-scale paradigm shift for California archaeologists, it was recognized that much greater variability was present in north-central California and the North Coast Ranges than previously thought. In Lake County, White proposed that "two cultural entities, marked by dissimilar stylistic assemblages and stages of technological development, coexisted in Clear Lake basin throughout much of the Middle and Upper Archaic" (White and Fredrickson 1992:38). At about the same time, evidence for similarly "contemporaneous, adaptively asymmetrical cultures" (White and Fredrickson 1992:37) had come to light in the Laguna de Santa Rosa area of Sonoma County (Wickstrom 1986:40-42), while in Humboldt County in the north, Hildebrandt and Hayes (1984) identified the contemporaneity of patterns ordinarily assigned to the Lower and Middle Archaic periods. This accumulated evidence of the plurality of prehistoric cultures in the North Coast Ranges, particularly during the Upper Archaic period, resulted in a call for a radical restructuring of the scheme (White and Fredrickson 1992). Around the same time, Psota (1994) identified evidence of two contemporaneous, culturally dissimilar groups at Jimtown in Sonoma County, while Stewart (1993) re-interpreted the Warm Springs Dam/Lake Sonoma data in terms of cultural diversity, arguing for the contemporaneity of Lower and Upper Archaic assemblages. Near the southern portion of the general study area, Hylkema's (1991) study of the coastal archaeology of Santa Cruz identified the co-occurrence of different adaptive modes sharing that region. While such diversity has long been acknowledged (e.g., Julian Steward's [1955] multilinear evolutionary model), researchers were stimulated by the new possibilities for revision after encountering archaeological evidence of dissimilar contemporaneous occupations where two linear ones had been supposed. The value of keeping such diversity in mind when reanalyzing old sites and looking at new ones is considerable. For example, Van Dyke's (1972) statement regarding the Mendoza facies' uncertain position at Point Reyes might be more closely examined with the idea of diversity in mind.

With the new variability identified in the region, the definition of a district clearly required revision, as the district's definition included the concept that "only one phase exists in one district at any one time" (Fredrickson 1973a:95). The reorganization by White and Fredrickson (1992:38) included the following revisions to the taxonomy:

1. The definition of spatial units—*Area, Region, District, Locality*—remains largely unchanged, but in the new framework, spatial units are regarded as biogeographic/physiographic study zones rather than coterminous with cultures.
2. Criteria for the *Phase* remains the same, except that its spatial distribution can no longer be regarded as homologous with aspect boundaries.
3. The *Aspect* is no longer regarded as being "composed of a unique sequence of phases," but rather as being made up of related sets of phases.
4. The concept of the *Pattern* is retained, but now includes the following new emphasis:

   > As originally conceived, the definition of *Pattern* and *Aspect* focused on techno-economic criteria. . . . The pattern and aspect units are reconfigured to reflect their larger meaning, in some respects parallel to the 'interaction sphere' (Caldwell 1958), with the aspect representing more direct, and the pattern more diffused interaction links [White and Fredrickson 1992:38].

NOMENCLATURE USED IN THIS OVERVIEW

In the current study, Fredrickson's framework and nomenclature are used whenever appropriate. For locales where very little information is available (e.g., coastal San Francisco/San Mateo), no aspect or phase identifications are attempted; instead the period names (e.g., Upper Archaic, Lower Emergent) are used, intending them as strictly temporal markers unless otherwise stated.

It should be noted that many archaeologists prefer to use very general labels for temporal and cultural units in the Bay Area, especially on the Bay and south of the Golden Gate. Most common is a simple Early, Middle, Late-period scheme mentioned in the Introduction to this overview. To incorporate periods predating the Early period, the designations for the Pleistocene and Holocene are used.

While no efforts have apparently been made to develop geographically and archaeologically broad cultural chronologies since Fredrickson and Bennyhoff's scheme, some individual researchers have contributed detailed studies of localities. Notable is Rosenthal's (1996) *A Cultural Chronology for Solano County, California.* Specifically applicable to the GGNRA is Hylkema's (2003) "Tidal Marsh, Oak Woodlands, and Cultural Florescence in the Southern San Francisco Bay Region" (too recent to incorporate in this study). A detailed chronology based on shell bead types was presented by Milliken and Bennyhoff (1993) and is regularly in use by many researchers. The sequence they offer is as follows:

A.D. 1800	Historic Period
A.D. 1500 to 1800	Late Period Phase 2
A.D. 1100 to 1500	Late Period Phase 1
A.D. 700 to 1100	Midde/Late Period Transition
A.D. 300 to 700	Upper Middle Period
500 B.C. to A.D. 300	Lower Middle Period
3000 to 500 B.C.	Early Period

(Note that some researchers [e.g., Hildebrandt and Mikkelsen 1993] see no reason to segment the Middle period, using instead a single range from 500 B.C. to A.D. 700.) Human occupation in California preceding this scheme is often referred to using geologic time—the Early Holocene: ca. 6000 to 3000 B.C., and the Holocene/Pleistocene Transition: ca. 10,000 to 6000 B.C. These and the designations above will be regularly seen in the literature when a relatively precise time period, but no precise cultural affiliation, is implied. Others precede the Early period with Fredrickson's cultural periods:

3000 to 500 B.C. – Middle Archaic Period (coterminous with Early Period)

6000 to 3000 B.C. – Early Archaic Period

8000 to 6000 B.C. – Paleoindian Period

TRIGGERS OF CULTURE CHANGE ON THE COAST

Narratives of culture history in north-central California have been developed for the North Coast Ranges and the Central Valley, but the San Francisco Bay and the coastal areas have produced too few data for detailed characterization. It has been recognized that "coherent, detailed diachronic models incorporating tangible settlement and subsistence data are largely lacking at San Francisco Bay" (T. Jones 1992:15). Instead, interpretations have focused on an interest in linguistic prehistory—primarily concern with the nature and dating of the introduction of Utian-speaking peoples into former Hokan-speaking territory (Breschini 1983; Gerow, with Force 1968; Moratto 1984). This interest in population movements is also prominent in other areas of the north half of the state, particularly in Clear Lake and the Sierra foothills (Fredrickson 1973a; Moratto 1984; Moratto, King, and Woolfenden 1978; White and Fredrickson 1992), where the theme is frequently linked to various paleoenvironmental shifts.

These often-interrelated triggers of culture change are discussed briefly before outlining the culture history of the study area.

PALEOCLIMATIC CHANGE

It is assumed that a change in climate—the glacial melt that resulted from global warming at the end of the Pleistocene—was the initial trigger that allowed and encouraged the human migration into the New World. Since then, various paleoclimatic shifts exerted stresses and offered opportunities to human populations. The gradual rise in sea level

and creation of San Francisco Bay (reaching its full extent beginning about 7,000 years ago [Bickel 1978]) were followed by the maturing of the Bay estuaries (see Meyer, this volume), which helped support the large populations occupying the substantial shellmounds of the East Bay. The Early Holocene climate would have been beneficial to human occupation and colonization, while ancient lakes contributed to ecological diversity. Perhaps the most significant period of climate change (although disputed by some researchers) after the settling of the Bay has been called the Altithermal, a time of inferred very warm and dry climate dating from around 5,500 to 3,000 years ago. A subsequent period of greater moisture and more abundant resources is believed to have unleashed some broad-scale population movements in north-central California (described as the Miwokan expansion below). Finally, a bimodal period of extreme drought, named the Medieval Climatic Anomaly (Stine 1994), has been dated from A.D. 900 to 1150 and again from A.D. 1200 to 1350. Widespread evidence of the Anomaly makes it one of the best-documented shifts in the region.

Models relating language-group movement and replacement to paleoclimate change are particularly well-developed for the Sierra Nevada (e.g., Moratto, King, and Woolfenden 1978), where elevational differences and shifting aspects result in a patchwork of microclimates and there is direct contact with the Great Basin. In coastal settings a more homogenized climate prevails; according to Jones, "group intrusions are here considered a relatively late outgrowth of population stress, resulting from human or environmentally-induced resource depletion. . . .[nonetheless,] high intensity/short duration environmental oscillation like red tides, El Niños, or river meanders could exacerbate resource stress and force abrupt population movements" (1992:5). Despite the climatic amelioration due to the marine influence, the cultural effects of more severely affected adjacent zones—as far away as eastern Oregon and the western Great Basin—ultimately reverberated on the Bay. In cases of extreme population stress along the coast, competition could result in firmer boundaries, heightened hostility, and forced intrusions into occupied territory.

While responses to climatic change might have often resulted in in situ cultural adjustments, the prevailing models in California prehistory involve population movements, as the examples above demonstrate. Some of these scenarios are presented below.

POPULATION MOVEMENTS

California is known for its linguistic complexity. A "tangle of languages, perhaps in some ways the most complex of all [on the continent], was found in the California culture area until the European conquest. . . . Over the mountains, valleys, and deserts of the area were spread no fewer than 64—and perhaps as many as 80—mutually unintelligible tongues, further differentiated into an unknowably large number of dialects" (Shipley 1978:80). For the archaeologist, this "complex California linguistic mosaic" demands that historic movements of language groups be considered when reconstructing culture history (T. Jones 1992:5). The topic warranted special priority by Moratto (1984:530-574) in his handbook to the state's prehistory, where he combines discussions of linguistic prehistory with paleoclimatic data.

At the base of most inquiries into linguistic prehistory in north-central California is the fact that, at the time of contact, native groups speaking languages attributed to the Penutian language stock formed a solid band in the core of the area—this includes the Miwok and Costanoan/Ohlone of the Bay Area, but also the Yokutsan, Maidu, Patwin, and other language groups of the Central Valley. Surrounding them were languages attributed to the Hokan language stock, including Pomoan in the north and Esselan in the south. The most reasonable explanation for this distribution is that Penutian-speakers entered an area controlled by Hokan-speaking people and absorbed or displaced the residents, remaining there long enough to allow both the Hokan and Penutian groups to diverge into a number of closely interacting ethnic groups, each with its discrete language.

Convergent Evolution and the Early Bay Culture

The linking of central coast archaeological populations with linguistic groups was first formally proposed in Gerow's (1968) convergent evolution model, developed from bayshore San Mateo, in which he proposed that two distinct cultures or traditions existed in central California between 1500 and 1000 B.C. and that "these Bay and Valley cultures and populations gradually converged" (Moratto 1984:265). First he argued, on the basis of archaeological and human osteological data, that southern California populations and those of the Sacramento/San Joaquin Delta (the homeland of the Cenral California Taxonomic System) were not, as commonly believed, similar populations but were quite distinctive ones that converged culturally during their adaptations to California conditions. Two somatic types were identified by Gerow's skeletal analyses: one with smaller, lower-vaulted crania, and the other with larger, high-vaulted crania. The former were considered to be earlier and possibly representing Hokan-speaking groups, while the latter were considered later and may have represented Penutian-speaking groups (Gerow with Force 1968:13); Gerow concluded that "San Francisco Bay is both geographically and somatically intermediate" (1974:17).

Miwok Expansion

In the North Bay, the interest in population movements has focused on the movement of Miwok-speaking groups. From modern language distributions and archaeological evidence, Bennyhoff (1977) proposed that the ancestors of the Miwokan peoples (members of the Utian, or Miwok-Costanoan language family—a subgroup of the Penutian language stock) once formed a solid band across the North Bay and through the Delta, from the coast in the west into the Sierra on the east. Some time between about 1000 and 500 B.C., this language continuum was split into two linguistic groups—the Western and Eastern Miwok (Callaghan 1977), probably representing the entry of other Penutian peoples.

Especially pertinent to Point Reyes and the northern GGNRA is Fredrickson's (1973a, 1984a) equation of the Houx aspect in the Clear Lake area, and other Berkeley pattern variations in the North Bay and Sonoma County, with a Middle-period Miwokan expansion into what is today Pomoan territory. This scenario envisions the Miwok initially(by 1000 B.C.) settling in around the Bay. Over time populations would have become relatively circumscribed, hugging the resource-rich ecotone comprising the margins of the Bay. With the wetter and cooler climatic conditions of the Upper Archaic, new interior areas to the north became complex wetlands (e.g., the Laguna de Santa Rosa in Sonoma County, Anderson Marsh near Clear Lake), encouraging similar adaptations. The Miwok with

their more complex social system (born of the pressures and opportunities of centuries of close living on the Bay margins), may have coexisted peaceably with local populations adapted to greater mobility and more ad hoc social interaction. Moratto (1984:278-281) provides a discussion of the expansion, along with a graphic showing the hypothesized Utian radiation. The expanded distribution lasted only a few hundred years; it is proposed that the Miwok retreated south to their ethnographic positions after climatic conditions again shifted.

The linguistic history of the Pt. Reyes and northern GGNRA lands has not been the subject of study. Some consideration is given below.

The "Anthropological" Model

Perhaps the most often cited model in the San Francisco Bay area and the South Coast Ranges is the "Anthropological" Model developed by Breschini (1983; quotation marks his). The model assumes that new conditions at the end of the putative Altithermal (which he dates to about 2000 B.C.) encouraged Penutian immigration, probably south from Oregon. He argues that rather than migrating out of an area with adverse conditions, the Penutian should be viewed as "a better adapted group of people *expanding into* an adjacent area that had a useable environment, and which was unoccupied or underpopulated" (Breschini 1983:65-66). One explanation for the Penutian immigrants' success is that they possessed "a more highly integrated social structure, technological superiority, and larger populations that allowed them to expand at the expense of their neighbors" (Breschini 1983:65). The differences between the incoming Penutian and the resident Hokan may be seen, according to the model, as equivalent to Binford's foragers and collectors (see discussion in Chapter 4).

The model assumes that Penutian speakers initially focused on areas that the Hokan speakers did not favor—those areas that had been most affected by the Altithermal. Later they settled in the East Bay, then expanded both northward and southward, limited to "those areas in which oak grasslands and either the San Francisco Bay or the Pacific Ocean was associated with reasonably large areas of marsh" (Breschini 1983:74). It is the absence of these favorable conditions south of Monterey that halted their expansion at this point at about 500 B.C.

In this model, the massive shellmounds of the East Bay are attributed to Penutian-speaking people on the assumption that these features resulted from their specialized subsistence activities. Breschini (1983:x) contends that the model is validated by the occurrence of two divergent archaeological components—the lower one representing an earlier, more generalized culture, overlain by one with a more complex and specialized economy. It should be noted that this approach singles out population replacement as the sole factor in culture change, ignoring the potential for in situ development. The model has been criticized for this reason, including Breschini's assumption that middens with shell represent the Hokan (ancestral Esselen), while shell middens represent the Penutian (ancestral Costanoan). The middens with shell are attributed to the Hokan Sur pattern, dated pre A.D. 1, and associated with a forager-like strategy; the shell middens are said to represent the Penutian Monterey pattern, dating to post A.D. 1, and associated with a collector-like strategy.

The model has never been well tested. According to D. Jones, "The model with its behavioral and historical implications has become a convenient taxonomy for ordering archaeological data. A stratigraphic shift in ratio of shell to midden in coastal sites has become associated with an abrupt cultural and economic transition in the Monterey region. This reasoning implies that a change in subsistence strategy logically equates with a population replacement" (1992:107). Moratto, in his widely read *California Archaeology*, contends that Dietz and Jackson's work in Monterey "confirm(s) the existence of two distinct prehistoric cultures . . . foragers (ancestral Esselen?) and collectors (early Costanoan?) . . . thus lending support to the concept of Sur and Monterey Patterns" (1984:252). In fact, as D. Jones's critique demonstrates, no such confirmation is possible until the model is revised with more discriminating operational criteria.

SUMMARY OF BAY AREA SEQUENCE

The nature and timing of initial human use of the coast is discussed under Settlement and Subsistence in Chapter 4 (and in more depth by Meyer, this volume). Below is a simplified review of the course of human events from the Early Holocene to the historic period of the Late Holocene era, which will be given more substance under various themes in the chapters that follow. (Historic-period Native American archaeology is treated separately, in Chapter 6.) The sequence described is essentially a culture-historical one based on Willey and Phillips (1958:1), which describes both structure and content. Because of the very large geographic scope taken, the discussion contains very little detail. Figure II.6 shows how some of the schemes for different districts in the region intersect.

PALEOINDIAN PERIOD: 10,000 - 6000 B.C.

This earliest documented period of human use of California occurred at a time of variable climate, rising sea levels, and other broad-scale environmental change. It is assumed that people living in this early period were organized into small, highly mobile groups occupying broad geographic areas, suggesting that most occupations would not have been of sufficient intensity or duration to leave significant remains. More importantly, many occupation surfaces dating to this time depth have been buried by alluvium or other deposits. Most of the handful of Paleoindian sites in northern and central California were found in lacustrine environments, where deposition may have been slower. This period starts at the interface of the Pleistocene and Early Holocene, a time of great environmental change. Moratto (1984:90-103) labels the culture that appears at this time as the Western Pluvial Lakes Tradition (WPLT). The WPLT may have evolved out of the Fluted Point tradition, as woodlands and deep lakes gave way to grasslands and shallow lakes after about 10,000 B.C. Recent finds in California, however, have exhibited more varied environmental settings and more complex occupations than are proposed in the traditional model of Paleoindian lacustrine adaptation (see below).

A Paleoindian occupation in the North Coast Ranges was first identified at the Borax Lake site (CA-LAK-36) in the Clear Lake basin. Called the Post pattern in that locale, it is manifested by fluted points, single-shoulder points, and flaked-stone crescentics. This

assemblage is thought to reflect an adaptation to lacustrine gathering and hunting of large and small game, including fowl. In the Sonoma and Marin districts, evidence of Paleoindian occupation is limited to a few finds, with all but one discovered in the past quarter century. (The exception is a cresentic in the Rose Gaffney collection from Bodega Head.) At the Laguna de Santa Rosa, a lacustrine setting in central Sonoma County, small, chert crescentics similar to those from the Borax Lake site were found by Origer and Fredrickson (1980) at CA-SON-977, while a recently collected obsidian crescentic from the site area yielded an appropriate reading for this antiquity (Origer, pers. comm. 2002). On the coast, at Duncans Landing north of Bodega Bay, a spectacular find for the whole region is SON-348/H, which possesses extensive cave deposits, the bottom layers of which have yielded dates of ca. 7000 B.C., suggesting Paleoindian occupation with an estuarine adaptation before sea-level rise encroached (Schwaderer 1992; see Chapter 4, Settlement and Subsistence). Further north, on the Mendocino coast, a lone fluted point representing this period was exposed by a bulldozer in a shell midden near Casper (Simons, Layton, and Knudson 1985). South of the San Francisco Bay is CA-SCR-177, the Scotts Valley site north of Santa Cruz, in a valley with the remnants of a Pleistocene lake. Radiocarbon dates indicate an initial occupation at about 10,000 B.C.; an eccentric crescent was another Paleoindian indicator (Cartier 1993:5). The recent discovery of the Cross Creek site near the coast in San Luis Obispo County revealed unexpected complexity for the time period. Here, a buried deposit contained milling equipment, cobble core tools, and flaked-stone tools within a stratigraphically discrete paleo-shell midden radiocarbon-dated between ca. 10,300 and 7500 B.P. (dates corrected; roughly 8250 and 5450 B.C.)—one of the oldest milling assemblages in North America (Fitzgerald 2000; Jones et al. 2002). According to Fitzgerald, the site lends support to the premise of a coastal migration into North America, a migration that involved not the big-game hunting of the Folsom culture, but a profoundly different assemblage, and opens up "perhaps more complex and intriguing possibilities to the peopling of western North America" (2000:132).

Evidence of Paleoindian occupation of the Central Valley and the San Francisco Bay Area would be buried beneath many meters of alluvium in the Delta or submerged under bay or coastal waters. As noted in the geoarchaeological study (Meyer, this volume), there is considerable potential for buried sites in the PRNS-GGNRA study area—particularly along the submerged coast and in alluvial valleys found along the San Andreas Rift, either north or south of the Golden Gate.

LOWER ARCHAIC PERIOD: 6000 - 3000 B.C.

The gradual warming of the Paleoindian period accelerated during the Lower Archaic, altering the extensive wetlands that would have characterized the coastal valleys in the study area. At the same time, sea-level rise inundated various coastal locales that would have been available for human use, including the inferred estuary at Duncans Point Cave (see Chapter 4). This period, also referred to as the Altithermal (although the dating of that environmental event has been disputed), was a time of persistent warm and dry climatic conditions. Adaptations to these more arid conditions, as available water decreased and grasses became more abundant, included relatively widespread use of millingstones and handstones—tools that continued in use in some areas. The culture was first identified as the Borax Lake aspect of the Borax Lake pattern at Clear Lake, present at the site type

CA-LAK-36 and other sites. The assemblage is unique in the massiveness of the points and the wide variety of forms, occurring in all four of the North Coast Ranges' obsidians. The signature projectile point is the Borax Lake wide stem, which has been found throughout the uplands of the North Coast Ranges and occurs singly or in small numbers in central California sites. Little can be inferred about the lifeways of these people, although a few burials have been recovered that add some information. At Clear Lake, burials from the Mostin site, also dating to this period, had relatively low frequencies of grave goods; included were a few dorsally extended and semi-extended individuals, but the majority were buried in loosely to tightly flexed positions (White and Fredrickson 1992:56). In the deeply buried Early Holocene site at Los Vaqueros (Meyer and Rosenthal 1997), site CA-CCO-696 yielded one of the oldest human burials in northern California (7400 cal B.P., or around 5350 B.C.). Artifacts from the Lower Archaic component included millingslabs and handstones, a wide-stem point, and cobble core tools.

No sites dating to this period have been uncovered within the PRNS-GGNRA, again probably due to conditions that would have submerged or buried some or all such deposits. One early site on the Bay, however, is of interest: CA-MRN-17 on De Silva Island, just offshore from the Tiburon peninsula, yielded the oldest date from San Francisco Bay. The site exhibited Late-period materials in the upper midden, but the 6-meter-deep deposits yielded an uncalibrated radiocarbon date of 5480 B.P. years (or about 3430 B.C.) from the submidden component (Moratto 1984:275). The lower deposits contained handstones and heat-treated chert, according to Breschini (1983:78); publication on the site is pending.

MIDDLE ARCHAIC PERIOD: 3000 - 500 B.C.

The Middle Archaic-period archaeological culture identified in the North Coast Ranges is the Mendocino pattern, which appears at numerous sites in the Clear Lake area, the Napa area, and at Sonoma County, where it is the first well-represented culture in the Santa Rosa area, the Black Hill aspect. The increase in the number of sites at this time probably reflects larger, more sedentary populations but may also be a function of landscape evolution. The assemblage is distinguished by obsidian or chert concave-base points, obsidian or chert narrow leaf-shaped points, chert stemmed points, obsidian biface blanks, biconically drilled schist charmstones, and a continuation of angular obsidian cores. The millingslab and handstone continue, while some mortars and pestles appear at this time.

The Middle Archaic is the time period of the first documented occupation of the Central Valley–Delta area: the Windmiller pattern, named for the type site CA-SAC-107. This is the classic Early horizon of the CCTS, with occupation of the extensive mounds along the Cosumnes and Mokelumne rivers suggesting large, semi-sedentary populations. Windmiller mortuary practices included scrupulous adherence to burial position—ventral extension (lying face down) with the head to the west—and grave goods in the form of perforated charmstones and distinctive abalone ornaments; there is little evidence, however, for status differentiation or formal ceremonialism. In the Sonoma district where the artifact assemblage is present, there is no information from site features (e.g. housepits, ovens, hearths) or burials to allow inferences regarding demography, settlement practices, social structure, and status differentiation during this period. On the coast just north of

the PRNS, the Duncans Point Cave (SON-348/H) continued in use, as it had since the Paleoindian period. In the Lower and Middle Archaic, the occupants at the cave were gathering nuts and seeds, milling plant materials, hunting sea mammals, and producing or repairing baskets and nets and attendant fiber-working activities (Schwaderer 1992).

On San Francisco Bay, no known occupation contemporaneous with the Windmiller pattern had been confirmed until the early 1960s, when Gerow, with Force (1968) identified the Early Bay culture at the University Village site (CA-SMA-77) and at various components of previously excavated sites suspected as being Early by Beardsley (Ellis Landing, CA-CCO-295; West Berkeley, CA-ALA-307; Emeryville, ALA-309; Ponce, CA-SCL-1; Newark, or Patterson, ALA-328). Far more similar to the succeeding Berkeley pattern of the Upper Archaic than it was to contemporaneous Windmiller in the Delta, the pattern on the Bay has been called Lower Berkeley in the Fredrickson scheme. (ALA-17, located in West Oakland in a buried dune radiocarbon-dated to 5400 cal B.P. [Meyer, this volume], is a recently discovered contender.) No evidence of occupation of any kind at this time period has been recovered directly from the southern portion of the GGNRA, although such use can be inferred, given the proximity of the University Village site at SMA-77 on the southwestern corner of the Bay and the early radiocarbon date from the BART skeleton at San Francisco's Civic Center.

At the PRNS, no Lower Berkeley occupation has been confirmed, although the lower, unexcavated levels of the McClure site (MRN-266) are believed to date to that time (Bennyhoff 1994; Van Dyke 1972). Elsewhere in Marin, the Pacheco site (MRN-152) north of San Rafael, was originally assigned to the Middle horizon (Upper Archaic) by Goerke and Cowan (1983) but has since been recognized as a Middle Archaic-period site with Lower Berkeley affiliation (Bennyhoff, pers. comm. 1982). Likewise, lower levels at SON-299 on Bodega Bay were considered to be possible Lower Berkeley deposits. The intensive occupation at Duncans Point Cave, just a few miles north of Bodega Bay, lends good support for assuming that there was active, widespread use of the coast at this time.

UPPER ARCHAIC PERIOD: 500 B.C. - A.D. 1000[1]

Significant changes during this period may represent a series of local adaptations to changing (cooler, wetter) climatic conditions in the North Bay, the Central Valley, and at Clear Lake. More likely, according to Fredrickson (1984a:524-525), the appearance of Berkeley pattern traits and mode of settlement may reflect Proto-Miwokan expansion from the San Francisco Bay—a response to intensified resource competition along the bayshore and the expansion of minimally populated wetlands in the north. In the Great Valley, a new adaptation and a genetically distinctive population carrying Berkeley traits (the Utian-speaking group) replaced the (possibly Hokan-speaking) Windmiller. The displaced Windmiller appear to have retreated to the south (the Stockton district), where the Meganos aspect of the Berkeley pattern—a hybrid of both cultures—appeared.

At the same time as this initial expansion, on the Bay itself and along the coastal terraces of the PRNS-GGNRA there was a proliferation of archaeological sites dating to

[1] The end of the Upper Archaic was originally dated by Fredrickson (1973a, 1974) to A.D. 500; more recent archaeological work has suggested a later date (Fredrickson 1994:100).

the Upper Archaic period, with substantial shellmounds intensively occupied at Ellis Landing (the Middle-period type site), Emeryville, West Berkeley, and Newark, and innumerable smaller sites. The pattern also appears, along with increased population, in the North Bay as the Laguna culture near Santa Rosa and at Clear Lake as the Houx aspect. The situation along the bays of coastal Marin and Sonoma counties is unclear: with an absence of archaeological information from this area dating to the Middle Archaic, is uncertain whether the substantial Upper Archaic sites at Point Reyes (McClure, MRN-266, and Cauley, MRN-242) and north at Bodega Bay (SON-299) are the result of in situ development or Miwokan intrusion. Greater study of this period, including attempts to isolate the period in the Duncans Point Cave site (SON-348/H), could yield significant information on this obscure point in the area's history. It is clear, however, that the ancestors of the ethnographic-period Coast Miwok were occupying the study area by that time (see Chapter 6). North of the PRNS–GGNRA, the Berkeley pattern did not extend north of the Russian River; instead, there was a continuation of the Middle Archaic Mendocino pattern until about A.D. 1000 (Dowdall 2003:302). South of San Francisco, on the peninsula coast of San Mateo County, there was also no Berkeley influence; instead, Hylkema (2003:250) identifies an unbroken assemblage for both the Early and Middle periods (i.e., the Middle and Upper Archaic), similar to Dowdall's finds on the northern Sonoma coast.

Appearing with the Berkeley pattern were changes in settlement and artifact assemblage, suggesting fairly large, semi-sedentary populations; the beginnings of clear social differentiation; and the appearance of formalized exchange. Although the mortar and pestle first appear in any numbers in assemblages from the Middle Archaic period, it is in the Berkeley pattern of the Upper Archaic that a focus on acorn-processing becomes a dominant subsistence trait. Mortuary practices during this period reflect widespread Berkeley-pattern customs: loosely and tightly flexed burials with no obvious orientation, usually in midden sites; frequent occurrence of red ochre in graves; and differential distribution of grave goods, including moderately high frequencies of specific *Olivella* shell beads, indicating status distinctions based on wealth. A reliance on a diversity of bone tools is a hallmark of the Berkeley pattern.

In the Delta and on San Francisco Bay, a **Middle/Late Transition** dating to around A.D. 700 to 900 (Fredrickson 1994:74), or A.D. 700 to 1100 (Milliken and Bennyhoff 1993:386), has been identified based on significant changes in grave accompaniments. The time marks a period of disruption in much of central California, perhaps reflecting Patwin speakers from the north, who forced various Berkeley pattern groups to retreat from their expanded distribution (Bennyhoff 1993:83). The new population is suspected of bringing northern traits into the region: harpoons, the bow and arrow, and grave-pit burning. While the period is recognized in fine-tuned analyses, it is often omitted from general overviews such as this one. Its precise temporal position is unclear. Its geographic extent is also uncertain; Hildebrandt and Mikkelsen (1992) remarked on the absence of cultural traits suggestive of the Middle/Late Transition in their 14 archaeological sites in lower Santa Clara valley, near Gilroy. Further awareness of the Middle/Late Transition and attempts to monitor the appearance of these traits at this time period will help to develop our understanding of the transition. (Note that it does not have a specific designation in the Fredrickson scheme, although a period of disruption is identified—see below.)

LOWER EMERGENT: A.D. 1000 - 1500

Unsettled climatic conditions and widespread population movements, as noted above, have been hypothesized for much of California and the western Great Basin at roughly the transition from the Upper Archaic to the Emergent period (Moratto 1984:560). The northern traits brought by the Patwin were readily adapted through central California by the Lower Emergent period; the ensuing culture was the Augustine pattern, named for a Central Valley site. In addition to a Patwin intrusion, the time may also mark the arrival from the north and east of Pomoan-speaking peoples into the Santa Rosa Plain, and westward to the coast, forcing some of the Miwok south again. Along the coast, however, the Miwok appear to have maintained their hold to the land up to the Russian River.

The Emeryville Mound (CA-ALA-309) is the Lower Emergent type site on the San Francisco Bay. An important innovation in the new assemblage is the introduction of the bow and arrow, replacing the earlier atlatl and dart point; the predominant Lower Emergent (or Phase 1) projectile point here and throughout much of central California is the small, serrated, corner-notched point. The rectangular *Olivella* bead, another widespread marker for the Lower Emergent period, also appears. Mortars and pestles become especially abundant during this time period, apparently attesting to a well-developed acorn economy.

During the Lower Emergent, burials were loosely flexed, accompanied by moderate quantities of *Olivella* beads and *Haliotis* ornaments; the so-called Banjo ornament that appeared at this time is believed to represent the introduction of the Kuksu cult, which continued in various forms into the historic period. Some sites appear in previously little-used areas, perhaps suggesting the firming up of tribelet territories and, with it, a more formalized seasonal round that would result in regular use of outlying areas. At Point Reyes and bayshore Marin, most of the datable sites were used for the first time during this period; this is also the case for many of the San Francisco sites, and for the significant village on Sweeney Ridge (CA-SMA-125). As the Point Reyes Mendoza aspect is believed to consist of at least two phases (Van Dyke 1972), use of the coast may have been sporadic at this time. The first occupation sites on Angel Island east of the Marin Headlands appear to be dated to Phase 1, or the Lower Emergent, indicating a desire to fill out a variety of niches.

This is the time period of the Medieval Climatic Anomaly, which is so distinctive in the Sierra foothills. Here, it is assumed that the final eastern and southern expansion of Miwokan peoples occurred, with the filling in of the ethnographic territory of the Sierra Miwok, who may have displaced Yokutsan people.

UPPER EMERGENT: A.D. 1500 - HISTORIC PERIOD

The lifeways represented by the Upper Emergent Augustine pattern, also termed the Protohistoric period or Phase 2 of the Late horizon, are believed to be similar to those at the time of historic contact. Included in the assemblage are obsidian nonserrated corner-notched points, the obsidian notchless point preform, chert bead drills, clam disc beads, *Olivella* lipped beads, and the hopper mortar and pestle. Clam disc beads were

manufactured at Sonoma and Marin sites and used as a form of currency for exchange in a network that ranged throughout California and into the Great Basin. These beads were also a major marker of wealth, worn in life to indicate status and buried in great quantities with their owners at death. Cremation was generally preferred for the wealthy, with remains placed in the midden, while persons of lesser status were usually buried in flexed positions, often away from the village. Aggregating large crowds for ceremonial purposes, a significant feature of the social and economic life during the ethnographic period, is reflected in Upper Emergent sites by the elaborate ornaments and other regalia and the presence of large-scale housefloors.

Some very large villages are inferred for this period, especially in the Delta and Central Valley where a mound might be occupied by several hundred people. On San Francisco Bay, a virtual abandonment of the bayshore was initially inferred, indicating a new emphasis on terrestrial resources. Accordingly, the type site for the Upper Emergent in the Bay Area is the Fernandez site (CA-CCO-259), a dark midden set well back from the Bay. While such a wholesale shift is no longer supported, a generally greater reliance on inland resources is suggested.

At Point Reyes, the Estero aspect is the marker for the first contact with Europeans. The descriptions of the native people gathered from Francis Drake's visit, in fact, served to date Phase 1 of the Late horizon. With Drake's visit taking place in 1579, it was arbitrarily assumed that the lifeways in place at that time had existed since at least A.D. 1500.

RESEARCH ISSUES ON CHRONOLOGY/ CULTURE HISTORY IN THE PRNS–GGNRA

CHRONOMETRICS

1. What tecniques will allow better definition of phases and time periods in PRNS-GGNRA archaeological sites? What opportunities are there for more aggressive dating efforts? Will AMS dating allow temporal control in situations that were previously thought to be undatable?
2. Can radiocarbon-dating shell samples from eroding sites yield useful settlement and chronological information? What variables must be controlled to enhance the value of this technique?
3. Are there extant collections containing ample obsidian and organic materials that might lead to refinement of dating techniques?

Data Requirements:

- Archaeological contexts with strongly associated datable pairs of shell and carbon for testing the Holocene changes in the reservoir effect.
- Archaeological contexts with strongly associated datable pairs of radiocarbon–obsidian specimen for testing the hydration curve.
- Curated collections from the study area with reasonably abundant obsidian items, datable organics, and typologically distinctive artifacts.

EARLIEST OCCUPATION

1. Are there Early Holocene archaeological sites on accessible buried or submerged landforms in the PRNS–GGNRA?
2. What accounts for the recently recognized greater complexity and diversity of Early Holocene occupation in California? Is it the result of greater site integrity (e.g., buried or cave deposits that have been protected)? Has our recognition of earlier cultural complexity than previously anticipated allowed us to "see" older site more readily? Beyond seeking buried and inundated sites, what techniques might increase our inventory of older sites?
3. Will a re-examination of previously excavated assemblages reveal some "earlier" sites in the PRNS–GGNRA, once the greater complexity of the Early Holocene assemblage is recognized?

Data Requirements:

- Identification of paleosols that may contain Early Holocene archaeological deposits.
- Archaeological exploration of submerged locales that may contain Early Holocene archaeological deposits.
- Curated collections that may be candidates for Early Holocene reassignment.

LINGUISTIC PREHISTORY

1. Is the appearance of the Berkeley pattern direct evidence of Miwokan expansion or of in situ development? Will Middle Archaic components in the PRNS–GGNRA, if identified, demonstrate the presence of Lower Berkeley affiliations in southern Marin County and the northern San Francisco peninsula?
2. What evidence is available in the PRNS–GGNRA for the social and environmental stresses of the "Middle/Late Transition period?" How will direct Patwin presence, vs. borrowed traits, be displayed in the archaeological record? Is a hiatus of occupation represented around the Middle/Late Transition period, or might the area have been outside the Patwin influence?

Data Requirements:

- A suite of archaeological occupation sites with secure dating to the time periods in question for testing dissemination of materials and ideas.
- Individual, stratified archaeological sites with secure dating to the time periods in question for testing in situ development.
- Artifact-rich deposits with diverse assemblages that will aid in determining the waxing and waning of various time-markers.

REFINING THE CHRONOLOGICAL SEQUENCE

1. In what ways might new dating techniques be used to sort out disparities in the archaeological record of the PRNS–GGNRA and environs? Will reassessment of time-markers based on new assignments help to interpret sites lacking in chronometric material?
2. Are some assemblages in the archaeological record better understood in terms of contemporaneous occupation of distinctive groups? Is this the case with the Mendoza aspect at Point Reyes, with its anomalous disjuncts?
3. Can refining the PRNS–GGNRA cultural sequence help in understanding culture-historical relationships in the greater Bay Area? Do inland–coastal patterns emerge from the new interpretation?
4. Will broader comparative research illuminate the population shifts in the PRNS? Will data from CA-SON-299 at Bodega Bay or other older Marin sites (e.g., the Pacheco Valle site, MRN-152) lead to new interpretations? Can newly discovered sites dating to the Middle Archaic/Upper Archaic transition period help to identify conditions at this time?
5. Can typologies for the study area (e.g., projectile points, mortars and pestles, etc.) be updated by new data and reanalysis of older finds?
6. Can the new theoretical focus on cultural variability and individual historical shifts open up new approaches to the chronological sequence.

Data Requirements:

- Archaeological deposits with chronometrically datable organics (in the form of charcoal, ash, bone, antler, shell, or soil humates), obsidian artifacts suitable for hydration analysis, or other chronometrically datable materials.
- Archaeological deposits with intact features with datable material (above) and stylistically distinctive artifacts that can serve as time-markers.
- A suite of archaeological sites that demonstrate a range of datable assemblages; individual stratified sites for identification of fine-grained variation.
- Re-analysis of curated collections or data to refresh old interpretations with new data and approaches.

CHAPTER 4 – PATTERNS OF SETTLEMENT AND SUBSISTENCE

INTRODUCTION

Encompassing a large swath of land through some of the most habitable and varied geographic settings on the north-central California coast, the PRNS–GGNRA is an ideal laboratory for investigating changing settlement and subsistence strategies through time and across space. There are at least 143 prehistoric archaeological sites recorded, and many more sites yet undiscovered—in buried or submerged settings or in the rugged and densely vegetated hills that border much of the coastal zone. There is therefore the potential for ample comparative data from the study area for use in understanding why people settled where they did, and how they adjusted their occupations to factors of seasonal resource variability and the logistical demands of the group.

SOME DEFINITIONS

Settlement and subsistence can be thought of as a single, overlapping concept. "Subsistence," as defined by Jackson, "refers to the suite of technological and cultural practices that supports a group's basic nutritional needs" (1994:13-2). "Settlement" is defined as the way people occupy the land through a subsistence cycle, and includes the locations of subsistence activities and social events. "Technology" includes a logical series of actions: "the activity sets involved in the procurement of raw materials; the preparation, modification, and alteration of those materials to create tools and tool kits; the techniques and combination of activities involved in the use of those tools to perform economic tasks; and the maintenance and discard of those tools" (Jackson 1994:13-2). A culture's adaptive strategy is made up of its technological, subsistence, and settlement choices. Important in maintaining and transmitting that strategy are various practices comprising the social organization of the group.

In the 1970s and 1980s, when processual archaeology was at its height, the application of ecological principles to archaeology tended to dehumanize the concepts. The description of settlement patterns below by Michael Jochim illustrates this point.

> The distribution of settlements represents the arrangement of consumers or demand, producers or labor, and technology or capital, in relation to the resources exploited. Settlement patterns also structure the relationship of people to one another in terms of competition, cooperation, and communication. The arrangement and accessibility of resources and other people, consequently, are critical factors in determining settlement location [1981:151].

While acknowledging the role of social interaction in the settlement process, the statement seems to treat people as passive reactors, whose responses can be predicted on the basis of economic rationality.

In contrast, the human face of settlement and subsistence is demonstrated by Jackson (1994), who describes an example from daily life. The head of a hypothetical hunter-gatherer family makes a decision to move the family for the fall to a location adjacent to multiple resources. This decision requires not only providing family members with access to these sometimes overlapping resources (ripening acorns, nearby lithic resources, deer-migration routes) but also linking the group's activities with longer-range plans, "conducted in a social matrix that may have included information-gathering for future cultural needs and activities such as subsistence scheduling, marriage and kin relationships, exchange relationships, and boundary-, territory-, or maintenance-of-access-rights, as well as religious or ideological duties and activities" (Jackson 1994:13-2). While these topics of social mediation are treated separately in Chapter 5, their importance in confirming and revitalizing the adaptive strategy are considered briefly below and should be kept in mind throughout this chapter.

CHAPTER ORGANIZATION

The scenario of settlement and subsistence above is ethnographic, describing the actions of living people. To identify elements of these patterns archaeologically is a usually daunting task that involves analysis of site-formation processes and modeling of human behavior. A consideration of these topics is therefore the first order of this chapter. It then turns to a discussion of what is unique about settlement on the coast, including shellmound development and analysis. It turns to a variety of settlement issues that—while closely linked to subsistence—are primarily concerned with where people lived. The second half of the chapter looks more at subsistence itself: the kinds of resources people used and the technology they employed to capture or modify them. This approach will provide organization to the chapter, while also emphasizing how deeply the domains are interconnected.

SITE-FORMATION PROCESSES

SITE STRUCTURE

Stratigraphic processes can be both natural and cultural. Natural processes provide the medium in which a cultural deposit is created (e.g., alluvial sediments); later they may cover over or remove (via landslide deposits or erosion) some or all of the cultural deposit (see Meyer, this volume). Most archaeological work takes place at the level of a site or a small section of a site (e.g., an archaeological "unit," such as a trench or other subsurface exploration), where distinguishing between cultural and natural processes is essential. As an example, consider the presence of a deep layer of virtually sterile (i.e., lacking in artifacts) sediments sandwiched between two artifact-rich layers; the sterile layer may represent a period of several hundred years during which the site was only sparsely occupied, or it may represent a deposit of soil delivered in one brief episode, followed by continued intensive site use (immediately, or after a considerable hiatus). In either case, another process will be ongoing: bioturbation, or the churning of soils by living organisms (roots or animals), which helps distribute the artifacts through the

intervening sterile layer. Identifying which interpretation is the correct one (long-term site abandonment or abrupt natural deposition) involves detailed mapping and description of sediment layers, and perhaps a comparison of profiles created by onsite and offsite trenching to identify change at the landscape level. A readable and detailed discussion of analytical approaches to archaeological deposits is given in Stein's (1987) "Deposits for Archaeologists."

Cultural deposits are often made by humans storing or discarding artifacts and non-artifactual cultural materials (most commonly, dietary bone and shell) on the soil surface, or in various receptacles in or on the ground. Humans actively create the spaces they use when they build dwellings, dance houses, and sun shelters, and dig firepits and ovens. They also actively transform existing cultural deposits as they dig human graves or storage pits. Therefore, consideration of the formation processes at work in a given deposit is a fundamental step in analysis and interpretation. A common problem ensuing from incorrect analysis of site stratigraphy is treating artifacts found in the same disturbed or mixed layer as contemporaneous. Making the reverse assumption can also be a mistake: assuming that ostensibly older artifacts found in more recent contexts indicate stratigraphic mixing when in fact they might mean poor taxonomic control or co-occurrence of adaptively dissimilar groups (see discussions in Chapter 3).

The phrase *site-formation processes* is often used to refer to these cultural and natural processes: it refers to the way the site is formed and transformed, during and after use. The activities associated with various human pursuits (e.g., processing plant products) are modeled to predict their archaeological correlates. This concept is discussed at several points in this chapter.

THE NATURE OF SHELL MIDDENS

Some Definitions

The term *shell midden* is applied to a variety of deposits of different function and structure, particularly in California where the terms shell midden and shellmound are used almost exclusively and interchangeably. The phrase *shell-bearing site* has been proposed by Widner (cited in Claassen 1991:252), who argues that any more precise term would require subsurface assessment of the deposit. He advocates the following typology:

1. Shell midden site—secondarily deposited shell from food consumption with no other activities evident at the site
2. Shell midden—discrete lens or deposit of shell only
3. Shell-bearing midden site—a site composed of secondary refuse of many kinds of remains, including shell, generated by a wide range of activities
4. Shell-bearing habitation site—primarily shell debris in site matrix used for architectural needs; the shell may or may not have originated as food debris [cited in Claassen 1991:252].

Claassen notes that one of the most useful aspects of this typology is the recognition that shell debris need not be equated with food debris. Instead, shells might have been amassed as structural features, providing a firm, dry base for occupation (1991:253).

In contrast, Waselkov, in his worldwide review of shellfish gathering and shell-midden archaeology, defines *shell midden* quite generally: "a cultural deposit of which the principal visible constituent is shell" (1987:95). Stein (1992:6) acknowledges that using the term midden can be misleading, as it technically refers to refuse accumulating around a dwelling place; she has nonetheless chosen to use the phrase shell midden because of its long tradition in the discipline. Following her lead, this document uses the phrase shell midden for most purposes. Shellmound, however, is used herein when referring to the huge shell structures that still bordered San Francisco Bay around the turn of the 20th century, some attaining more than 30 feet in height and covering as much as 300,000 square feet (Schenck 1926:162).

Early Shellmound Research in the San Francisco Bay Area

The construction and function of these shellmounds has been a topic of interest in California since archaeologists first began exploring the mounds surrounding San Francisco Bay and along portions of the coast at the turn of the 20th century. Some knowledge of the structure of shellmounds is an essential tool for basic understanding of sites in the study area. The mounds along the coast and its estuaries do not appear to have ever reached the massive proportions of those on San Francisco Bay. Shellmounds are found throughout the world and are still occupied today in some countries; some of the earliest and most active research was undertaken by archaeologists exploring the mounds on the coast of Denmark (Waselkov 1987:139).

What we know of the mounds on San Francisco Bay today is based mainly on mere shreds of evidence, documented by Nels Nelson and others at the turn of the century. Because Indian settlements occupied the same locations desired by later immigrants, most of the mounds had been removed for subsequent development, while the spoils were re-used for a variety of purposes.

> For example. The composition will sometimes yield splendid crops of potatoes and other vegetables; and this fact, as it has become known, has generally led to reduction and cultivation of the mounds. In addition to this source of destruction, the material is removed to serve a variety of purposes, such as ballast for roads and sidewalks, as garden fertilizer, and even as chicken feed. It is said that mound material, mixed with rock salt, produces tennis courts that for combined firmness and elasticity are unexcelled. The result is that while there is still ample opportunity for the investigator, not a single mound of any size is left in its absolutely pristine condition [Nelson 1909:326].

Referring mainly to the mounds ringing the bay, Nelson (1909:325) described "the typical shell heap" as oval or oblong in outline, with smooth slopes—steepest on the short sides—and with the longer axis generally parallel to the shoreline or a stream. The basal dimensions ranged from 9 to 183 meters (30 to 600 ft.) across, while the mounds rose from 1 to 9 meters (3 to 30 ft.) above the 1908 land surface (Lightfoot 1997:131). At many sites, mound material continues to several meters below sea level, indicating the location's

initial occupation before Early Holocene sea-level rise was complete. Although the mounds are made up of comparatively loose material, Nelson noted that they erode only minimally, due partly to the binding power of the broken fragments. As an illustration of this integrity, he cited the fact that a 6-ft. square, 25-ft. deep shaft could be sunk into one mound without the need for shoring. He contended that the mounds, under perfectly natural conditions, would have remained as they were left for centuries. "A few of the larger and better preserved examples present roughly flattened tops and in two instances these surfaces are dotted with distinct saucer-like depressions, as of house pits" (Nelson 1909:326).

While Nelson spoke of the integrity of the extant shellmounds, Edward Gifford described the attrition of the material as a result of human habitation. Noting that mussel breaks up more readily than clam shell, he wrote:

> Besides the cause just mentioned, another has been operative in producing layers and streaks of finely broken shell at various depths in the shellmounds. This second cause, which operated constantly while the mounds were inhabited, was the people themselves. In their excursions for fuel, food, water, and other necessities, the mound-dwellers must in time have formed more or less well-defined trails. Not only must we consider trails, but also the places frequented by people around their houses. Then, too, dances and other ceremonies, which attracted a large number of visitors, were certainly instrumental in breaking up the shell. On the other hand, pockets of unbroken shell probably represent refuse heaps where people were not in the habit of walking [1916:11].

The content of San Francisco Bay mounds studied by Gifford (Sausalito, Greenbrae, San Rafael, Ellis Landing, West Berkeley, Emeryville, San Mateo, San Mateo Point, and San Francisco) averaged 56 percent animal remains (fish, other vertebrates, and shell); 15 percent material produced by combustion (charcoal and ash), and 29 percent inorganic sources (rock, earth, and sand). Human remains were regularly found in San Francisco shellmounds—more than 700 in the Emeryville mound alone. They occurred in defined cemeteries ("discrete clusters of burials containing more individuals than a nuclear family" [Lightfoot 1997:131]), in possible family groups associated with housefloors, and as isolated burials. Artifact content in the mounds is typically low, with a meager high of 3 artifacts per cubic meter at Emeryville, and recovery from other mounds as low as 0.3 to 0.8 artifact per cubic meter (Lightfoot 1997:131)—vs. the hundreds to thousands of cultural materials per cubic meter found in interior soil middens—causing many researchers to question whether the mounds were indeed residential.

Gifford's (1916) primary interest in quantifying shellmound contents was derived from his and Nelson's (1901) effort to determine the probable age of the cultural deposits based on the rate of accumulation of materials; they separately assessed the relationship of the quantity of shell to population using weight and volume, respectively. S.F. Cook, noting that their methods resulted in age estimates of 14,500 years and 6,900 years, concluded that the approaches needed refinement. In addition to volume and weight, Cook considered such variables as group size, gathering capabilities, and the nutritional values of shellfish, along with the amount of dried shellfish meat exported from the site, and the amount of other animal food consumed. Cook arrived at a figure of at least 3,000

Table II.4. Categories of Shell-midden Research

(source: Stein 1992:8)

Category	Description
1	Examining shellfish remains in terms of available food supply (e.g., reconstructing meat weights and categories)
2	Plotting variations in shellfish species, as measured from column samples in shell middens, to infer changes in ecological conditions within nearby aqueous habitats (e.g., noting shifts from abundant rocky-bottom bay shellfish species to abundant soft-bodied bay species)
3	Delineating ancient shoreline locations by plotting geomorphic positions of shell middens, and inferring that the location of the shell midden indicates the location of the paleoshoreline
4	Ignoring the shellfish remains in the site and constructing cultural historical sequence by analyzing artifacts only
5	Examining the shell midden in terms of its depositional and postdepositional processes

years and proposed further study of the formulas used. He continued with a wide range of studies with other California researchers (e.g., Cook and Heizer 1952; Cook and Treganza 1947, 1950). Together, their efforts are known internationally as the California School of Midden Analysis (Waselkov 1987:141). Waselkov notes that when the advent of radiocarbon dating made such circuitous formulae for dating sites unnecessary, "the by-now-immortal equation was simply turned on its head and used to estimate the remaining uncontrolled, dependent variables: population size, average annual length of occupation, and relative dietary contribution of shellfish" (1987:141-142).

Table II.4 provides a summary of the categories of shell-midden research that demonstrates the range of approaches over the past century.

Problems in Shell-midden Excavation and Interpretation

The rapid rate of shell-midden accumulation and its tendency to resist weathering and other destructive processes create some interesting problems. Among these, Waselkov (1987:143) notes, is the creation of small sites that might otherwise have been overlooked by archaeologists: few other site types that were created over a period of no more than a few days are as archaeologically visible as the individual shell heap (an exception that comes to mind is rock art). Another distinctive trait noted by Waselkov is the tendency for shell middens to maintain vertical stratigraphy, with the thickness of the individual layers "much exaggerated in comparison to nonshell middens"; in some cases the physical separation may lessen the mixing of materials from different layers (1987:143-144). Shell middens have nonetheless been considered to be "the most stratigraphically complex types of sites in the world" (Stein 1992:xv).

Accretion middens are those that result as individual shellfish-processing events begin to accumulate in the same area. When these locations are chosen for occupation as well as

refuse disposal, this process creates uneven surfaces, with the deposition from succeeding occupants filling in old depressions and creating divergent surfaces. This "asymmetric accumulation of accretion middens" (Waselkov 1987:144) is partly responsible for the difficulties that archaeologists encounter in excavating shellmounds, and one of the reasons why strict stratigraphic control is essential. The asymmetry also aids in distinguishing discrete events. In non-shell middens "the by-products of numerous tasks become intermingled and produce a composite, or time-averaged, view of activities performed in a village" (Foley 1981:173, cited in Waselkov 1987:145); in contrast, in many shell middens the "rapid accumulation of shells serves physically to separate debris derived from different activities, permitting their archaeological recognition" (Waselkov 1987:145). But other conditions may operate against this condition. One vexing problem with poorly consolidated shell middens, for example, is the presence of many open spaces between shells, through which small artifacts can fall, ultimately settling way below associated materials. Further, in habitation sites where damage from treading is heavy, large artifacts may be repeatedly brought to the surface while small ones cycle downwards (Waselkov 1987:147).

Reoccupation, or successional use, may be a requisite for the creation of most large shell middens. Waselkov notes that "if there was no feature on the prehistoric landscape to focus settlement, then no great midden depth is likely to have developed" (1987:144). This may account for the broadly distributed, but relatively shallow, middens on much of the Marin and Sonoma coast, both on coastal terraces as well as on some estuaries. CA-MRN-298 on Limantour Spit, for example, with an absence of freshwater resources, rock outcrops, or tree stands, is a broadly spread, shallow deposit.

Stein's edited volume, *Deciphering a Shell Midden*, strives to impress shell-midden researchers with the need to thoroughly evaluate postdepositional effects on shell middens before attempting cultural interpretations. At the northern Washington shell midden that is the subject of this book, Stein found that "porosity, alkalinity, low density of artifacts, and saturation by rising sea level have all affected the formation of the site" (1992:2). Commenting on the stratigraphy that has been observed at other shell middens but never analyzed—an obvious division of light-colored matrix in the upper portion of the midden and dark-colored matrix in the lower portion—she notes that "this dual stratigraphy stems from the postdepositional saturation of the shell midden by groundwater," a function of Early Holocene rise in sea level.

> The groundwater has hydrated the clay and organic matter, darkened the color of the organic matter, leached carbonate from the fine-grained sediment fraction, and produced the characteristic 'greasy' feel of the matrix. These processes have been superimposed onto the stratification of subsistence and artifactual material, and need to be separated if appropriate archaeological interpretations are to be made. The properties of the shell midden and its proximity to the shoreline have resulted in drastic alterations of the original stratification of the site" [Stein 1992:2].

Not all mounds of shell are the result of on-site shell-processing; instead it is proposed that many were secondary deposits (perhaps created from shells carted in baskets from small, nearby activity areas), amassed to form a dry and firm base for occupation (Claassen 1991:253). (See Chapter 5 for a discussion of mound-building as a function of the social–

ceremonial system.) Natural shell heaps can be deposited by storms, or natural shell beds can also be exposed by hydrological shifts. On a smaller scale, shell may accumulate when birds or other shellfish eaters habituate the same spots to break open and discard shells. Distinguishing cultural from natural heaps is relatively easy; one uses the same indicators as with other midden sites (e.g., the presence of artifacts, manufacturing waste products, other dietary debris, the remains of structural features), although the matrix consists of larger and more angular objects. In cultural deposits, "shell attitudes or angle of repose usually coincide within a heap, with bivalve shells lying parallel to the surface of the pile, concave sides up, suggesting that they had been tossed there individually" (Waselkov 1987:147). In contrast, when shells have been dumped en masse (as one can find behind modern seafood establishments), they create an irregular deposit. Assessing shell orientations also can allow identification of site features.

Sampling of shell middens poses particular problems, and there are advocates for widely diverging techniques; Claassen (1991:254-266) has summarized these approaches. Due to extremely redundant assemblages, column sampling is commonly used, especially to obtain zooarchaeological samples; here a warning is made against arbitrary levels. Investigating by component, or perhaps more appropriately by activity area, is considered preferable to a site-wide approach. The latter allows "treating each layer and feature as an independent population to be sampled"—an ideal approach that is often thwarted by the enormous number and dispersed distribution of activity areas (Waselkov 1987:151). It has been noted that, while a shift to stratigraphic excavation of shell middens has occurred in recent years, it has brought new problems:

> Field procedures, descriptive attributes, and reporting styles are not standardized. The criteria used to define a "natural level" are not agreed upon by the discipline. Every excavator creates a new set of criteria and is trusted to do it 'correctly.' . . . If excavators are asked to describe the manner in which the natural levels are defined, they turn to the profile and define contrasting lithologies. One stratum looks different from the other [Stein, Kornbacher, and Tyler 1992:96].

A detailed system for standardizing description of midden strata is presented in Stein, Kornbacher, and Tyler (1992) and is discussed in other chapters of *Deciphering a Shell Midden*.

Another type of shell-bearing site along the Sonoma Coast and also found in the South Bay is often referred to as a dirt mound with shell; it has been associated with earlier habitation along the coast (Breschini 1983; Dowdall 1995), while others have been assumed to be habitation sites with some coastal access but with greater subsistence focus toward the interior.

Discussions of cultural and sociopolitical aspects of shellmounds, settlement patterning and shell middens, and the subsistence aspects of shell middens are found under their respective topics below in this chapter, or in Chapter 5.

COASTAL SETTLEMENT

THE COASTAL ZONE AS A HUMAN HABITAT

The first environmental description of the study area (at Drakes Bay in the PRNS, according to most researchers) was compiled from notes taken in June 1579 by Francis Fletcher, Francis Drake's chaplain. Although praising the "faire and good Baye, with a good wind to enter same," the coast itself was not otherwise valued by the visitors. In contrast, they found the interior (presumed to be Olema Valley by some) to be "farre different from the shore, a goodly country, and fruitful soyle, stored with many blessings fit for the use of man." This sharp contrast between coast and inland is repeated in most accounts of Point Reyes as a human habitat. According to Van Dyke (1972:96), for example, coastal Marin County was an unused "biotop" on the occasion of initial McClure aspect occupation at the beginning of the Upper Archaic. Conditions on the coast, he claimed, would not have drawn occupants until some other pressures focused the population there. For the most recent native occupation, A.L. Kroeber (1925:273) claimed that while Tomales Bay had been occupied ethnographically, Point Reyes itself was believed to be uninhabited. Beardsley also had an unfavorable impression of the area, noting that Point Reyes was "the foggiest weather station on the California coast. During the summer it averages 26 foggy days each month. It is also exceedingly windy; velocities up to fifty miles per hour are not uncommon. . . . Winter rainfall, though moderate (twenty-four to twenty-seven inches annual mean), comes in heavy downpours which turn the area into a muddy wilderness impassable for vehicles and discouraging to travel afoot" (1954:14).

Despite these negative valuations, the coastal zone was indeed occupied, in some places intensively and early. How and when it came to be settled is a major research issue.

Resource Value on the Coast

The coastal zone as a desirable human habitat has become a topic of particular debate over the past decade: some researchers argue that coastal resources were marginal and would not have been exploited until inland terrestrial resources were degraded by post-Pleistocene climate change (e.g., Chartkoff and Chartkoff 1984: Moratto 1984; Yesner 1987). Jones (1991) counters that coastal habitats contain significant fish, shellfish, and mammalian populations, and can in some cases be more productive than adjacent inland habitats. He also argues for looking at resources in terms of the potential they offer all members of a group—from range-restricted gatherers to more mobile hunters, noting that the value of shellfish may lie in its accessibility to mobility-restricted members (Jones 1991:421). Certain coastal micro-environments would have far outranked other areas in terms of productivity. Lightfoot, working primarily in the Fort Ross area, notes that "some kinds of coastal zones, such as low wave-stress estuaries, can be extremely productive environments, providing a diverse range of foodstuffs that facilitate the rise of sedentary communities, high population densities, and complex hunter-gatherer societies" (1993b:170-171).

Jones proposes a key test for assessing habitat value: "If coastal habitats are highly valuable, their exploitation should be seen early in the archaeological record; if not, a time lag should be evident between the initial exploitation of terrestrial and coastal environments" (1991:419). He then demonstrates that, whenever archaeological visibility allows its detection, this relation is apparent. Archaeological evidence has established

that rather than being big-game hunters, as had been posited, Paleoindian and Lower Archaic people were most likely foragers. These people along the coast would have focused on bays and their surroundings—areas that "could be depended on for consistent access to important hunted resources—larger terrestrial and marine mammals—as well as valuable collected resources such as shellfish and tubers" (Jones 1991:435). Similar findings have emerged for non-coastal habitats as well. In the Mojave Desert, for example, the population relied as much on jackrabbits and cottontails as they did on bighorn sheep, mule deer, and antelope, while rodents and lizards supplemented the diet (Douglas, Jenkins, and Warren 1988). Similarly dated faunal remains from Buena Vista Lake, though few in number, indicate that freshwater clam, fish, turtle, and birds were eaten along with deer (Fredrickson and Grossman 1977). From data such as these, Willig and Aikens (1988) conclude that big-game hunting may have been no more important during this period than it was during the Archaic.

During the Early and Middle Holocene along the southern California coast, there was an emphasis on medium-sized and small mammals, most notably rabbits, but this pattern is reversed as one moves further north: only 3 percent of faunal assemblages from the north coast are medium and small mammals, rising to 15 percent along the central coast, and an overwhelming 95 percent at sites along the southern California coast (Wake and Simons 2000:303). This distribution follows the degree of biotic heterogeneity along the coast, which increases as one goes north, ultimately resulting on the north coast in a much wider range of large and small prey to exploit. Much of the PRNS–GGNRA would fall in the central zone, where larger mammals were already an important factor in the diet.

In all cases, a given coastal zone's resource value will be partly a function of the value of noncoastal resources in the same general latitude: did a particular hunting and gathering group along the coast have unrestricted access to superior terrestrial resources? "Some marine environments—estuaries, islands, and semiprotected rocky shores—were among the first habitats settled by hunters, but others, such as the exposed open coast of northern California, apparently were avoided until much later" (Jones 1991:436). The coast line in the study area is a variable one today, with long stretches of rocky coastline near the Marin Headlands and south of the Golden Gate. The Early Holocene topography, however, suggests a considerably more beneficial environment, with open stream valleys and estuaries paralleling the continental shelf (Wake and Simons 2000; Meyer, this volume). The obviously rich array of resources available to occupants of Duncans Point Cave (CA-SON-348/H) attest to the value of the Early Holocene environment in this region.

Initial Use of the Coast

There is an acute disparity between the southern California archaeological record and the central and northern California records during the Early Holocene. Sites dating to this time period in the south are plentiful, and have been known for decades, while there is only a pair of recorded Early Holocene coastal sites in the north, and they were only recently discovered. The disparity has received a great deal of attention in Pacific coast prehistoric research (Erlandson and Colten 1991; Jones 1991, 1992; Lightfoot 1993b). In 1993 when Kent Lightfoot summarized the literature on the subject, there were more than 75 sites radiocarbon-dated to between 7000 and 10,000 B.P. in the coastal strip between

San Diego and San Luis Obispo (1993b:171). Most of these Early Holocene sites are shell middens containing a variety of mollusk species, intertidal and estuarine fish remains, and varying quantities of sea mammal and terrestrial mammal remains. Erlandson (1991:97) demonstrates that the largest component was shellfish, with the other species making less than 10 to as much as 42 percent of the remains; he argues that shellfish, in combination with hard seeds processed with millingstones, would have provided a highly nutritious diet. Acknowledging that there is considerable support for the shellfish/hard-seed argument, Lightfoot (1993b) notes that shallow rock-reef, kelp-bed, and lagoon fishing may have been important at other Early Holocene sites.

EARLY HOLOCENE ADAPTATIONS NEAR THE PRNS–GGNRA

In the central and northern Northwest coast, sites began to show up at about 5000 B.P. (ca. 3000 B.C.). In sharp contrast, the majority of northern California sites date to less than 1500 B.P. (ca. A.D. 500). Only a handful of sites identified on the San Francisco bayshore appear to date to the Middle Holocene (Early Berkeley pattern), and more are assumed present under the Bay waters (see discussion under Chapter 3, Chronology, and Meyer, this volume). Evidence for Early Holocene sites on the northern coast is restricted to the recovery of a crescentic found at Bodega Head (in the Rose Gaffney collection), a fluted point near Caspar in Mendocino County (Simons, Layton, and Knudsen 1985), and one exceptional early site, the Duncans Point Cave site (CA-SON-348/H) north of Bodega Bay, just a few kilometers north of Tomales Bay and the PRNS–GGNRA. This 3-meter-thick midden filling a cave near a coastal cliff, attests to very concentrated use of the area, beginning by at least 8200 B.P.—some five thousand years earlier than other known coastal sites north of the Golden Gate. The diversity of activities represented is astonishingly broad; this is due more to the superb site preservation afforded by the cave environment than to any unique traits of the setting. As Schwaderer describes the site:

> The artifacts, features, and faunal materials unearthed at Duncans Point are indicative of a variety of activities: collecting mussels and other shellfish from the intertidal rocks; fishing off the rocks and in tidepools; hunting marine mammals in rookeries, terrestrial mammals on the coastal terrace, sea birds from the open coast and calm water birds in protected bays or estuaries; processing of animal materials including shelling and perhaps drying shellfish, butchering and cooking or drying meat and working animal skins. The lithic inventory indicates the manufacture and maintenance of casual tools from local lithic raw materials as well as finishing and maintenance of more formal tools from imported obsidian blanks or preforms. By the time of the Component 3 [7850 B.P.] occupation at least, gathering of nuts and seeds, milling of plant materials, and the production or repair of baskets and nets and attendant fiber-working activities were added. There is evidence of wood-working in Component 5 [~3400 B.P.] and shell ornament manufacture in the uppermost levels. This broad array of activities suggests that the site functioned as a residential base occupied by men and women, perhaps seasonally at certain times and year-round at others, throughout the history of occupation [1992:69]

Marine mammals were exploited throughout, while exploitation of estuarine mollusks appears to have been largely abandoned by Component 3. There was a shift from estuarine birds to open sea birds (most notably cormorants) in Component 4. Bone tools do not appear until Component 3, while shell beads and ornaments, never abundant, first appear in Component 4. A well-preserved floral assemblage; represented by bay, buckeye, manzanita, wild cucumber, red maids, miner's lettuce, bulrush, bedstraw, and *phacelia*. Notably absent were acorns. The variety of animals exploited near Bodega Bay 8,000 years ago is consistent with the current view of Early Holocene adaptations. Late Pleistocene and Early Holocene populations in California, rather than being specialized big-game hunters like their contemporaries of the Southwest and the Plains, were no doubt "generalized hunter-gatherers who harvested the resources of interior pluvial lakes, riparian fauna and flora, and coastal habitats" (Lightfoot 1993b:173).

A recent, more in-depth analysis of the archaeofauna from Duncans Point Cave (Wake and Simons 2000) correlates changes in the faunal remains with the evolution of the coast during the Early to Middle Holocene sea-level rise. Initially, the kinds of shellfish and marine mammals present reflected an estuarine environment, with nearby mainland marine mammal haul-outs and rookeries; later, these areas were inundated, leaving the rocky shoreline apparent today. The timing of this shift, based on faunal remains from dated strata, occurred between 6,300 and 4,600 years ago, a range that corresponds to the end of sea-level rise in the Middle Holocene.

While the Duncans Point Cave site clearly demonstrates that coastal resources were valued and repeatedly sought in northern California as early as the Early Holocene, data from many more such sites would be necessary before the full extent of the zone's desirability can be understood. In Jones's sweeping review of marine-resource value, he concludes that the evidence points to "complex patterning that does not exclusively support one position or the other" (Jones 1991:417). Jones characterizes the value of marine resources as "highly situational," with extreme fluctuations, and notes that they must be assessed in relation to other available resources; their value must also be viewed in terms of the varying mobility of different members of the hunting and gathering groups (Jones 1991:434-435).

The near absence of known early coastal sites in the north and their abundance in the south has been attributed to one primary factor: the differences in coastal topography between southern and northern California, resulting in differential inundation of the coastal margins (see Meyer, this volume). But other explanations have also been sought: unrepresentative sampling, including a focus on shell middens, has been cited by Lyman (1991) as a primary factor in the paucity of known sites.

SETTLEMENT VARIABILITY ALONG THE COAST

Early and Middle Holocene occupation within PRNS/GGNRA can be inferred from available data, but no such site deposits have been identified within the parklands. In contrast, all portions of the study area, with the possible exception of Sweeney Ridge, contain some recorded habitation sites dating to the Upper Archaic period. These Berkeley-pattern sites reflect a fluorescence of human occupation around the Bay and on the coast

during that period, which may be primarily a function of visibility, as many earlier deposits (including the basement levels of some known mounds) are submerged below today's sea level. The most extensive and diverse site in the Point Reyes area (CA-MRN-266, the McClure site, on Tomales Bay) is at least Upper Archaic in age, probably earlier, while the only known occupation sites in the GGNRA in San Francisco (CA-SFR-29,-30,-31 at Fort Mason) yielded Ellis Landing (Berkeley-pattern) bead types and radiocarbon dates from the late Upper Archaic (Baker 1978). Similarly, CA-SMA-22 (the Princeton Mound on Half Moon Bay), the only known residential base in that area, is also described as an Ellis Landing facies site (Moratto 1984:233).

These and many other examples throughout the Bay Area led Beardsley (1948, 1954) and others to conclude that most shoreline sites had been abandoned as living areas at the beginning of the Late (or Emergent) period, to be replaced by large, semi-sedentary earth midden sites set a mile or more back from the shore, such as CA-CCO-259, the Fernandez site, which is the type site for this period. Late-period Bay Area settlement-subsistence strategies have been postulated as largely sedentary (Bocek 1987:336, cited by T. Jones 1992) or based on a seasonal round between winter bayshore villages and inland summer camps (King 1974; Simons 1981), but Jones argues that these views are in conflict with the archaeological record. Instead he believes that the settlement system employed during the Late period in the San Francisco Bay region consisted of fairly permanent occupation of inland valleys and logistical use of both foothill and bay resource zones (T. Jones 1992:15). Sites near the GGNRA in San Francisco (SFR-5, -6, -21, -129) have not been studied sufficiently to determine the nature of the occupations.

New data from sites along the coast may provide evidence of a different site type late in time. At Big Lagoon near the settlement of Muir Beach, Meyer (2003) identified a buried deposit (the Fan Site) on an alluvium fan near the base of the hills. Little could be determined on these exploratory investigations, but the findings (many whole and fragmentary shells and animal bones, pieces of heat-altered rock, and a few pieces of chert debitage) suggest an occupation site of some kind. The shell is primarily mussel, possibly suggesting a seasonal occupation.

An accurate assessment of the resource value of various prehistoric settings is hampered, according to Jones (1997), by two factors: absence of paleoenvironmental data, and inappropriate sampling strategies for characterization of wetland adaptations. Sampling strategies at shell middens are discussed below under Subsistence.

SUBSISTENCE STRATEGIES, SETTLEMENT PATTERNS, AND SITE-FORMATION PROCESSES

THE ETHNOGRAPHIC DATABASE

Settlement-pattern studies were defined pragmatically by Tom King in the Point Reyes compendium: "Such a study focuses on the number, size, temporal affiliation, and especially location and internal features of archaeological sites, with reference to environmental variables" (1970a:280). Analysis of settlement patterning often relies on

ethnographic analogy gleaned from various accounts of contact-period site locations and seasonal movements, reported family size, hunting-group activities, and so on. While ethnographic data are often based on limited information from disrupted contexts, they serve as location-based information that can stimulate speculation. The relatively rich accounts of Drake's interaction with the Coast Miwok notwithstanding, there is a severe dearth of ethnographic data for the Point Reyes seashore and adjacent coastal Marin County for periods prior to the early 20th century. (The 20th-century ethnographic work [Kelly 1978; and Collier and Thalman 1996], while rich in ethnohistorical detail, provides no information that would allow reconstruction of the settlement system.) For the southern coast, J.P. Harrington (1942) structured field notes he had gathered around three decades earlier, producing Culture Element Distributions XIX (Central California Coast), from San Francisco to Los Angeles. While specific informants were identified for groups further south, Harrington lists only "San Jose Mission and Vicinity" for the Northern Costanoan and "San Juan Bautista, Carmel, and Soledad missions" for the southern Costanoan. The San Francisco peninsula—including project-area locations such as the Presidio and Fort Mason, as well as the San Mateo coast and upland rift valley—suffers from an even sparser ethnographic record, but has a few tantalizing historical accounts; the latter, along with mission-record research conducted by Randy Milliken (1983,1995), have allowed tentative drawing of tribelet boundaries and a variety of inferences about seasonality, social structure, and intergroup networks. But there are no accounts of the different kinds of occupation sites, the size of villages, or details of how they were laid out and used. While ethnographic accounts—had they been available—might have helped with reconstructing lifeways back to perhaps as early as A.D. 1500, they must always be used cautiously when attempting to identify settlement systems for earlier times and to model the archaeological correlates of inferred practices.

THE FORAGER–COLLECTOR CONTINUUM

In order to understand Emergent-period and earlier settlement systems, it is necessary to develop a theory-based model of the settlement system and its relationship to resource distribution (Glassow 1997:155). While a variety of hunter–gatherer research approaches have been developed since archaeologists first devised models for foraging adaptations, most are derived from Lewis Binford's (1980) typological scheme, which presents a continuum of mobility and subsistence strategies: from foragers to collectors.

The Role of Environment

A major assumption in this approach is that a necessary relationship exists between cultural behavior and the natural environment among hunter–gatherer populations. At less-complex levels of sociocultural integration (e.g., the family band, extended family organization), the relationship is close; it is characterized by the movement of the effective economic unit (e.g., the family) to the resource as it becomes available. Binford has called groups organized in this manner *foragers*. A forager strategy is characterized by high residential mobility, within an area of flexible boundaries. At the other end of the continuum are *collectors*, who often break into specific task groups to procure particular resources, which are then returned to a major village or base camp. At the extreme end of the spectrum are those collectors with firm territorial boundaries (and an inferred tribelet

sociopolitical structure) who are dependent not only on well-developed food-storage capabilities, but also on the exchange of goods with neighbors. At this extreme, because of the development of more complex exchange relationships, the heavy dependence on and necessary response to environmental forces is transcended to some extent, to be replaced by a need to develop and be dependent on complex social relationships.

Binford proposed that these strategies rose out of a response to the spatial and temporal distribution of subsistence resources, which vary from homogeneous (perennial) to heterogeneous (patchy to seasonal). D. Jones summarizes the two strategies well:

> Homogeneous resource zones invite a forager or mapping-on strategy that stresses group mobility and moves the residential group to resources. Individuals hunt and gather resources on an encounter basis within a day's foraging radius of a residential base. As resources are depleted, the forager group moves to the next foraging area and establishes a new residential base. Heterogeneous resource distributions invite a more sedentary strategy, where permanent residential bases are maintained by collectors who use a logistical strategy to acquire patchy or seasonal resources. Task groups travel to a target resource and may spend days collecting it in bulk quantity, then return it to the residential base. Some resources are cached to sustain the population during predictable seasonal shortages [1992:105].

At the base of both strategies, forager and collector, lies the *principle of optimization*: the long-term tendency for a group to find solutions to the problem of attaining an energy input–output balance that will allow for reproductive success. This is also known as the mini-max model, the strategy that provides a maximum of resources for a minimum of effort. Processes of optimization for foragers include responses to the seasonal availability of resources and resolution of scheduling problems when key resources become available at the same time but at different places, and even a randomness (or flexibility of behavior) in environments that tend to be unpredictable with respect to the occurrence of resources. (A discussion of optimal foraging is presented below under Subsistence and Technology.)

Different kinds of sites are required to accommodate each strategy. A collector-type group might create residential bases, locations, field camps, stations, and caches to organize and carry out subsistence efforts, with additional site types (e.g., rock art, mourning sites) as needed for administering the group's social and symbolic needs. Foragers, in contrast, are assumed to have only two basic site types: residential bases and locations, reflecting constant abandonment and resettlement throughout the year. Jochim comments on the rationale behind this strategy:

> Since large, permanent settlements, which represent considerable investments of materials and energy in one location, are so expensive to move, they cannot be responsive to many changes in the arrangement of these factors [resources and people]. The greater the mobility and impermanence of settlements, therefore, the more likely it is that their location can adjust to the distribution of resources [1981:151].

The forager–collector model is problematic when it is seen as a unilinear scheme, with early foragers bent on a one-way path to Late-period collecting. In fact, a range of

variables operates within each system: responses to a variety of environmental changes—both social and natural—can encourage foragers to assume more logistical, collector-type strategies or prompt collectors to reduce their range of options. Given a productive, heterogeneous environment, however, the large populations and inherent social complexities of the Late period generally demanded a complex, logistical subsistence strategy. As populations increased, the resulting pressures would have led most groups to increasing resource intensification—expending more and more effort to procure less-productive resources. A forager strategy may have been most appropriate to the low population levels assumed for the Early Holocene, although a greater elaboration in site types—and hence in adaptive modes—has come to light during the past decade in California (e.g., Fitzgerald 2000; Fitzgerald and Jones 1999; LaJeunesse and Pryor n.d.; Schwaderer 1992). In addition, the fallacy of a strict correlation between temporal period and settlement/subsistence strategy is clear in light of the several recent discoveries, in northern California, of pairs of contemporaneous, adaptively dissimilar human groups occupying the same habitat, although not the same environmental niche. (Further discussion is presented below.)

The forager–collector continuum can be viewed as a set of adaptive strategies that have certain observable archaeological implications (Thomas 1983, summarized by Fredrickson 1991:49):

- Specific site patterning in time and space;
- Degree of microstratigraphic integrity of specific site types;
- Long-term positioning and land-use strategies;
- Approaches to economic zonation;
- Patterns of faunal transport and discard;
- Staging, damage, and discard of lithics;
- Long-term implications for sedentism;
- Implications for population growth and increase of resource exploitation; and
- Long-term potential of given strategies across varying landscapes.

This list of implications serves as a good review of subsistence-settlement research issues that can be addressed using site data from the PRNS–GGNRA parklands, which constitute an excellent setting for such studies. Several of these topics are discussed below.

Site Types in the Forager–Collector Continuum

Because of the need for constant abandonment and resettlement among forager groups, Binford conceived of only two site types for this strategy—*residential bases* and *locations*. Locations are places where resources are collected, minimally processed, and packed for transport back to the residential base. Given a mobile strategy, all activities take place relatively near home, so locations have very sparse, redundant assemblages, while residential bases contain all the artifactual necessities for individual and social life. In contrast, the collectors' need for accommodating a variety of logistical efforts distributed across a heterogeneous landscape resulted in at least five types. *Residential bases* for

Table II.5. Collector and Forager Residential Bases

(compiled from Dietz, Hildebrandt, and Jones 1988:400-402)

	COLLECTOR RESIDENTIAL BASE (Permanent occupation)	FORAGER RESIDENTIAL BASE (Redundant but sporadic use)
Site Structure:	Discrete activity areas, including residential structures (e.g., house pits, house floors); cemetery areas; well-developed cooking facilities; storage facilities; well-developed refuse areas.	Little or no evidence for residential structures; cemetery areas with few individuals and no internal structure; ell -developed and maintained cooking facilities are less prominent; storage facilities absent; refuse areas are diffuse.
Artifact Form and Diversity:	High diversity of forms associated with processing and consumption of a wide variety of resources and forms related to manufacture and maintenance of tools, clothing, and facilities	Similar to collector residential bases, but limited to tools used for local, seasonally specific resources (not for stored materials or materials from distant localities).
Faunal Remains:	Use of relatively diverse set of taxa from an extensive catchment area; seasonal indicators reflect year-round procurement and consumption.	Diverse remains, but restricted to locally available taxa exploited during a particular season of the year.
Material Density:	Cultural materials occur in high densities (relative to natural deposition of sediment).	Cultural materials occur in low densities (relative to natural deposition of sediment).

collectors are fewer in number than those of foragers, contain established storage facilities and permanent structures, and other evidence of a relatively sedentary and complex system. *Locations* served the same purpose as those of collectors; *field camps* were the places where collectors ate, slept, and stored their tools and personal goods while away from home on a resource mission; and s*tations* were temporary logistical centers.

In one of the first tests of the forager–collector model in California, Dietz and Jackson (1981) proposed that along the outer central California coast, collector groups would have been engaged in more temporary, specialized activities. Sites could be combinations of field camps, locations, and seasonal residential bases. The latter site type would differ archaeologically from permanent settlements in the interior simply on the presence of marine-based artifact assemblage and faunal remains, as opposed to mixed terrestrial and marine indicators (Hildebrandt and Mikkelsen 1993:37). Dietz and Jackson proposed that the earliest collector bases in the Monterey Bay area were established by new arrivals in locations environmentally similar to their former territory—that is, in "areas where they knew the nature and potential of the resource base" (1981:667). The proposal has been questioned by D. Jones, who states that a strict Binfordian critique (with its inherent environmental determinism) would not accept the assumption that "collectors arrived with a cultural package and imposed their subsistence strategy on the environment, not the reverse" (1992:109). In addition, such a critique could not accommodate the notion that "two strategies are implemented in a single environment" (D. Jones 1992:109). It is

interesting to view this critique using a postmodern approach; in this view, it is not difficult to acknowledge that different groups' perceptions of the environment and their experience and differential success with manipulating it can create multiple environments at any one time.

In their work at Elkhorn Slough, at the northern end of Monterey Bay and about 40 miles south of the GGNRA's San Mateo units, Dietz, Hildebrandt, and Jones (1988) attempted "to enhance the predictive powers of the model and define the relationship between material remains and human behavior" (D. Jones 1992:111). Among their efforts was the explication of the archaeological correlates of collector and forager residential bases, a distinction that has troubled many researchers. How does one distinguish between a residential base that was one of several occupied during an annual cycle and a residential base that was the sole focal point of a settlement system? (Glassow 1997:161). The shift from a forager strategy to a collector strategy, which is primarily a shift from a generalized economy to a specialized one (Clark 1998:41), created fundamentally different social systems; interestingly, the difference in terms of archaeological site expression may be primarily one of degree, resulting in an especially subtle distinction not detectable without archaeological excavation. Table II.5 summarizes Dietz, Hildebrandt, and Jones's (1988) criteria for the two residential site types based on presumed forager–collector strategies. The authors note that a key attribute that distinguishes a forager residential base from those of collectors is "the blurring of activity areas" in the former, which results in a rather homogeneous structure (Dietz, Hildebrandt, and Jones 1988:401).

Tests of the model have met with limited success, primarily because of the high data requirements for such studies, including the following:

- a large site universe, preferably one that constitutes an entire drainage system, equivalent to a catchment area or a Late-period group's tribelet territory;
- reasonably good dating for all sites in order to identify suites of contemporaneous sites;
- sufficient examination (preferably subsurface) of each site to yield a reasonably accurate inventory of site contents, including
    - faunal and macrobotanical remains (seasonality, diversity, and local/nonlocal availability);
    - number and complexity of dwellings and other facilities; and
    - a representative sample of the full artifact assemblage.

ENVIRONMENTAL PRODUCTIVITY AND SUBSISTENCE STRATEGIES

The forager, or mapping-on strategy has been associated with homogeneous resource zones, while a sedentary strategy is encouraged by heterogeneous (or "patchy") resource distributions. Resource homogeneity is most pronounced in the Great Basin and other arid regions, including nonriverine settings in the Great Valley, but is a less-useful distinction along the northern and central California coast. Here a fair degree of heterogeneity would have prevailed, particularly within a given tribelet territory, as these

units were fashioned, ethnographically, to include whole watersheds. Beginning with the often homogeneous coastal strand or prairie on the west, tribelet territories continued east to encompass valleys, riparian river or stream corridors, and exposed slopes with wooded drainages.

A Fort Ross Example

In contrast to the patchiness/homogeneity model, Perlman's productivity model (1980, cited in Lightfoot 1992:39) looks at coastal productivity in terms of terrain and the degree of wave stress. In high wave-stress, mountainous, coastal regions, such as the North Coast Ranges, coastal hunter-gatherer societies will exhibit high residential mobility, small group size, and minimal sociopolitical complexity. The rocky coastal shore and uplands of Mendocino and Sonoma counties near Fort Ross, according to Lightfoot (1992:39), fit the description of Perlman's low-productivity zones, and ethnographers have indeed characterized the Pomoan groups occupying this area as living in small dispersed groups. (A similar site type in similarly rugged land prevails on the Santa Mateo-Santa Cruz coast south of Sweeney Ridge; see below.) In contrast, Perlman predicts "large, sedentary communities will evolve along highly productive coastlines characterized by broad and shallow continental shelves and low wave-stress estuaries" (Lightfoot 1992:39). Estuaries, the focal point of settlement in the Point Reyes/Tomales Bay locale, have long been recognized as highly productive zones that contain, or provide access to, a diverse range of terrestrial, estuarine, and marine resources. Lightfoot concludes that "establishing residential bases in the estuarine ecotone minimizes transportation costs by limiting the distance task groups travel to nearby resource patches" (1992:40).

In the Fort Ross study, most of the sites conforming to ethnographer Omer Stewart's (1943) model of the central-based village were found to be located along the coast-facing slope and at the top of the first ridge. Some exclusively shell-bearing sites along the coast may have been strictly seafood-processing stations, but two others on the coast are more complex: CA-SON-1889 and -1892 contain not only shellfish debris but lithic assemblages suited to plant processing, and more generalized lithic production and maintenance. Lightfoot suggests that these may be short-term camps or even relatively stable small-family residences, perhaps "integrated within the settlement hierarchy of the first ridge" (1992:49). Thus the inferred settlement system at Fort Ross indicates that logistically organized collectors in coastal environments are not associated exclusively with low wave-stress, gentle terraces containing extensive estuaries, and that "a more diverse range of hunter-gatherer settlement patterns may be found along rocky, mountainous stretches of coastline in central and northern California than previously expected" (1992:50).

In comparing the Fort Ross setting to the GGNRA parklands, it can be seen that an important characteristic of the former area is the network of ridge travel routes in the mountains backing Fort Ross, which lead not only north and south but also extend east to interior valleys (Alexander Valley, Ukiah Valley). In contrast, much of the PRNS–GGNRA both north and south of the Golden Gate consists of peninsulas; thus Bolinas Ridge, which leads from Tomales down to the lower ridge slopes of Tamalpais and the Marin Headlands, and Montara Mountain and Sweeney Ridge in the south, would have provided inhabitants with access to the both bay and coastal resources. The striking ecotone along the San Andreas Fault on Sweeney Ridge, together with easy travel conditions, would have been

a key factor in the development of the unusually large and complex prehistoric settlements in the San Mateo parklands (Babal 1990; Hylkema 2003; Salzman 1983).

A collector strategy, with its system of permanent villages on the interior supported by specialized sites on the coast, is assumed to have prevailed by the Upper Emergent period throughout much of north-central California. For the southern Santa Clara valley east of Elkhorn Slough, however, Hildebrandt and Mikkelsen note that seasonal residential bases on the Monterey coast continued in use after 1400 B.P. (ca. A.D. 600), suggesting that "a wholesale shift to a collector strategy did not occur late in time" (1993:40). They propose a more complex, seasonally shifting, strategy: at some times of the year, semi-permanent villages could have been occupied in the interior, where stored resources were consumed, and from which collector-type, task-specific groups would make forays to the coast, resulting in the ubiquitous small shell middens. "At other times of the year, interior populations could have dispersed into smaller, more mobile groups, creating the forager residential bases we see along the outer coast of Monterey Bay" (Hildebrandt and Mikkelsen 1993:40), similar to the actions of Late-period groups in the Great Basin. The strategy is also documented ethnographically among the North Bay and North Coast Ranges Native American groups—where extended families might spend several weeks of each year on the coast (Peri, Patterson, and McMurray 1985:213-215), although it is possible that this use represents a strictly historic-period adaptation.

The San Mateo and Santa Cruz Coast

South of the San Mateo GGNRA parklands, Mark Hylkema (1991) has focused on identifying the archaeological correlates of the forager–collector continuum and testing its applicability to the western San Francisco Peninsula, from the ridgeline to the coastal shore within San Mateo and Santa Cruz counties. Hylkema identified different zones along the peninsula, finding that the environmental setting of each encouraged a different kind of strategy. "Task-specific procurement stations along the coast used by collectors were established only where they were still in range of interior residential bases large enough to furnish stored staple resources" (Hylkema 1991:387). This arrangement required a relatively high degree of social complexity to allow for effective distribution of people across the landscape. The complexity of these strategies increased over time—in response to population growth, resource depletion, and other constraints and opportunities—with the Lower Emergent-period groups in the San Andreas Fault Zone area (in which the GGNRA lands are situated) exhibiting a collector strategy that allowed use of both coastal and bayshore resources from the same ridge-top village site. Archaeological sites CA-SMA-125 and SMA-147 (one of which may have continued in use or been reestablished as the ethnographic *Lamchin* village of *Ssupichom*), at the southern end of the GGNRA Sweeney Ridge, were both large residential sites with abundant and diverse assemblages and a large number of well-furnished human burials, all dating to the Lower Emergent period, or Phase l of the Late period. At the same time, according to Hylkema (1991:390), there is only one adequately documented Emergent-period site in the Half Moon Bay area, SMA-115, and it is task-specific in nature. The situation is different south of the parklands, in the heart of Hylkema's study area, where steep and densely forested slopes predominate and homogeneity (albeit with tremendous biomass—the redwood forest) typifies the setting. There the archaeological sites demonstrate a generalness:

> The co-occurrence of mortar and pestle milling tools with handstones and milling slabs at sites from both the Middle and Late Periods, the distribution of multi-use sites over a wide range of ecological zones and the generalized hunting pattern within these zones through time leads to the conclusion that a forager strategy along the coast of [southern] San Mateo and Santa Cruz Counties co-existed with a collector strategy which surrounded the area [Hylkema 1991:391].

One goal of Hylkema's study was a test of the population-movement models that have driven much of the research in this area (see Chapter 3). He characterizes the interactions between these groups as primarily supportive. Through intermarriage and reliable exchange relations, some groups were prompted toward greater cultural complexity required of coordinating these interactions, while others benefited from a steady input from outside. "These groups were not homogeneous and composed a system of interacting populations supported by a range of adaptive patterns that adjusted to variable ecological productivity and resource demands" (Hylkema 1991:391).

The situation is similar to that identified or proposed in a variety of North Coast Ranges locales (see Chapter 3) The northern examples, however, are all dated to the early Upper Archaic, or Middle period (ca. 500 B.C.), at the time of the inferred Miwokan expansion. Hylkema's asymmetrical populations, in contrast, date from the Middle through the Late periods. (This topic is dealt with again in Chapter 5.)

SETTLEMENT STUDIES IN THE PRNS–GGNRA AREA

Because of its undeveloped nature and grand size of its landholdings, the Point Reyes National Seashore has been the subject of several settlement-pattern studies, while the rest of Marin County has also been the subject of a few. In contrast, the settlement system of San Francisco can only be the subject of conjecture based on reconstructions of the landscape and connecting the dots that represent buried resources identified in the city. Intensive studies have been done of the settlement system of southern San Mateo and Santa Cruz counties, while a recent publication describes the settlement system for the south Bay (Hylkema 1991, 2003), but no similar work has been done for the GGNRA parklands on Sweeney Ridge. Some of the Marin and southern San Mateo studies are described below.

MARIN COUNTY

Explicit settlement-pattern studies for Marin County include Van Dyke's (1972) testing of a colonization model, with the quantification of a number of site-location variables. Some of his findings, particularly those pertaining to the PRNS, are discussed below. Another ambitious study was Slaymaker's (1977) investigation into identifying tribelet structure from archaeological remains. Using nine sites in the Gallinas Valley in western Marin, he isolated clusters of sites with natural physiographic zones and compared sites and their morphological characteristics. Subsurface investigations were made to determine the sites' temporal relationships, including the archaeological identification of remains

believed to represent ceremonial and residential structures. Slaymaker identified a cluster of minor sites focused around a major settlement at CA-MRN-138, which he proposed might be the Coast Miwok village site of *Shotomoko-cha* (Morrato 1984:273). "With the isolation of sites within the physiographic zone which are contemporaneous with the ceremonial locus . . . the tribelet settlement pattern and type of political organization can be predicted archaeologically" (1977:198-199). Slaymaker's work has been influential. The equation of a tribelet with a single physiographic zone, however, appears to belie the ethnographic pattern of capturing a range of zones within a group's resource base.

King (1974b) has proposed models for the expanding settlement of western Marin that involve a positive feedback between population growth and natural environmental conditions. As population pressures develop, daughter groups "bud off" from the original, sedentary group. With the ties to the parent population maintained through various trade mechanisms, the daughter populations can survive effectively, allowing for sedentary occupation in less optimal locations. This model has been useful in considering both settlement matters—in which the interrelationship among sites is emphasized— and sociopolitical ones (see Chapter 5).

In another more general consideration of the Coast Miwok settlement pattern of southern Sonoma and Marin counties, King used the apparent Emergent-period patterning to highlight how the concept of settlement pattern intersects with social systems and to emphasize the diversity of lifeways in the area.

> On the San Francisco Bayshore, the clusters of small sites seemingly satellite to larger villages can be taken to suggest a socially ranked residence system like that apparently adhered to by the Southern Sierra Miwok, in which a ruling family resides in a village constituting the ceremonial and social center of a cluster of "commoner' communities. An alternative model is that of a dispersed population seasonally congregating at a central locus. On the Pacific Coast the relative smallness of most sites and their regular spacing suggest a permanently dispersed population, perhaps consisting of isolated family bands. The large single villages of the interior lead one to expect a nucleated population and its characteristic social complexities. Such a variety of basic societal formats, in a limited geographic area of presumed linguistic homogeneity, is difficult to accept as a logical possibility. We need to investigate the relationships among the sundry subregions: was each the locus of a separate social entity, pursuing an independent course towards effective adaptations, or are the archaeological patterns we abstract the manifestation of temporal or seasonal population-shifts? If the latter is the case, what sort of social structure can handle such variety in residence pattern, or what caused Miwok social organization to change in such a way as to leave the evidence we have recorded? If on the other hand, the former is correct, what environmental factors required, and what social institutions contributed to the observed settlement patterns? [1970b:283].

While King's questions focus on social organization (and are discussed again under that chapter), they require settlement data for their resolution. Three decades later,

settlement data from site survey and analysis remain deficient, especially with regard to seasonality and sedentism. We do not know whether groups remained in their settlements and obtained outside resources through trade and occasional expeditions, or whether they moved as resources became seasonally available within their territory. Of equal importance, we do not have adequate control over time: some sites are not dated at all, while most others are loosely dated on the basis of temporally diagnostic artifacts (whose temporal positions may be in question). Richard Gould recognized this problem for the San Francisco Bay in the 1960s, where sites were being treated as though they were occupied year-round. He noted that if seasonality did occur on the bay, it would upset much of the dating that has been established for the area: "Could it be that some of the groups assigned to different facies might in fact be only the seasonal manifestations of the same group?" (1964:158).

Seasonality can be fairly readily identified when excavating sites with robust floral and faunal assemblages, but many sites have limited assemblages, and location is the primary test for non-excavated sites. Seasonality was determined to be significant in Marin County by Van Dyke, who analyzed the Marin data in terms of a colonization model. Looking at 140 sample site locations with respect to access to water, he found that 44 and 43 percent of the Middle Horizon and Phase 2 Late Horizon sites, respectively, occurred with no mappable water, suggesting seasonal movements for the full span of the (then known) sequence (Van Dyke 1972:118).

Investigating the colonization of Marin County, Van Dyke's findings demonstrated that archaeological site distributions resulting from colonization in a patchy environment and those that represented a pre-adapted population operating on the basis of an optimization strategy would be similar, thus obscuring the identification of colonization in the archaeological record. "First, hunter-gatherer societies can quickly adjust to new conditions and—in the absence of a large investment in terms of structures at a particular site—can move on to improve their situation. Secondly, the process of colonization is followed rapidly by the process of 'spread' which encourages changes in settlement distribution" (Van Dyke 1972:97-98). Testing, in part, Tom King's budding-off hypothesis (see above), Van Dyke notes that both the "budding off" and "colonization" models of site clustering are based on an assumption of sedentary living. While semi-sedentary living appears to have supplanted mobility in much of north-central California beginning some time in the Upper Archaic period, it is possible that true sedentary occupation for the whole population was rare even in the Upper Emergent period.

INITIAL POINT REYES SETTLEMENT STUDY

In the 1970 compendium in honor of Adan Treganza, Rob Edwards (then of San Francisco State University) reported a proposed settlement pattern for the Coast Miwok based on his archaeological survey of Pt. Reyes during 1967-1968. He had attempted to revisit all the 121 sites recorded with the Archaeological Research Facility at Berkeley, and to record previously unrecorded sites where encountered; once duplicate recordings and destroyed sites were eliminated, a total of 78 sites were available for his study.

Nearly all the sites Edwards relocated were shell middens; only one midden lacked shell, while two sites were non-midden sites with artifacts. Population estimates were made based on site size, using Cook's logarithmic formula (Cook and Treganza 1950), resulting in the division of all sites at Point Reyes into three size classes: 10-family sites, 5-family sites, and less than 5-family sites. Based on ethnographic information, a family size was assumed to consist of 6 to 8 persons. For Point Reyes, Edwards estimated the total population of the 10-family sites to be 578, and the total population of the smaller sites to be 435. While in a semi-sedentary society, the population converges on the larger villages at certain times and then disperses, Edwards concluded that "there is a constant population in the larger villages which should result in an archaeologically visible imbalance in favor of the larger sites; this imbalance seems to be evident on Point Reyes" (Edwards 1970:108).

The settlement model guiding this Point Reyes hypothesis is Kroeber's (1932) definition of a tribelet, which Edwards summarized as follows:

> Groups small on the average, several settlements (not necessarily occupied simultaneously); average population of about one hundred; smaller settlements not occupied permanently; territory usually definable as a stream drainage; and, water not a boundary, rather both sides of a stream typically held by one tribelet; each group acting as a homogeneous unit in matters of land ownership, trespass, war, and major ceremonies [1970:112].

He also distinguished three multi-site clusters on Point Reyes, based on

> (a) mutual proximity of member sites, (b) geographic breaks between presumptive clusters, and (c) approximations of balance between the project populations of large and small sites within each presumptive cluster [Edwards 1970:111].

These three groups were presumed to represent tribelets: the northernmost takes in both sides of Tomales Bay in the Toms Point vicinity; the central one takes in both sides of the remainder of Tomales Bay; and the third is suggested as exclusive to Point Reyes and adjacent Olema Valley (Edwards 1970:113). The former two tribelet areas are assumed to extend into adjacent valleys to the west. (Slaymaker's [1982] subsequent research using mission records indicated one large tribelet group in this area [see Chapter 6]; he proposes, however, that Edwards's tribelet territories may have prevailed prior to historic-period aggregation.)

Edwards was optimistic about his model, proposing that "further ethnohistoric and archaeological research should make it possible to tighten the definition of these territories and the societies that occupied them, and to use them as units of observation in broader socio-environmental studies" (1970:113). Edwards's model has several problems, however, that have deterred its use: (1) no consideration of the time depth of these sites and thus no assurance of contemporaneity; (2) a consideration of seasonality but no effort to account for it; (3) no consideration, beyond size, of differences in site type; (4) equating site size with population size; and (5) assuming that all archaeological sites were residential.

The assumption of residential use cannot be justified, archaeologically or ethnographically, as both site content and ethnographic data indicate that a large proportion of the sites would have been used solely or primarily for processing, while another sizable percentage would have been logistical camps: residential locations, but of very short-term duration. The actual occupation sites (permanent to semi-permanent villages and hamlets) might be represented by Edwards's 11 10-family sites, but these, too, are problematic, since there is no necessity to assume that they were contemporaneous. In addition, two of the largest, on Limantour Spit, were proposed by their excavators to be "occasionally occupied camps whose primary *raison d'être* was the exploitation of resources offered by the estero system" (King and Upson 1970:177). While King and Upson could not determine population size, they suggested that the group was possibly larger than 10 people (the number of inhumations and cremations discovered, which were believed to be the result of a single disaster); it was proposed that those camped there represented only a certain segment of the village community—probably the healthy and robust (King and Upson 1970:174).

Van Dyke, in his settlement study of Marin County, offered this caveat on Edwards's study and settlement-pattern studies in general:

> Settlement patterns can neither be assumed to be constant nor to have changed. The recognition of a pattern for all extant sites can never be assumed to be the cultural pattern, but rather a combination of patterns existing at different points in time. Settlement patterns must, thus, be recognized from a sample of coetaneous sites and, further, from only those sites occupied contemporaneously [1972:94-95].

Some of the 10-family sites identified by Edwards, such as those at Limantour, could instead represent casual, intermittent, repeat visits to the approximately same location as visited previously (i.e., to the same camping area, rather than the same camp). The result of many decades of such behavior is a very large archaeological site, which could be classified as a village, as both Edwards (1970) and Polansky (1998; see below) have done. King and Upson express the same notion: "Site dimensions as used by Cook and Treganza (1950) and Cook and Heizer (1965) to suggest settlement population are of little use in a site where multiple specialized economic functions can be inferred and horizontal stratigraphy is a strong probability" (1970:174). In fact, Edwards himself notes that "the Limantour Spit sites . . . are probably seasonal special purpose camps" (1970:112), despite having classified them as 10-family sites.

RECENT POINT REYES SETTLEMENT RESEARCH

Barbra Polansky (1998) conducted a settlement-pattern analysis for Point Reyes that is presented in her master's thesis. Rather than focusing on site size as an indicator of population, she developed a typology primarily based on the presence and co-occurrence of site constituents, although size and density were also factored in. After developing descriptive criteria for each site type, she correlated these descriptions with a hypothesized site type based on function. She warns that "the true function of each site remains unclear and an interpretive jump is made when behavioral traits are applied to functional attributes of the sites" (Polansky 1998:15). While her results show some clear correlations between

Table II.6 Proposed Site Types for Point Reyes National Seashore

(compiled from Polansky 1998:75-85 and Table 8)

Constituents	**Site Type**	**Number and Location** (site trinomials from Table 8)
Shell midden only	Special Purpose – Shellfish Processing Station	9 Sites – all on Bay/Estero (MRN-222, 223, 224/H, 249/H, 250, 256, 270/278, 304, 390)
Flaked-stone tools and debitage only, or Flaked-stone and millingtools* only (no midden or dietary debris)	Special Purpose Site – No Midden	5 Sites – all zones (MRN-228, 239, 278, 291, 292; latter two also rockshelters)
Low- to moderate-density shell midden, faunal and/or lithic remains, few or no milling tools; small size	Temporary Camp Site	16 Sites – 11 on Bay/Estero; 1 and 4 in Ocean and Inland (MRN-216, 231/305, 246, 263/H, 272, 285, 288, 293, 377, 387/H, 388/H, 389, 391, 392, 393, 394)
Moderate- to high-density shell midden, milling equipment, and both faunal remains and flaked stone; less than 3,000 sq. meters.	Semi-permanent Residential Base Camp	17 Sites – 9 on Bay/Estero, 6 Ocean, 2 Inland (MRN-226, 230, 234, 238/237, 248, 258, 269, 271, 273, 274, 276, 277, 287, 290, 294, 379; one ocean site not identified)
High-density shell midden with all site constituents (milling, faunal, lithic); more than 3,000 sq. meters.	Permanent Residential Base	8 Sites – 7 on Bay/Estero and 1 Inland (MRN-232, 242, 266, 275/302, 296, 298, 375; one bay/estero site not identified)

*Items at reported "millingtool-only" sites are hammerstones and may therefore be associated ith lithic processing, not food milling.

site type and location (within three zones, identified as bay/estero, ocean, and inland), it is important to note that Polansky used location to aid in determining site type in many instances. Her results are shown in Table II.6.

Using her new site typology for Point Reyes, Polansky evaluated two models of settlement. The first is proposed for "an earlier period of occupation" that is "characterized by a residentially mobile population whose activities created the temporary camps"; for this settlement model, she predicts (citing Cleland 1995:5) that there would be the following elements:

1. the presence of shell midden, in particular shellfish remains of available species at the locality of the site itself and faunal dietary refuse and possibly lithic material

2. the general absence of milling equipment, generally signifying the necessity for efficiency of movement for a highly mobile hunter-gatherer population
3. low frequency of special purpose sites
4. general uniformity of site size
5. faunal and floral remains will be seasonally specific if they are temporary or seasonally occupied . . . [Polansky 1998:99].

She contrasts this "earlier-period" settlement mode with the expected elements of a later-period one (Lightfoot's [1992] central-based village model), based on the assumption that populations generally develop a more sedentary settlement strategy through time:

1. the presence of dense shell midden and dietary refuse, including the remains of species found out of the immediate vicinity of the site and a diverse artifact assemblage
2. the presence of milling equipment
3. the presence of several different types of special purpose sites
4. faunal and floral remains may reflect exploitation over extended periods possibly at different times of the year [Polansky 1998:99-100].

Comparing the Point Reyes sites against the two models, she argues that both settlement modes may be represented by the sites. Greatest conformity is found with the central-based village model, where the "permanent sites" of her site typology are seen as the tribelet centers that Lightfoot discusses. With eight such sites identified—and no stratification for time—it is unclear how these might fit the prevailing tribelet model. The sites designated as semi-permanent residential bases were found to have many of the same attributes as permanent ones, but were generally smaller (Polansky 1998:102).

Polansky's designation of Point Reyes sites represents the first time that these sites have been stratified according to functional characteristics, a significant break-through in the area's settlement-pattern research. Current analysis for this research design indicates that a number of issues in the database need clarification. The following concerns will also need to be addressed before the typology can be used to reliably test settlement-pattern models.

1. The geographic unit to be studied must take into consideration a full drainage system or some greater area consistent with the known extent of one or more tribelets (see Edwards, above).
2. With this increase in geographic scale, the sites must be considered in relation to interior permanent residential sites (central villages).
3. The sites must be independently tested for age.
4. Site-type designation might benefit from being based solely on site constituents, independent of site location.
5. Assigning site size should make some attempt to identify volume rather than surface area alone, since the larger sites can often be the result of ad hoc visits without focus on a site center (e.g., some Limantour Spit sites).

Finally, a review of the constituents identified at different sites is in order. Many of the sites considered milling locations, however, may have served different functions, while at least one of the rockshelters and a bedrock milling station have been discounted on a subsequent survey (Jablonowski 2001 pers. comm.). As with any large database of this kind, some infield rechecking will be warranted. It is hoped that future archaeological researchers in the PRNS will continue to work with this dataset, which has great potential.

SMALL-SCALE SPATIAL ANALYSIS

Small-scale spatial analysis—attempting to determine how people organized themselves, both economically and socially, on the basis of the material remains of a living site—also falls under the rubric of settlement-pattern studies. These studies are especially effective, and therefore widely used, in such sites as architectural ruins in the American Southwest, where discrete activity areas and discard patterns can be clearly traced from room to room. California sites are notoriously difficult to analyze in this way, with an absence of architecture, unstable terrain subject to slumping and earthquakes, and loose midden soils riddled with the tunnels of burrowing animals. Broad exposures at deeper levels, however, have allowed more detailed descriptions (Meyer and Rosenthal 1997).

The research design for the National Forests of the North-central Sierra (Jackson 1994) describes an interesting activity-area analysis: Greg White's (1988) report on excavations at CA-CAL-991, a Late-period rockshelter in upland Calaveras County.

> Through detailed mapping of the distribution of artifacts and occupational residues in the rockshelter deposit, White reconstructs three temporal periods of occupation characterized by changes in economic and organizational focus. His efforts are mostly couched in terms of demonstrating the economic rationale for occupying an otherwise apparently poor subsistence resource areas. However, there are clear implications throughout his study regarding the organization of labor in the context of changing modes of production [Jackson 1994:15-6].

Operating as they do on the level of individual action, such studies can be classified as investigations of social organization, as well as settlement pattern, with the potential to view the individual activity as a microcosm of the culture as a whole.

Cave sites provide an ideal stage for such analysis, both for their exceptional preservation and the often undisturbed conditions present. While encountering an undiscovered cave site on the order of the Duncans Point Cave north of Bodega is not likely, some small rockshelters may remain unrecorded in the uplands along Bodega Ridge or Montara Mountain in San Mateo County. The most likely intact sites with small-scale site-analysis potential are buried ones that have been protected from modern intrusions and possibly from subsequent cultural or natural prehistoric disturbances as well.

SUBSISTENCE & TECHNOLOGY

OPTIMAL FORAGING – DIET BREADTH

Optimal-foraging theory is one of the most widely used and regularly tested approaches to hunter–gatherer research, both archaeological and ethnographic (Jochim 1983; Thomas 1986; Winterhalder and Smith 1981). The theory assumes that we humans make optimal use of our efforts at resource procurement and processing, employing rational decisions that will minimize costs. The currency involved in optimal foraging is energy; thus the optimal forager acts to expend the least amount of energy to acquire the greatest benefit (i.e., the mini-max model). Over time, natural selection operates to favor the most optimal behavior. "The greatest appeal of optimal foraging models," Thomas notes, "is their ability to bring specific testable projections of human behavior to bear on real data" (1998:413). Because optimal-foraging theory was borrowed by archaeologists from biologists, culture was at first a missing factor in all its equations.

While aspects of optimal-foraging theory are still in wide use today, reliance on the approach has been tempered by critiques, some offered by the most active practitioners. Jochim (1983:163-164), for example, identifies three major assumptions of the theory that may not be fully justified, greatly summarized as the following:

1. That selection operates consistently and intensively, when in fact optimal behavior may not be consistently selected; he suggests that looking at the penalties paid by suboptimal behavior in various contexts may be more useful.
2. That optimal behavior is attainable, and the best decisions cannot necessarily be expected to be reached, especially if they require complex computational ability and knowledge of nutritional values.
3. That the predictive value of optimization models will favor energy efficiency. He notes, for example, that resource selection takes quite different forms depending on whether land or labor is scarce.

After describing a number of other difficulties with optimization models, Jochim nonetheless advocates their retention, considering such models to be "one of the most valuable and exciting of recent developments in anthropology and archaeology" (1983:167). Rather than discarding models, he argues that archaeologists should be generating *more* hypotheses to be tested—including very simplistic ones—with competing models differing in terms of underlying assumptions and mathematical structure.

RESOURCE INTENSIFICATION

Hunter-gatherer resource intensification has been defined as a significant shift in a resource-production strategy that entailed population increase, decreased range and frequency of residential moves, enhanced intergroup interaction, and "a rise in the number of social roles and statuses within and between communities" (Bouey 1987:54). It is apparent that this suite of traits essentially defines the distinguishing characteristics of the central California Emergent period in contrast to the Archaic. It has often been remarked that possession of these and related traits placed California groups at a similar level of

complexity as that of early agricultural societies. What allowed this kind of development, according to the prevailing view, was the acorn, the main staple of the California Indians (Baumhoff 1963). In fact, Baumhoff (1963:162) valued the acorn so highly that he assumed that periods of starvation mentioned by some groups ethnographically must have been caused by the failure of acorn crops.

In accordance, in part, with modern western societies' high regard for civilization, the Native Californian settlement-subsistence pattern at the time of contact has been seen as a highly compatible adaptation among human groups and between humans and the environment. Raab (2000:3) notes that Albert Kroeber did much to establish this perspective, with his oft-quoted statement:

> The food resources in California were bountiful in their variety rather than in their overwhelming abundance along special lines. If one supply failed, there were a hundred others to fall back upon [Kroeber 1925:524].

On a local level, Adan Treganza echoed this view when writing of the Point Reyes peninsula. Remarking on the presumed simplicity of Coast Miwok economic pursuits, which he attributed to the bountiful environment, he stated:

> Environmental pressures which often have driven other peoples to extremes of great material or non-material achievement were largely lacking in California. If ever there existed an 'aboriginal Garden of Eden' then this was the spot. . . . Food was everywhere available to be obtained with minimum effort. We call this same level of achievement retirement [Treganza 1960:5].

This same romantic view continued to inform researchers until the 1980s, when the results of various research efforts began to contradict the notion of California as paradise.

The most convincing and widely cited effort is Mark Basgall's (1987) study of the resource value of the presumed staple of California Indian diet: the acorn. Basgall proposed, and Wohlgemuth (1996) has subsequently confirmed through archaeobotanical data, that acorns do not appear in the archaeological record earlier than about 5000 B.P. (ca. 3000 B.C.), and some regions of the state did not take up the acorn until the last millennium. Since humans are believed to have occupied California for at least 10,000 years, the acorn's late appearance in the diet is curious, if indeed it is as beneficial as earlier researchers had thought (Baumhoff 1963). Raab notes that, "If this question troubled early researchers, it was dismissed with explanations based on changing food tastes, 'settling in' to the environment, discovery, experiments and other inscrutable processes" (2000:5).

Optimal-foraging theory assumes that humans will use available time and energy to pursue prey that optimizes energy return rates. Basgall argued that the ethnographic diet dominated by acorns was not, as was once held, an optimal food responsible for the region's high population densities; instead, it was a high-cost undertaking requiring significant organizational and technological investment: "Lacking compelling evidence for environmental degradation or a sudden jump in socially mediated production demands, we can probably explain the intensification of acorn exploitation in terms of greater population density, no doubt brought on in localized areas by in situ growth or immigration or both" (Basgall 1987:43). Looking at data compiled from studies of central California

skeletal populations, he concludes that, "Available archaeological data are consistent with the notion that balanophagy [a reliance on acorn processing] brought with it increased dietary reliability . . . but not a qualitatively better diet" (1987:44). Basgall concludes that, "requisites of an acorn-based economy (intensified use of smaller tracts of land, decreased mobility, formal territorial demarcation) appear to be behind the organizational complexity evident in much of the late prehistoric and protohistoric" (1987:45).

Based on these and other studies, resource-intensification theory has come to focus on the costly outcomes of these endeavors in California prehistory: expending more and more effort to procure less-productive resources. What pressures would lead people to engage in these less optimal practices? Basgall suggests, above, that population density alone would be sufficient. There is, however, evidence for climatic degradation around the time of the sudden adoption of the acorn as staple. This is the Medieval Climatic Anomaly, dated to A.D. 800 to 1350, which has played a role in models of culture change in other areas of the state, particularly the Sierra foothills (Moratto 1984; Moratto, King, and Woolfenden 1978) and has received fairly solid support in recent years (Jones et al. 1999; Stine 1994). While there is no direct evidence of the effects of such a climatic regime along California's coast, the conditions that prevailed at this time period have been proposed as indirect evidence of the Medieval Climatic Anomaly:

> On the coast, there is significant evidence for settlement instability, population movement, exchange breakdown, and interpersonal violence during the terminal centuries of the Medieval Climatic Anomaly. Research of the past several decades has emphasized that high population density of California hunter-gatherers, their intensified economies, and their relatively complex sociopolitical systems. Still, the dependence of these people on a few ubiquitous, labor-intensive, storable resources put them in ecological jeopardy [Jones et al. 1999:155].

Several criticisms of the assumptions proposed for the Medieval Climatic Anomaly have been published, some of which emphasize that the poor resolution of the archaeological record and the questionable fit of the archaeological correlates do not warrant the level of certainty that has been expressed. Basgall, for example, suggests that alternative explanations may be implicated: "The sudden shift in site locations might not reflect continued expansion in diet breadth, but it could mark a change in settlement organization the better to exploit different microenvironments (intensification, after all, can be marked by increased use of high-cost resources, shifts to more labor-intensive extractive technologies, or enhanced exploitation of sub-optimal resource tracts)" (1987:45). Other new views of outcomes of intensification include an increased recognition of warfare and a re-evaluation of the role of exchange (see discussion in Chapter 5, Social Organization).

Several criticisms have been waged against intensification theory. Among these are the comments of White et al.: "to date, economic intensification theory (at least its manifestation in northern California)—while quite powerful and operational in other respects—has posited little or no role for co-use or coaccess to resources, and in fact assumes territorial circumscription as a basic element in cultural dynamics." They conclude that "multi-group co-use or coaccess was common in the context of resource abundance in Northern California" (White et al. 2000:55). (See the discussion of multilinear adaptations in north-central California in Chapter 3, Chronology.)

Pragmatic, detailed studies have, nonetheless, verified the fact that prehistoric native people did have a profound effect on the native flora and fauna of California. The most influential for coastal California is Broughton's (1999) *Resource Depression and Intensification*, which focuses on the Emeryville Shellmound faunal collection. His analysis, mentioned further below, provides detailed support of models that predict "declines in the effectiveness of resource procurement as a function of human population growth and declining absolute or per capita abundance of high ranked resources" (Broughton 1999:70).

MODELS OF PROCUREMENT STRATEGIES

Deer Economy Model

A summary of zooarchaeological research in the San Francisco Bay area (Simons 1992) presented arguments for various hunting strategies in inland, bay, and coastal settings. Simons describes the prevailing "deer economy model," which involved exploitation of deer as primary prey, backed up by a secondary hunting strategy that was focused on a variety of upland game birds and mammals (i.e., quail, pigeons, doves, rabbits, rodents). People participating in a "deer economy" placed great attention on the development and elaboration of an interlinked series of hunting techniques. "These, with appropriate modifications accounting for behavior(s), abundance(s), and distribution(s) of particular prey species, were applied to hunting a constellation of birds and mammals inhabiting similar habitats." The result was that hunting was a "highly opportunistic event, with hunters often switching . . . from pursuing one prey species to another as specific circumstances warranted" (Simons 1992:88).

Simon's deer economy is similar to the concept of "coharvesting," which was developed by Yesner in his work among the Aleut; the Aleut case, however, is described as more serendipitous:

> Optimal foraging theory predicts that any prey encountered that has a low handling cost, or a handling cost/benefit ratio below a given level will be harvested. "Coharvesting" is a type of optimal foraging when additional species are obtained as part of the same general hunting procedure. For example, desert hunters returning unsuccessfully from a large mammal hunt may capture and kill a tortoise or porcupine that they discover along their path, so as not to return empty-handed [1981:162].

Although the deer economy model was first identified for the foothills of central and northern California, Simons notes that a similar pattern of coharvesting hunting strategies, focused on terrestrial and marine mammals, can be seen in coastal and interior locations throughout the San Francisco Bay area. Over time, there was an increasing exploitation of sea otters, probably coharvested along with waterfowl and fish as a part of an intensification strategy. Among the related topics needing further investigation, according to Simons, is a focus on other central California estuaries to determine whether patterns of mammal exploitation observed at prehistoric San Francisco Bay sites characterize prehistoric sites situated on Elkhorn Slough, Bolinas Lagoon, Drakes Estero, Tomales Bay, and Bodega Bay (Simons 1992:88). Investigations at Elkhorn Slough north of Monterey Bay were

relatively robust, but the other locations in and near Point Reyes have had only minimal faunal studies from poorly dated contexts. There is, of course, evidence of a former estuary—that is, an estuary later drowned by sea-level rise—at the Duncans Cave site near Bodega Bay; extensive faunal studies have been conducted at that site (Schwaderer 1992; Wake and Simons 2000).

Intensification may have had an early beginning along the California coast. McGuire and Hildebrandt suggest that, in response to the effects of Mid-Holocene warming, subsistence intensification directed at certain plant resources, small mammals, and shellfish may have accelerated. The result would have differed greatly from the intensification of the Upper Archaic. They note that the intensification during the Mid-Holocene

> must be viewed within the severe constraints of what probably remained a dispersed forager strategy, possibly lacking permanent or semi-permanent settlements, and with a minimal reliance on the use of stored resources that characterized their later acorn economies of prehistoric California (see Basgall 1987:43) [McGuire and Hildebrandt 1994:45].

At the Emeryville Shellmound (CA-ALA-309), intensification is not seen until the Upper Archaic. Radiocarbon dates indicate that the decline in high-ranked prey types occurred over a 600-year period, roughly between 2600 and 2000 B.P. While in some locations the decline may have continued, Broughton (1999:54) notes that, on the Bay, higher-ranked prey types (particularly terrestrial mammals) rose in abundance from 2000 B.P. until 700 B.P., the end of the sequence represented at Emeryville. This latter resurgence is linked to exploitation of distant patches, a specific response to resource depression.

While lacking substantial faunal remains from the sites along the northern Sonoma coast, Dowdall (2003) was able to extract an array of subsistence information from blood-residue analysis conducted on flaked-stone tools. For Mendocino pattern sites, birds (probably predominantly quail), rabbits, fish, and bear. The faunal remains from Augustine pattern sites, in contrast, show a reliance on rocky-shore marine resources, acorns, deer, and sea mammals (Dowdall 2003:294-295).

Evolution of Sea-mammal Hunting

Hildebrandt and Jones (1992) have developed a diachronic model of sea-mammal hunting that links the kind of reproductive behavior of different species with overexploitation by humans over time. They divide sea mammals into two groups based on their differential availability during the breeding season. The first, called migratory breeders, includes Steller sea lion, California sea lion, northern fur seal, and southern fur seal; none of these breed or give birth while in water, but rather occupy offshore rocks and islands during breeding season, where males have their harems and the population remains until pups are able to swim—about two months after birth. The other group, resident breeders, includes the harbor seal and sea otter, both of whom have the potential to breed and give birth in water. When hauled out, resident breeders will quickly return to water if danger is sensed, while the migratory breeders are obliged to remain with their young if a predator appears—hence their offshore rookeries, at least in late prehistory.

The model proposes that prior to intensive settlement on the coast, migratory species maintained their rookeries onshore, but that "these hypothetical mainland breeding

colonies were exploited so heavily that they were eliminated relatively quickly, leaving offshore contexts as the only viable sites for continued breeding" (Hildebrandt and Jones 1992:389). In areas with suitable offshore rocks, human hunters intensified their approach to marine mammal hunting through the development of watercraft; marine mammal populations could remain robust because the high cost of such hunting expeditions would have encouraged resource management. In areas without suitable offshore rookeries, the human population would have been left with harbor seals and sea otters, and—because of their lower desirability—would have turned to terrestrial mammals as documented in the studies of Broughton and others. Disagreements on aspects of the model have resulted in some debate that has been followed by a detailed and positive reassessment (Jones and Hildebrandt 1995; Lyman 1989).

SEASONALITY

All nonagricultural prehistoric human groups employed mobility to some degree. "Mobility is a strategy for redistributing people in the environment. Such redistribution may facilitate procurement and communication, help avoid risks and reduce stress, and allow the reorganization of residential composition" (Jochim 1981:148). One consequence of such mobility is that archaeological sites distributed across the landscape would have been occupied during different seasons.

Identifying Seasonality

Seasonality is an estimate of the time of year that a particular site was occupied (Thomas 1998:402). This movement through the seasons in pursuit of various resources that become available season by season is referred to as a *seasonal round*. It is clearly the basis of a foraging strategy, which deploys the whole population across the landscape through a series of seasonal settlement changes; the yearly movement is referred to as a *round*, as it is assumed that the residential bases and locations are visited each year in a cyclical pattern. The notion is also used for Late-period and historic-period groups that followed a collector strategy: here one or more specialists orchestrate the seasonal round, which involves coordinating numerous groups of specialists and sometimes small family groups—primarily in the summer and fall—who return regularly to the primary village. Without an understanding of seasonality, a group of archaeological sites are relatively mute in the information they can convey. "Put enough such contemporary, seasonally specific sites together, and you can reconstruct an ancient seasonal round" (Thomas 1998:402).

Seasonality is generally determined from the age (or size) of mammals in the faunal assemblage, while floral remains can be even more discriminating. Other inferences can be drawn from various seasonal features of the landscape (e.g., areas accessible only when the creeks are low) or more subtle seasonal differences. For example, in considering whether Middle-period (i.e., Upper Archaic) occupants of the central coast would prefer coastal (Elkhorn Slough) or inland (southern Santa Clara Valley) winter bases, Hildebrandt argues that "it is useful to consider the contrast between the regular exposure of shellfish during low (sometimes minus) winter tides, and a lakeshore inundated for months by heavy winter rains" (1997:222). In general, it is reasonable to require the presence of several corroborating seasonal indicators before seasonality can be determined (Thomas 1998:403).

Seasonality on the coast is of particular interest in that early sites may have been occupied year-round, while later sites along much of the coast and bayshore appear to have been task-specific or short-term camps. T. Jones proposes that what may "distinguish coastal from terrestrial settlement histories is rapid population growth early, and fewer seasonal residential movements" (1992:22). What allowed this early sedentism, according to Jones, is the availability off California shores of marine fish, which can be exploited year-round without the need of storage facilities.

Inadequate paleoenvironmental data for a region can result in misleading inferences, as certain environmental events could have significantly altered habitats and their constituent resources. In his reply to Hildebrandt, Jones cautions that "such variability over time makes it difficult, if not impossible, to establish strict optimization ranking of habitats. Estuaries, for example, provide rich resource bases when they are open to the sea, but when tidal inlets are shut off, they become stagnant and unattractive for human settlement" (1997:286).

Fish and Shellfish Remains and Seasonality

Bone preserves especially well in shell middens and thus assemblages of mammal remains from these sites are often substantial. This is probably due to the alkali-rich shell, mixed in with the faunal deposits, neutralizing the typically acidic soils (Stein, Kornbacher, and Tyler 1992). Fish remains, however, are small and relatively fragile, and Jones warns that they require "fine-grained, controlled recovery techniques; coarse methods can lead to misrepresentation" (1997:284). Among shellfish remains, mussel shells are nearly always underrepresented in 6-mm mesh because they are much more fragile than clams or oysters. As an example of implications for seasonality confusion, Jones notes that while other researchers have suggested that Elkhorn Slough was a winter resource, the faunal data base and contemporary studies indicate that the area "harbors its greatest numbers and highest variety of fish in the summer when spawning migrants enter the system," which corresponded to the time of peak human occupation. Slough fishing probably involved traps, nets, and/or baskets, which do not preserve well archaeologically; shell hooks are associated with fishing on rocky shores (Strudwick 1986, cited by Jones 1997:285). Employing larger-mesh screen or dry-screening techniques may occasionally be mandated by management concerns for time or fiscal efficiency; some means of testing the efficacy of certain sampling techniques might be the best first step, followed by the recovery of as many control samples (to be processed in the laboratory using 3-mm wet screening) as are possible or warranted.

Jones (1997) makes a strong argument for reassessing some putative supporting evidence for resource intensification during the Late period. Since fragile shell (particularly freshwater shell) and fish bone will become heavily fragmented over time, samples recovered using coarse methods will have an overrepresentation of Late-period faunal material.

TECHNOLOGICAL STUDIES

The definition used at the beginning of this chapter conceives of technology as activity sets involved in obtaining materials; the preparation, modification, and alteration of those

materials to create tools; and the maintenance and discard of those tools. While the definition is a useful one, it is an example of what Marcia-Anne Dobres considers the standard view of technology, which sees the domain as little more than "the physical transformation of hard matter from one state to another" (2000:29); at the same time, archaeology has typically defined past cultures in terms of what humans make and how they make it. Rather than being about "the making and use of things," she notes that prehistoric technology is "simultaneously and inseparably about the social relations, divisions of labor, beliefs, values, contexts, and politics through which objects came into being" (Dobres 2000:29). For decades, various researchers (with the French among the forefront) have been propounding a *chaines operatoires* strategy toward studying prehistoric technology, in which the actions of prehistoric manufacturers are reconstructed step by step (flake by flake, in the case of stone tool manufacture). Dobres describes the benefits of the approach:

> As an analytic focus, knowing the step-by-step physical actions and material procedures by which ancient technicians procured, prepared, modified, altered, shaped, used, repaired, reworked, recycled, and ultimately discarded their material culture, tells the researcher an enormous amount: about technical stocks of knowledge and alternative technical strategies practiced to achieve a desired end, about levels of skill, competence, and *savoir-faire*, about the constraints and possibilities inherent in the chemical, mechanical, or other physical properties of the materials being worked, and especially about individual and group (even species-level) problem-solving strategies, cognitive capabilities, 'world views,' value judgments, intentions, and shortcomings [2000:168].

Flaked-stone Tools

Nearly all technological analysis in California prehistoric archaeology has been focused on flaked-stone tools. While several archaeologists have analyzed reduction sequences (e.g., from quarried boulder to core to biface to projectile point) in the Great Basin and the Sierra foothills (e.g., Bieling 1992), extensive technological lithic analyses are not common in Bay Area sites. The studies have focused on the behavioral context of stone tool manufacture and use, encompassing mobility strategies, exchange, and other issues beyond technology. The typical lithic site of the North or South Coast Ranges, with its lack of midden constituents and with the dominant or only artifactual material being flaking debris and flaked-stone tools, has not been recorded for San Francisco, while only a few such sites are among the Point Reyes inventory (Polansky 1998). Further surveys along inland ridges may yield more representatives of this site type in the future. Generally the lithic content of shell middens is so low (from less than 1 flake per cubic meter to rarely more than a few dozen) that detailed technological analysis is rarely warranted. (See Chapter 5 discussion of obsidian exchange.)

Other kinds of analyses of flaked-stone tool distributions (across a site or a landscape) have been devised to characterize mobility, settlement structure, and procurement activities. A valuable example is Greg White's (1984) Archaeology of Parts; among his models are inferences about the nature of site use based on the proportions of tips, midsections, and bases of projectile points at a site. A simplified example would be that tips will represent butchering activities, as they would have been lodged in the carcass,

while bases will represent residential activity (repair of the tool kit). A number of other scenarios are presented using different tool types and reflecting different levels of logistical organization. Kelly's (1998) "Three Sides to a Biface" provides another perspective.

The technology of hunting and butchering has been analyzed and modeled by various researchers, but no such studies are known to have focused on the north-central California coast. Readers wanting some background in flaked-stone tool and debitage identification should review Crabtree's (1972) definitive work, *An Introduction to Flintworking*, or Gramly's (1992) *Guide to the Paleo-Indian Artifacts of North America.*

One of the several programmatic approaches taken by the California Office of Historic Preservation to redundant site types—the California Archaeological Resource Identification and Data Acquisition Program—was developed for sparse lithic scatters (Jackson et al. 1988). This site type, which is frequently manifested as a relatively small number of flaked-stone debitage items, can yield important information about settlement distributions, technological practices, and mobility strategies. The information, however, is often readily recovered from recording the location of the deposit and gathering some data on the number, kind, and distribution of the debitage. The Sparse Lithic Scatter Program allows archaeologists to conduct limited tests to determine whether an archaeological deposit meets the criteria for the program—low frequency of materials, relatively few formed flaked-stone tools, no other tool categories represented (e.g., beads or milling tools), and a limited depth of deposit. If the criteria are met, the agency may chose to proceed with the program, mitigating impacts to the location programmatically rather than following the progression of evaluation and data-recovery investigations under CEQA or NHPA.

Milling Tools

Like flaked-stone tools, which also have a chronological function, milling tools are typically treated under technology in archaeological reports. The relegation of timing and specific function of millings tools was initially simplistic: handstones and slabs were considered early, beginning in the Lower Archaic, and were thought to have been used for hard-seed grinding; mortars and pestles appeared around the Middle Archaic but did not dominate until the Upper Archaic, where their frequent numbers were considered indicative of acorn reliance. In fact, in most regions, handstones and millingslabs appear throughout the sequence, although often in smaller numbers and possibly as curios from the past. There is also evidence to suggest that acorns were ground on millingslabs, while a variety of seeds, tubers, nuts, fruits, meat, and non-food materials were pounded or ground using either toolkit.

A recent guide to research on milling tools is invaluable for study of a large groundstone collection (Adams 2002). It deals with studies in the Southwest, where detailed use-wear replication studies have been conducted. Research on technological aspects of milling tools in California has focused on the study of wear patterns present on tool surfaces, which aids in construction of typologies (Mikkelsen 1989, 1993) and can allow inferences about the manner and intensity in which the piece was employed (Mikkelsen 1993; Reid and Pritchard-Parker 1993). California researchers now recognize the presence of intentionally shaped handstones but have made few statements regarding the manufacturing process. Relatively little was known, in fact, about procuring raw material

for milling tools or replicating their manufacture until Huckell (1986) conducted some in-depth investigations near the Colorado River, where quarry/manufacturing sites consist of acres of debris of near megalithic proportions. Olsen and Payen (1983) reported on archaeological evidence of pestle-manufacturing industry at CA-MER-130 and describe the process, while Stewart and Gerike (1994) describe a sparse rhyolite cobble quarry that may have served as a source of handstone blanks. Evidence of manufacturing of milling tools has apparently not been reported in the study area; this a relatively new topic, however, and might turn out to be a productive one.

In the Upper Archaic period at Point Reyes it is likely that the prevailing cobble mortars were locally procured and manufactured, perhaps on site. In the Emergent period, however, mortars occurred in modest numbers at the Mendoza, Cauley, Estero, and McClure sites as Beardsley's type A1—carefully made, fully dressed, and flat-bottomed. Most were recovered from burials, where they were purposefully damaged (chipped rims or completely shattered); about half were made of basalt, of which there is no suitable source nearer than 30 miles inland, close to Petaluma. Beardsley concluded that "these ornamental mortars must have had connotations over-reaching their food-grinding function: otherwise it is hard to account for the labor of carrying mortars weighing up to eighty pounds over thirty miles of hills and marsh only to destroy them as funeral offerings" (1954:31). This statement is a reminder or the dynamic intersection of technology and sociocultural practices and values, which is discussed further in Chapter 5.

A ubiquitous site type in the Sierra Nevada and not uncommon in the South Coast Ranges, bedrock milling stations are rare to absent in the western North Coast Ranges and the Marin peninsula, where the only such site recorded in the PRNS is more likely a natural phenomenon. Bedrock mortar sites have been recorded in drainages around the Bay. In the southeastern corner of the Bay, nearly 20 milling station sites have been recorded in the vicinity of the large shellmounds of the Coyote Hills area, believed to be part of a seasonal round associated with these semi-sedentary villages (Parkman 1994). None, however, approach the size of the bedrock milling stations of the Sierra foothills, where hundreds of mortar cups can be found on a single outcrop. Hylkema (1991) mentions bedrock mortars in his study of the southern San Mateo–Santa Cruz mountains, but these seem to be of relatively modest proportions.

Other technological studies, such as investigation of the nature of building construction, analysis of basketry technique, or replication of a fishing toolkit, are dependent on serendipitous finds.

Changing Perspective

An important change in perspective has pervaded technological studies over the past few decades—one that recognizes the complexity of human activity and the myriad impediments to interpreting past activity through archaeology. Stating that "archaeology has emerged from an 'age of innocence,'" Thomas notes that we now require better-reasoned associations before drawing conclusions on seasonality and annual round:

> Grinding stones were once considered to equal (1) women and (2) seed collection, but we no longer assume such a relationship. Projectile points once meant "men went hunting," but . . . we now realize that the relationship between gender and technology is considerably more

> complex. . . . While middle-range research on seasonality, size sorting and intrasite patterning, tool kits and activity-areas, regional variability, taphonomy, and postdepositional modifications proceed apace. . . such progress carries with it the sober realization that archaeological data are more intractable than was appreciated during the first decades of the processual agenda [1998:416-417].

This shift in approach appears well-grounded in the archaeology of coastal California at the beginning of the 21st century.

RESEARCH ISSUES ON SETTLEMENT AND SUBSISTENCE IN THE PRNS–GGNRA

THE NATURE OF SHELLMOUNDS

1. What factors contributed to the variations in shell-midden structure in the study area? In what ways do shell middens in the PRNS contrast with those on the Bay? Are the differences related to temporal, functional, or geographic variables?
2. How does the structure of shell-processing sites differ from that of residential shell middens? Can structural differences in short- and long-term occupations be discerned in shell middens in the study area?
3. Can buried sites in San Francisco provide information on shell-midden formation that is missing from the current record?

Data Requirements:

- Paleosols in urban or other fill settings to test for buried shell middens; archaeological exploration of submerged locales that may contain early shell middens.
- Intact shell middens with stratigraphic integrity, especially deposits with datable assemblages of artifacts and dietary remains.
- Macrobotanical and zooarchaeological remains that allow reconstruction of environmental settings.

COASTAL SETTLEMENT

1. What kinds of Early Holocene archaeological deposits occur on the submerged shelf adjacent to the PRNS-GGNRA or under the waters of Tomales Bay or Bolinas Lagoon? Are additional buried deposits present on the ocean terraces (such as the deep strata in the Duncans Cave site) and alluvial valleys? In what ways can this early chapter in coastal history be explored? (See Meyer, this volume.)
2. Can fuller assemblages from submerged or buried settings be used to make inferences about older surface sites with poor preservation?

3. In what ways might seasonal coastal sites relate to one another, and how can these relationships be viewed archaeologically? Is coastal settlement linked to inland land use—seasonally or as a regular part of the group's catchment?
4. During the Middle/Late transition period, were coastal settlements buffered from the environmental stresses evidenced inland in the Bay Area? Were portions of the coast considered non-contested areas at this time due to the new focus on terrestrial resources?

Data Requirements:

- Buried or submerged archaeological sites with intact and varied assemblages.
- Sites with secure dating for testing dissemination of materials and ideas.
- Artifact-rich deposits with diverse assemblages that will aid in determining shifts in resource base in terms of toolkit.
- Dietary assemblages from coastal sites that will aid in determining shifts in resource base in terms of inland and coastal resources; seasonal indicators from both inland and coastal sites.

SITE-FORMATION PROCESSES AND SUBSISTENCE

1. Can a shift from forager to collector be seen in the study-area archaeological record? How can the archaeological correlates for these strategies be tailored to the study-area? In what ways can these behavioral modes be distinguished from seasonal strategies?
2. What variables might be operating to make a difference in timing of the shift from foraging to collector in the study area? Are there portions of the PRNS–GGNRA that demonstrate a retention of foraging characteristics late in time, similar to findings to the north at Salt Point and south on the San Mateo/Santa Cruz coast? Would such a retention, rather than coastal site abandonment, explain the apparent absence of later sites in some localities? How might this retention be demonstrated in the archaeological record?
3. What is the environmental productivity in the various units in the parklands (patchy, or heterogeneous? homogeneous?). Do these assessments compare well with the site types represented?
4. What is the focus and/or breadth of prehistoric subsistence? Are subsistence systems intensive and selective, or broad-based? Is the variability reflective of different social groups, different functions, or different time periods?
5. How do the nature and breadth of subsistence activities and exploited resources correlate with environmental and archaeological patterns involving technologies, settlement, demography, and social organization?

Data Requirements:

- Archaeological deposits with datable, artifact-rich deposits.

- Analysis of well-dated deposits in order to confirm or refute retention of cultural assemblages or co-existence of adaptively dissimilar groups.
- Information on seasonality for archaeological deposits based on the nature of recovered faunal and floral resources.
- Flaked-stone or other assemblages of tools for use in blood-residue analysis.
- Information from a suite of well-dated sites to determine patterns of foraging and collecting strategies and their archaeological correlates.

TECHNOLOGY

1. Will application of formal flaked-stone tool analysis raise new questions regarding technology in the study area? Are there extant collections that could be examined for identifying coastal central California traits?
2. Did coastal people have access to quality lithic resources, or were flaked-stone assemblages pieced together from less than optimum materials? Is this behavior recognizable in the conservation of lithic materials and the modest nature of the toolkit?
3. Are there more local sources for the mortars found in the PRNS than the proposed 30-mile distant quarries of Sonoma County? If such long-distance importation of heavy stone did take place, what other factors (subsistence, social, or ritual) might have been related to this activity?

Data Requirements:

- Archaeological sites with well-developed flaked-stone assemblages; flaked-stone assemblages in curated collections.
- Geological analysis of the region to identify potential source locations.
- Identification of other exotic materials in the collection and their sources.

Chapter 5 – Social Organization, Interaction, and Complexity

INTRODUCTION

A broad category of research interests focus on topics that deal with social systems and intergroup interaction—topics that are much less visible in the archaeological record than settlement and subsistence. Even less tangible are various themes that concern how people think and feel, and how they value different elements of their personal and communal lives. In some archaeological settings (e.g., Mesoamerica, Egypt, or the historic-period U.S.), where it is possible to recover abundant written information on the ideology and social fabric of a group, these topics might be treated under a wide range of headings. In the PRNS–GGNRA, as with most of prehistoric California, few studies have approached these subjects archaeologically, and good datasets for future studies are not expected. This chapter covers a range of topics that relate to how people organized themselves and interacted among themselves and with other groups, and considers how social complexity increases with increasing population and sedentism. Some archaeologists may find situations in which these issues can be featured more prominently; lacking such opportunities, it is nonetheless wise to consider the full spectrum of human experience, even if only for its contextual value.

The term *social organization* is used to refer to the way in which society is structured in terms of agreed-upon statuses (recognized social positions) and roles (behavior patterns prescribed for these positions). Among the included topics are the degree of specialization within a society and the method of assuming various positions: either through accomplishment (achieved status) or inheritance (ascribed status). Further, the general domain of social organization looks at how social groups interact with one another, the level of complexity of these interactions, and how this interplay affects cultural change. While social interaction has sometimes been analyzed atheoretically, post-processualists have preferred to turn to the concepts of *human agency* and *social power* to achieve a more dynamic and human-centered approach to interpreting social organization (Thomas 1998:373).

Often explored under this social dimension are the topics of exchange and complexity—the one a catalyst to the other, as exchange is one of the primary mechanisms that support sedentism, which in turn requires a complex system of social roles and actions to mediate the stress inherent in crowding and staying in one place. Among the ways of mediating these stresses are various ceremonial and ritual practices, artistic expressions, and lore that bring meaning to life's circumstances. Other solutions to stress may be more negative, such as warfare and the fission of social groups.

This chapter looks at a variety of ways that archaeology can uncover information on social life and individual experience, focusing on some of the studies that have been undertaken in or near the PRNS–GGNRA study area.

MORTUARY ANALYSIS

Archaeology has long attempted to go beyond purely material questions of technology, settlement, and resource use in order to access the ideas and values that motivated actions in the past. No matter how symbolic or cerebral the subject of interest, it must have material correlates that can be identified archaeologically. The most immediately accessible subjects for these studies have been human burials, which are concrete representations of human life in the past. They put the investigator in direct contact with the individual's physical remains and, often, the objects that defined the person in life. Matters of status and gender and notions of supernatural power may all be represented. Analyzing burial populations, one can see interactions among members of society expressed in material form.

THE SOCIAL FACTS OF MORTUARY PRACTICE

For nearly a century, mortuary analysis—the interpretation of human burials, including skeletal remains and associated artifacts (called "grave goods")—has been the primary archaeological means of examining prehistoric social life. The basic premise behind social interpretations from mortuary analysis is that, cross-culturally, death is a significant event that warrants special actions and that people treat their dead in ways that reflect their status in life.

The ways in which the body is interred and the distribution of different kinds of contemporaneous burials throughout a site have been relied on as indicators of the degree of social stratification in a society, of demography, and even of insight into worldview. Some of the variables are

- degree of flexure (from tight fetal position, suggesting minimal ceremonial expenditure, to fully supine, suggesting elaborate procedures reserved for those of high status; these traits can also serve as time-markers, as they went in and out of fashion over time);
- orientation (head to setting or rising sun, or variant thereof) of individual burials and patterning of orientation across the site (including no set orientation);
- the remains of body ornamentation (such as remnants of bead necklaces, pendants, beaded capes, abalone-shell gorgets, and red ochre body paint);
- the relative quantity and kind of grave goods interred with the dead and the frequency of their associations in terms of age and sex (e.g., are males associated with wealth objects while females are associated with functional objects, such as basketry awls? are grave goods found only with adults or with children as well?);
- grave goods with apparent significance beyond economics or gender that may indicate the presence of ritual specialists (e.g., clusters of bat sting rays or raptor claws, exotic minerals, etc.).

Table II.7 – Burial Complex from Point Reyes – Human Remains ith Associated Artifacts *(adapted from Beardsley 1954:27)*

SITE NAME	MIDDLE (B Components)	LATE (A Components)	
	Burials	Burials	Cremations
Mendoza	0	14	12
Cauley	7	18	7
Estero	4	6	3
McClure	24	17	10
Total	**35**	**55**	**32**

Note: All B components appear to date to the McClure facies, hile all A components, except that of the Mendoza site, date to the Estero facies.

Additional information on social organization can be inferred from osteological analysis of the human remains themselves, such as:

- the evidence of certain kinds of wounds, which can indicate warfare or suggest spousal abuse;
- types of bone deformation, reflecting specific occupations or frequently performed tasks;
- various nutritional deficiencies detected in bone and teeth, which may be correlated with differential diet in accordance with rank or age/sex;
- various physical anomalies, such as a high occurrence of supernumerary teeth, suggesting inbreeding.

MORTUARY REMAINS IN THE PARKLANDS

Changes in mortuary practices constituted one of the primary datasets for building the central California cultural chronology in the first half of the 20th century. Much of the work was done for the purpose of identifying analytically useful temporal divisions, but analysis of mortuary remains for the purpose of characterizing social variables had already had a long history in the archaeology of the Old World, and was used to contextualize the various aspects and patterns in culture historical sequences.

Beardsley's Analysis of Point Reyes Remains

In order to characterize the Point Reyes/Tomales Bay district and compare and contrast it with San Francisco Bay, Marin Bayshore, and the Delta, Beardsley conducted an analysis of the burial complex at Point Reyes (Table II.7). The analytical universe includes those sites listed as intensively excavated by Beardsley and Heizer in 1940-41 (see Table II.2). Because of the relatively small sample size from the B components at Point Reyes, Beardsley also analyzed the burial complex recovered from nearby CA-SON-299, which was considered contemporaneous with the McClure aspect.

Burials: Position, Orientation, Grave Goods

All but two of the burials were placed in a flexed position, from completely flexed to semi-flexed, with the two exceptions being semi-extended burials from the B components of both the McClure and Cauley sites. All but a few burials were oriented to the setting sun, which in only a few cases was the immediate body of water.

There were 10 instances of intrusive burials into earlier interments, which makes it apparent that grave markers were not used or were not permanent. A number of group burials were also present, invariably in B components, although burials of females with infants occurred in both levels. The groups generally appeared to represent portions of family units—a mature person coupled with an infant, child, or adolescent.

Grave goods were not common in Estero site burials: 1 of 6 Component A burials and 1 of 4 Component B burials had artifacts. For the remaining three sites, grave goods were present in more than one-half to three-quarters of the burials from both components. "A recurrent feature of B horizon burials in particular is the presence in the grave of unworked bones of sea mammals, birds, etc., and chunks of chert or rounded pebbles in considerably greater quantity than the general nature of the deposit would justify" (Beardsley 1954:29).

Cremations: Grave Goods and Modes

There were three modes of cremation represented: (1) in situ burning, represented by a large pit with ash lining and abundance of bones; (2) possible grave pit burning, in which the body is placed in a pit and exposed to high heat before burial; and (3) the most common form, burning the body elsewhere and bringing the ashes to the place of burial (evidenced by a small pit, lack of ash lining, and scarcity of bone fragments).

Artifacts nearly always accompanied cremations. Only at the Mendoza site were cremations lacking grave goods; given the overwhelming presence of grave goods elsewhere, it is likely that these remains were buried with perishable goods.

Beardsley's (1954:30-57) discussion of artifacts from the site identifies those present in burials and cremations. They run the gamut of all artifact types, from the most elaborate and ceremonial to the most expedient. Analysis of social organization and demographics represented by these distributions was not attempted.

Comparison with San Francisco Bay Sequence

The PRNS burials reflect a similar pattern to that of the San Francisco Bay. The McClure facies equivalent on the Bay is the Ellis Landing aspect. Of greatest interest in light of their importance on the Bay at that time period, is the scarcity or total lack of shell beads and Haliotis ornaments that typifies the McClure and Cauley site burials.

Human Remains at Limantour Spit

The mortuary remains recovered from Limantour Spit around 25 years later by San Francisco State College archaeologists represent a small but interesting group. The remains include those from CA-MRN-216—7 inhumations and 5 cremations, and 1 cremation from MRN-298 west. A few anomalies are present among the inhumations, including an adult female with hands crossed in front of her face, a large (13 x 10 x 5 in.) angular granite boulder over her head, a small mammal radius at her left leg, and a complete set of elk

antlers above her rib cage. An adolescent also had animal bone associated: in this case the process of a sea-mammal long bone and a bird bone, along with a clam valve. Three of the inhumations had no associations (King and Upson 1970: 133, Table 1). In contrast to the inhumations, all cremations had associations, many of them a mix of traditional native items and 16th-century artifacts. One adult cremation, for instance, had the following associations:

> Complete porcelain cup, 2 porcelain sherds, mortar, pestle frag. Copper frags., obs. corner-notched pt., worked bone, polished & incised bird bone, cut bone, burned clay, poss. worked sandstone, clam shell disc beads, glass trade beads, bird, fish and mammal bones, shell as in midden deposit, burned and unburned redwood (*Sequoia sempervirens*) [King and Upson 1970:134, Table 2].

King and Upson suggest that the burials and cremations were the result of a single event—perhaps a foreign-introduced epidemic. It is important to note, however, that one of the male skeletons had a projectile point embedded in his tibia. Thus it is possible that one or all of the other six individuals represented by the inhumations were also the victims of an attack on Limantour Spit, perhaps even a case of rivalry with another native group over the salvage rights to the remains of the *San Agustin*. It is interesting that there are no 16th-century items present with these inhumations, which either place the event(s) before Cermeño's wreck or at least before large-scale scavenging had begun. For the cremation population, however, there appears to have been more time to dispose of the dead. First, cremations are more time-consuming to execute and, as noted above, all cremations had grave goods, with two of the five having 16th-century items. It might be the deaths represented by this group occurred over a somewhat longer period (perhaps from epidemic disease), presumably while camping near the *San Agustin* in order to strip the wreckage of its desirable materials. It is interesting to speculate what conditions would have prevented the group from returning home with the deceased for proper burial or cremation in a village setting—perhaps at Olema Valley or Tomales Bay, or further into the interior.

CLASS DISTINCTIONS: THE DEAD AT TIBURON

Social ranking in central California is generally believed to be an Emergent-period phenomenon, where it occurs at all; in some relatively marginal areas, an egalitarian form of social organization prevailed up to contact. King's (1970b, 1974) analysis of cemetery patterning at archaeological site CA-MRN-27 on the Tiburon Peninsula suggests that social ranking in the San Francisco Bay region may have had considerably greater time depth. King notes that the burials at MRN-27, dated to about 2000 B.P., represented an organized cemetery unusual for the Bay Area. Because the site was to be destroyed by development, most of the cemetery area was archaeologically excavated as a salvage operation, just prior to the state and federal legislation that would have required a more considered approach. Comparing the Tiburon burial pattern with that at the McClure site in Point Reyes, King notes that the latter site gives the visual impression of unplanned dispersion throughout the midden, as does the burial pattern at the similarly dated SON-299 at Bodega Bay. At Tiburon, in contrast, 49 individuals in single and multiple graves were disinterred in an area of about 24 square meters; the rest of the midden was substantially if not entirely

devoid of burials. Presumably, King notes, this distribution reflects elements of social structure.

Interments appear to have been placed within the cemetery according to a set of social rules, with the center reserved for cremations with many grave goods. Adult males without significant numbers of grave goods were interred at the periphery of the cremation plot. At the farthest limits of the cemetery, females and males were interred with very few goods. This differential treatment of the dead indicated that status was ascribed (given on the basis of kinship affiliation) rather than achieved (as occurs in egalitarian societies). Noting that MRN-27 was a very small, insubstantial site overlooking a much more typically expansive Bay Area midden (MRN-26), King (1974:38-39) suggests that large shellmounds may have been exclusively or primarily the homes of low-ranking families. High-status lineages may have lived in somewhat separate locations that appear today as small, satellite sites. One reason that we do not have more evidence of social ranking in the Bay Area, he argues, may therefore stem from the focus on large shellmounds, while small sites were often bulldozed away.

King related the development of complex social systems, such as that evidenced at MRN-27, to the degree of sedentism of an area. He proposed a number of criteria for judging whether burials represented socially ranked societies. These included high frequencies of non-utilitarian burial associations, cross-cutting age and sex categories.

SAN FRANCISCO MORTUARY PRACTICES

Many East Bay shellmounds contained cemeteries of huge proportions: archaeologists recorded 706 burials from the Emeryville site alone, while some mounds may have contained thousands of graves (Lightfoot 1997:131). In comparison, existing San Francisco mortuary data are extremely sparse, with only one reported find from GGNRA lands—an isolated human burial (CA-SFR-26) near the Presidio (Heglar and Moratto 1973).

Since the first report of prehistoric human remains in San Francisco in 1872, only 52 individuals from 11 sites have been encountered; well over half of these were found at two sites: SFR-7, the Bayshore Mound at Candlestick Park (Nelson 1911), and SFR-114 at Howard Street between Third and Fourth (Pastron 1990). Rudo (1982) has added considerably to the data base from SFR-7 by integrating published and unpublished information and documenting and describing previously unpublished, or partially published, information on artifact assemblages and burial populations. The site was determined to date from A.D. 300 to 1300, which overlaps the Upper Archaic and Lower Emergent periods (or Upper Middle period, the Middle/Late period transition, and most of Phase 1 of the Late period, using Bennyhoff and Milliken's 1993 chronology). Of the human burials from the site (28 individuals), one quarter had associated grave goods (5 adults and 2 infants). Nearly all burials were in relatively good condition, with only a handful not identifiable as to age and sex. While numerous *Haliotis* ornaments were found with some burials, there were no elaborately furnished burials (for comparison, see SFR-114, below). One male who died in his early 40s was accompanied by an array of objects that might identify him as a spiritual specialist: *Olivella* thin rectangular beads, incised *Haliotis* ornaments, eight bird-bone whistles, the talons and paired tarsi of a bald eagle, and a polished fragment of a pointed bone artifact (Rudo 1982:59). In 1982 the assemblage

and burials of the Bayshore Mound constituted "the most extensive body of archaeological data yet recovered from a controlled excavation in San Francisco" (Rudo 1982:139).

Excavations in the late 1980s added a contrasting pattern to the San Francisco database. The archaeological deposit, SFR-114, was identified at depths of 3 to 6.3 m (10 to 20.7 ft.) below modern ground surface at the Yerba Buena/Moscone Convention Center construction site. All 11 human burials excavated at SFR-114, dating to around the same time as the Bayshore Mound, were accompanied by extensive grave goods, suggesting that all the individuals were of uniformly high status. One individual "was buried with 5,000-10,000 olivella disc beads, hundreds of perforated mica ornaments, several quartz crystals and unmodified quartz cobbles, and more than a dozen carefully shaped bird and mammal bone whistles or tubes" (Pastron 1990:26). This disparity of grave-good wealth between sites of similar age warrants analysis.

BURIALS FROM SAN MATEO

In San Mateo County, just inside the southern boundary of GGNRA-managed lands, is CA-SMA-125—a large, significant village site with an exceptional mortuary component. The site is located on the Filoli Estates in the hills of Redwood City, about 10 km from the bayshore and 13 km from the ocean coast. The site was first excavated in the 1930s by San Mateo Junior College classes, then again from 1970 to 1976 by field classes from Cañada College. A total of 46 human burials (including 29 infants and children) were recovered. Huge quantities of shell beads and numerous other grave goods were found with 19 of the burials, totaling 4,559 items. Included were *Olivella* spire-lopped beads and thin rectangles, 392 bat-ray spines, 338 *Haliotis* ornaments, 164 bird-bone whistles, mortars, pestles, imperforate charmstones, and a few flaked-stone tools. Six radiocarbon dates document site use from A.D. 895 to 1450, comparable to the Emeryville aspect of East Bay (Salzman1983). Due to its abundant grave goods, the site was chosen by Milliken and Bennyhoff (1993) to be among the sites analyzed for their shell-bead chronology. The site materials are being analyzed by San Francisco State University graduate students in 2003 (Hankins 2003).

BEYOND MORTUARY ANALYSIS

INDICATORS OF COMPLEXITY

Other archaeological indicators of sociopolitical complexity have been recognized in recent years, in part through greater experimentation with *middle-range theory*, which seeks to identify the archaeological correlates of task-oriented behavior—from tool kits to site types. Lightfoot (1993b:178) identified a number of other cultural traits or social activities that can help provide a measure of the nature and scale of hunter-gatherer complexity; they are listed below (the original contains numerous references for each topic):

1. the spatial extent of logistical movements as defined by specialized site types;
2. the overall elaboration of material culture;

3. the level of subsistence intensification;
4. the dependence on storage economies;
5. the degree of craft specialization;
6. variation in house styles, sizes, and contents;
7. the level of conflict and warfare;
8. the regional integration of exchange systems involving prestige goods;
9. settlement size and spatial organization.

To these Lightfoot adds the insights that have been achieved through the refinement of obsidian-hydration and sourcing analysis, including the ability to examine diachronic change in long-distance exchange networks, and "evaluating sociopolitical factors that may influence the spatial distribution of utilitarian and prestige goods" (1993b:179).

While each of these issues can be placed under more than one of the major domains discussed in this volume—primarily settlement and subsistence—it is their role in complexity and intensification that is of interest here. Several of these topics are discussed under the themes below. In some cases, the concepts are abstract, and direct archaeological correlates cannot be proposed. These ideas may nonetheless provide context for analyses and suggest perspectives that can lead to fuller interpretations of archaeological phenomena. The discussion that follows, also by Lightfoot, is an example of such a contextual study.

SYMBOLIC STATEMENTS

Bay Area Moundbuilders

Shellmound construction, which may appear to be solidly in the domain of settlement, is given a broader dimension in Lightfoot's (1997) analysis of why shellmounds rather than low, linear heaps, were created. Shellmounds first appear on San Francisco Bay in the late Middle Holocene (around 5,000 years ago), while the sea level was still advancing. To stay ahead of the rising sea level, people could simply have moved their residences upslope, resulting in relatively thin linear midden deposits, with the oldest remains downslope and the youngest upslope (Lightfoot 1997:139). Instead, Bay area people accumulated shell on top of their original homesites, building middens as high as 30 feet in the air, whose basement levels were well below sea level after around 3,000 years ago. Lightfoot suggests four reasons why Bay Area people built shellmounds rather than broadly dispersed lateral middens:

- Mounds were constructed to keep villages well above high tide…. The construction of mounds along the low lying bayshore would have insured that residential places remained dry during all seasons of the year.
- Mounds were constructed as ideal locations for exploiting nearby estuarine resources….Mounded villages along or in bayshore waters were ideal points from which people could paddle across the greater San Francisco Bay to visit other villages, to hunt ducks and geese, to harvest sharks, sturgeons, and surf

perches using nets and fishhooks, and to collect molluscs from productive beds.

- Mounds were constructed as long-term repositories for the dead. Human remains were placed in the basal deposits of the earliest shell mounds, and later residents continued to use the mounds as burial grounds and as ceremonial places. . . . Bay area peoples dwelled on top of mounds whose cores encapsulated the sacred remains of their ancestors going back many generations, possibly spanning nineteen hundred years or more.
- Mounds were constructed as territorial symbols for local village communities. Over generations of use and deposition, shell mounds became highly visible cultural features on a relatively flat bayshore landscape. Residences on top of these mounds would be evident to people across the bay, especially at night when fires burned in hearths and cooking pits. I believe these mounded villages served as landmarks to hunters and fisherpeople in boats, providing a cultural map of the communities along the bayshore. Bay area village communities probably justified their territorial rights to nearby land and estuarine resources by claiming genealogical relations to their ancestors buried in the mounded villages. These ancestors would be viewed as the original users of bayshore locations and their many resources [1997:139].

Lightfoot's argument is especially rich and credible because it encompasses so many aspects of human life in the Bay Area. Rather than offering four conflicting hypotheses, he builds a theme out of layers of meaning, including what would likely have been both conscious and unconscious, rational and spiritual reasons for constructing mounds. It is interesting to consider that the keepers of the large shellmounds might have been the "commoners" King (1970b) proposed for his analysis of the Marin cemetery in *The Dead at Tiburon.* This pattern of large mound overseen by a village of the elite is essentially untestable in today's urban setting, where so many sites have been destroyed and virtually all remaining sites lie under fill and pavement.

Rock Art

A primary means of making symbolic statements in California prehistory and ethnohistory was rock art, which occurs in north-central coastal California as petroglyphs (rocks altered by pecking and scratching, rather than painting). A form of rock art that was initially thought to be restricted to northwestern California, petroglyphs were the focus of a study by Teresa Miller (1977) in Marin County, where she recorded more than 26 such sites. Most were located on ridges overlooking the Bay, with the majority now protected at Ring Mountain in the Tiburon Archaeological Preserve. One of the petroglyph forms noted by Miller (1977:30-31), the "pecked curvilinear nucleated" type (or PCN), may represent the Middle Archaic or earlier in Marin. The form is widespread; she recorded PCNs on 68 outcrops at 10 separate locations in the Coast Ranges.

This form and the simpler cupule rocks (known as Baby Rocks in Pomo country) are both thought to have been associated with fertility rituals (Jordan 1995). Cupule rocks, because of the simple structure of their elements and due to the results of weathering, can be difficult to identify. Cupules in the Bay Area and Marin and Sonoma County are

generally found on glaucophane schist outcrops of the Franciscan formation. Most of the PCN and cupule rocks recorded by Miller (1977:23) were about 1 meter high and 2 x 2 meters or less in size.

To date, no rock art has been noted for the PRNS or in locations in the GGNRA. Geological map research prior to archaeological survey and careful examination of outcrops may yield several such sites in the study area.

INTERACTION AND EXCHANGE

A number of systems were in place in California by the Emergent period that have been recognized as factors in creating a highly complex society in a nonagricultural setting. Fredrickson, in the first publication on his chronological scheme, described the Late-period situation:

> I propose the concept of the Emergent as a nonagricultural equivalent to the [Mesoamerican] Formative. Evidence continues to accumulate that Californians modified the environment to increase its natural productivity…, that food storage and exchange relations served to equalize the distribution of resources unequally distributed in time and space…, that complex forms of social, religious, and occupational organization were emerging…, and that ranking societies and possibly chiefdoms were developing in several regions of the state [1974:48-49].

While these traits were flourishing in many areas of California in the Emergent period, their beginnings can be seen in the Upper Archaic period, where sedentism and specialization are first suggested. (Considerably greater time depth, back to Middle or even Early Holocene, for semi-sedentary occupations is being evidenced at important sites in central California since the early 1990s [e.g., Fitzgerald 2000; Meyer and Rosenthal 1997; Pryor and Weisman 1991].) An associated shift—to different degrees in different regions—was the change from foraging to collecting strategies, with the greater complex coordination required for the latter (see Chapter 4).

REDUCING SOCIAL STRESS

THE PRICE OF SEDENTISM

When the topic was considered under the Settlement and Subsistence section, the proposed causes of intensification that led to increasing social complexity were seen as resource scarcity and/or competition. Here, under the social dimension, the question can be looked at in terms of the social stresses inherent in large population aggregations. Cohen (1986) cautions that economic vulnerability is not the only problem faced by humans when they are forced into relatively large and permanent social groupings. For the past several decades, researchers have recognized that, quite independent of problems of subsistence, interpersonal tensions tend to prevent egalitarian or non-complex groups from remaining in large aggregates for long periods. While seasonal shifts in settlement

among foraging groups may seem to be motivated by changes in resource availability, Cohen proposes that these "seasonal rounds" might have been also (or primarily) prompted by the need to relieve intragroup stress. Once sedentism arises and is supported, other mechanisms must be devised to take the place of mobility as a means of relieving stress. Cohen (1986:106-107) identifies a number of features in the environment (in addition to resource scarcity) that must be addressed: *congestion, information load, loss of privacy,* and *loss of control.* He writes of the importance of perceived control over one's situation as being at the base of various magical systems and formal religions that are found at all levels of cultural elaboration. Reducing information overload for an individual can be achieved if other people are "(1) similar to it and therefore predictable in their behavior, (2) clearly labeled and categorized (stereotyped) and abide by the category boundaries on their behavior, or (3) easily dismissed as inconsequential or as consequential only in specified kinds of interactions" (Cohen 1986:108).

The notion that mechanisms arose to reduce social stress is one of that group of issues that cannot be conclusively tested in the field, but which contribute to archaeological interpretation through the development of a richer context. It is possible to infer these mechanisms, however, if the necessary elements are in evidence: indicators of year-round occupation (based on faunal, floral, and other seasonal indicators, and the remains of relatively substantial structures) along with assemblages indicating stylistic elaboration of ceremonial regalia, personal adornment, or occupational toolkits.

HANDLING GROWTH AND COMPLEXITY

Looking at archaeological site distributions around the San Francisco Bay and interior Marin, King (1974b) proposes a model for the rise in complexity and concomitant status ascription in the Bay Area. While the dominant theme is one of settlement, the mechanisms at work have to do with social structure and interaction and ways of maintaining low-stress relationships in periods of increasing complexity.

Since populations generally increase with sedentism, groups adopting more settled lifeways must soon exert some control over the situation before all local resources are exhausted. King proposes that such a group has three options: reinstating the population-control measures that operated during more mobile times; developing new subsistence practices; or the group "can fission, usually along lineage lines . . ., 'budding-off' daughter populations into adjacent regions" (King 1974b:40). There can follow a series of such fissions, involving increasingly marginal territories that place the daughter populations under increasing pressure to readapt. A less elaborate alternative than adopting agriculture, King contends, would be the development of exchange networks, especially in areas where resource distribution is both varied and abundant. Further population growth occurs, "until a point is reached at which the parent community is socially circumscribed by the presence of daughter communities." At this point, according to King,

> fission then becomes a decreasingly viable option for population adjustment; mechanisms must then be found to maintain a larger population in the home environment while neutralizing potential competitors in the home environment. Meanwhile, the daughter

> populations, occupying less stable environments than does the parent group, come under considerable adaptive stress. The needs of both parent and daughter communities can be met through increased interaction, either in the form of warfare or in the form of resource-sharing via exchange systems. Either form of interaction requires formal organization of the population which amounts to the development of formalized nonegalitarian political systems [King 1974b:41-42].

Archaeologically, this scenario appears to be reflected in the relatively large number of somewhat evenly dispersed, usually Emergent-period, small occupation sites in relatively modest settings. While the resource-rich areas of the parent communities had allowed large settlements for some time, perhaps since earliest occupation of the area, the hinterlands where the daughter populations reside would have been formerly used only for short-term resource-procuring forays. The pattern can be seen on the Marin peninsula, and in other Bay Area counties including Sonoma, Napa, Solano, Contra Costa, and Alameda. At the survey level, it is essentially impossible to differentiate between these sites and seasonally used camps. Their identity should be more easily seen with excavation, where diversity of assemblage (indicating sendentism) and a rather high level of expensive trade goods (reflecting a mutual arrangement with the parent population) should be apparent. The dating of most daughter settlements to the Emergent period suggests not only a mechanism for reducing stress caused by population intensity, but also suggests an important aspect of complexity: the seasonal round may be eliminated, for example, when the parent group can get a daughter group to make that round for them, symbolically and literally, through exchange. This is a settlement issue in that it calls into question the earlier assumption that such sites were seasonally occupied by the same group that held the dominant sites; it is a social issue, however, in the way that it requires thinking of site distributions and other archaeological phenomena as a consequence of a problem-solving mechanism on the group level—ameliorating potentially stressful situations, while setting up support networks for the future. In many of the inland portions of the study area in the historic period, for example, it would have been adaptive to have safe and familiar locations in place at the time that Euroamericans began disrupting settlement: essentially friends in the country, who could help out in times of need.

WARFARE AND STRESS IN CALIFORNIA

In a call to give warfare its appropriate position in the list of byproducts of Late-period intensification, Raab (2000:7) notes that while California researchers have uncovered much evidence for interpersonal violence, warfare has rarely been included in models of culture change. He cites Lambert and Walker's (1991) argument that "the Late Holocene appears to have been a time of mounting stress, with shrinking water and food supplies encouraging greater territorial density and escalating rates of inter-personal violence" (Raab 2000:7). While the most convincing evidence for warfare, covering a span of 8,000 years, has been recovered from Chumash territory in southern California, northern California has also produced direct evidence in the form of injuries sustained from apparent conflict, projectile points embedded in skeletal remains, and mass burials. The tendency toward population aggregation may well be one of the most reliable archaeological

indicators of warfare in any region, according to Raab, who feels that this topic "deserves greater attention by California archaeologists" (2000:9).

Raab takes a dimmer view of the role of exchange in California than do most regional researchers (see below). He believes that the true scale of Late Holocene stresses, which included "a long-term and widespread decline in foraging efficiency, exacerbated by intense Medieval-era droughts" (2000:10), could not have been ameliorated by trade. Finding that "cultural and natural environments of the Late Holocene were characterized more by stress and scarcity than by the managed resource abundance envisioned by traditional reconstructions of California prehistory" (Raab 2000:10), Raab calls for consideration of "the real constraints that shaped culture change, along with models based on evolutionary ecology" (2000:11). Among the mechanisms he sees as having played a prominent role is the turn to warfare. While our evidence is relatively slim in northern California, an open consideration of warfare's role would be justified.

EXCHANGE SYSTEMS

The budding-off of new daughter populations that creates small, interrelated exchange networks may have been the earliest form of exchange and the most direct. Other systems sometimes involved the movement of materials over great distances, sometimes in a series of exchanges. Raw materials of utilitarian value, such as obsidian, moved across the landscape, as did items of more symbolic significance, to which the value added by the purveyor was the most important attribute.

THE CLAM DISC BEAD HORIZON

The Coast Miwok were producers—perhaps the inventors—of the clam disc bead, the focus of a sudden and extensive exchange system that gained popularity no earlier than the end of the 16th century and possibly not until the last century before contact. There is abundant bead-manufacturing debris, in the form of broken beads and nonperforated bead blanks, at most Emergent-period sites in Marin and southern Sonoma County. According to King, the disc beads acted not as currency, but as "the tangible element in a complex of social interactions that facilitated the redistribution of food against periods of famine and shortage" (1970a:285). King proposes an explanation of the inception of the clam disc bead industry in relation to his social circumscription model, described above. Over the past 2,000 or more years, populations living in large villages on the Marin bayshore would have opted for budding-off to occupy less favorable areas whenever the strain of sedentism became too severe; King singled out the interior of the Marin peninsula and Point Reyes as two likely candidates for daughter populations: locales with unstable resource bases—Point Reyes because of its lack of oaks, the interior because of its lack of shellfish (King 1970a:285). As populations in these new settlements rose, a system that would facilitate the transfer of food surpluses into the marginal areas would have been highly adaptive: hence the inception of the clam disc bead trade. What is not explained, however, is the clam disc bead's rise in popularity, nor why the clam disc bead and not

some other item became the focus of the trade—both questions that King considers worthy of attention. He proposes two hypotheses to be archaeologically tested:

1. In areas where clam disc beads were developed and/or heavily utilized, we should find evidence of adaptive stress. Such stress might be evidenced by high infant mortality, recurrent childhood illnesses, indications of intergroup conflict, high incidence of disease, and indications of experimentation with new subsistence techniques and patterns of social organization.
2. Clam disc beads should be found in least numbers in sites such as those on San Francisco Bay, where resources were relatively stable, and in such sites there should be relatively little evidence of traumatic stress [1970a:286].

Questions regarding the clam disc bead horizon are many. There is an apparent 200-year gap between the inferred beginnings of clam disc bead manufacture in Marin and the use of the beads in the Sacramento Delta area. Present evidence implies, as Beardsley (1954) notes, that the clam disc beads spread from the coast to the North Bay and no further for 200 years, then exploded across the state in the last 50 years before Euroamerican occupation. King and Upson (1970:180) propose that the clam disc bead industry may be a post-16th-century phenomenon, as suggested by excavations at CA-MRN-298 on Limantour Spit.

By the late-19th-century, clam disc beads had become highly important in terms of validating social statuses. Bead thicknesses and bore diameters increased, and quantities skyrocketed; Beardsley (1954:44) notes that individual burials in the Sacramento Valley possessed up to 15-foot lengths of strung beads. Photographs from the period attest to women being weighted down with thick ropes of the beads, which remained prized possessions in the 20th century (see photos of Bodega Miwok women in Collier and Thalman 1996:196-197). Prehistorically, use of the clamshell disc beads was more modest at Point Reyes, where 1,773 beads were divided between 9 burials and 15 cremations; they occur in groups of 5 to 590 beads, with very few burials having more than 100 beads (Beardsley 1954:44). In the 19th century, the beads were used as payment for training in various specialties or in exchange for shaman services; admission to ceremonies was paid for with the beads, while permission to pass over boundaries was also subject to bead payment (Collier and Thalman 1996:201-202). It is unclear how payment with clamshells operated in the protohistoric period.

OBSIDIAN EXCHANGE SYSTEMS

The Duncans Point Cave site north of Bodega Bay provides the first conclusive evidence for Early Holocene obsidian movement to the coastal region north of the San Francisco Bay, with just over half of the 89 specimens from the Annadel source, just under half from Napa Valley, and one each from Franz Valley and Borax Lake. Both Annadel and Napa Valley, however, could have been visited in a day or two, suggesting that people might have picked up obsidian on an ad hoc basis on their seasonal round. By the Emergent period, obsidian had come to be seen as a necessity: of the 510 projectile points recovered from Limantour Spit at Point Reyes, all but 3 were of obsidian (King and Upson 1970:136).

Obsidian Sources in the PRNS

A breakdown of the distribution of obsidian sources at Point Reyes can be seen in Thomas Origer's (1987) sample of obsidian projectile points from Sonoma and Marin County, as a part of his hydration-rate study; this is the only reported obsidian study conducted with materials from the PRNS. Of the 36 sites in the study, 6 were from Marin County. Samples from within or adjacent to the present study area include 20 corner-notched and serrated points, all of Annadel obsidian, from Toms Point [MRN-202] on Tomales Bay; 1 eccentric specimen of Annadel obsidian from MRN-216 at Limantour Spit; 13 corner-notched points of Napa and Annadel and 1 serrated specimen of Napa from MRN-230 on Bull Point on Drakes Estero; and 9 corner-notched, 6 serrated, and 2 concave-base specimens from MRN-396, north of Preston Point near the mouth of Tomales Bay. Points from the last-named site were mostly of Napa obsidian, while 2 corner-notched points and 1 serrate were of Annadel (Origer 1987). No obsidian from distant sources has been reported, similar to the situation in southern Sonoma County, which may have been Coast Miwok prior to contact; in central and northern Sonoma County, however, in solidly Pomoan country, an active exchange with people in the Clear Lake interior is suggested by the appearance of Konocti and occasionally Borax Lake obsidian at Warm Springs Dam area sites and the Alexander Valley. Konocti, in fact, is a common obsidian source along the coast at Salt Point (Dowdall 2003), about 50 rugged miles from its source.

Obsidian Distribution Models

While many researchers equate the spread of Konocti obsidian use with the movement of the Pomoan people out of Clear Lake and into the Russian River drainage, there has been little discussion of the social means by which these materials might have moved through the area. The only model proposed is an informal one that suggests that the maintenance of kinship ties with Clear Lake Pomo groups would have allowed easy access to homeland resources (Layton 1990). This is in keeping with Basgall's (1979) conclusions that direct access, usually without payment, was the ordinary means by which western Pomoan peoples obtained obsidian ethnographically. For the Dry Creek phase at Warm Springs Dam area sites, however, Basgall and Bouey contend that "the use of obsidian at Warm Springs during this phase reached a peak [around 2,500 years ago] that implies a systematic or regularized strategy of exchange relationships" (1991:178), but they do not offer a model for those relationships. Stewart (1993) proposed that the mechanism operating at Warm Springs involved an entrepreneurial relationship between expanding Coast Miwok groups (see the Berkeley Expansion under Chronology) and the indigenous Proto-Wappo who had pioneered the Dry Creek drainage, resulting in the contemporaneous occupation of two adaptively dissimilar groups. The two groups would have been held together by their different roles in obsidian supply and production.

The most elaborate discussion of obsidian production and exchange in north-central California is presented by Jackson (1986, 1989). He notes that of nine chemically distinctive obsidians in the North Coast Ranges, there is archaeological evidence for the extensive use of only four sources: Annadel, Borax Lake, Mt. Konocti, and Napa Valley. One implication of this selective use, Jackson (1986:90) suggests, is that obsidian projectile point or arrow manufacturers must have had restricted access to the material. Furthermore, there is consistency in the percentages of obsidian sources in any given tribelet territory—

evidence, he contends, that some mechanism for management must have operated at local and regional levels. On this basis, Jackson states:

> Extrapolating from ethnography, we could conclude that the political and economic authority of village leaders was sufficient to exercise very explicit and pervasive control through the redistribution of resources. Also implied is a political unity and perhaps a class distinction among these social elites. Maintenance of that class and its authority may have been through the regulation of exchange in general, including the exchange of wealth items like clam disk beads [1989:90].

Jackson notes an interesting simplification of production of Emergent-period projectile points after A.D. 1500: the elaborately serrated corner notches of Phase 1 are replaced by simple, nonserrated corner-notched points, which Jackson notes "could be modified easily to accommodate the aesthetic/stylistic demands of a range of consumer societies" (1989:91). At the same time, the clam disc bead appears archaeologically, whose principal function, according to Jackson, was to maintain status among elites engaged in inter-tribelet exchange. Jackson concludes with a summary of exchange in the North Coast Ranges:

> At present there is tantalizing evidence to suggest that obsidian exchange took place within closely regulated redistribution systems. There was no monolithic 'obsidian exchange system.' Obsidian was only one commodity moving in regional systems, and obsidian in different forms very likely was distributed in very different ways [1989:92].

Long-distance Interaction Model

In contrast to Jackson's local model, Bouey and Basgall (1984) introduced the first formal call for recognition of broad-scale economic articulation as the appropriate approach to the interpretation of changing obsidian-source distributions in central California. Their focus is the Central Valley, adjacent foothills, and the obsidian sources in the eastern Sierra and the Napa Valley. They suggest that direct procurement by western Sierra foothill populations was likely the means by which Casa Diablo obsidian from the eastern Sierra entered the western slopes, while foothill-valley exchange provided the avenue by which these materials entered Central Valley and Delta sites. This relationship continued for centuries, with the peak of Casa Diablo use occurring between ca. 3000 and 1600 B.P., when eastern obsidian virtually disappeared from the lower elevations in the west. Here a shift occurred, with Napa Valley obsidian—previously only minimally represented—becoming the dominant source, first as status markers and later used for utilitarian items after overproduction resulted in "swamping" the market.

While the details of this complex event are not pertinent to the current study, Bouey and Basgall's basic premise is of interest:

> If we are to grasp a more complete understanding of evolutionary prehistory, we must ultimately account for both internal developments and external contexts; evaluations must be made of economies in articulation and not in isolation [1984:150].

Also of interest are some of the exchange mechanisms Bouey and Basgall offer: (1) that direct procurement (e.g., visits to the source by the western foothill populations) may be

inferred when the source population is organized on egalitarian, wide-ranging lines and, thus, less likely to set up long-term production systems; and (2) that a complex production system, such as that of Napa Valley, may be developed not simply to supply demand but to satisfy internal needs:

> Residents of the Napa Valley may have begun to develop, completely on their own and without central California intercession, a greater productive capacity and thus of their own accord exported relatively more obsidian into the latter region [Bouey and Basgall 1984:150].

A feedback relationship may have developed between the two regions, with Napa residents exporting greater amounts of obsidian, "not to meet central California wants, but to support their own extant (or developing) sociopolitical structure" (Bouey and Basgall 1984:150). Another way of looking at Napa's entrance into the central California exchange network is as a move to support their own sedentism. Stewart (1993) proposes a similar complex relationship for the expansion of Konocti obsidian in the Warm Springs locality.

The role that coastal peoples might have played in this complex socio-political scenario is poorly understood, primarily because of the limited number of scientifically framed excavations in the parklands. More about the Point Reyes area's marginal setting in the Emergent period, and its implications for social change, is presented below.

BOUNDARY CULTURE: A MODEL OF SOCIAL CHANGE

In the broader sense of sharing material and information, exchange systems may have had a key role in the development of cultural complexity in prehistoric central California. This issue is explored in several alternative theoretical formulations (Bouey 1986; Ericson 1977; Fredrickson 1974). A model of social processes that looks at the interdependence of social systems in a region is posited by Fredrickson (1974, n.d.) and presented in White and Fredrickson (1992) and White and Meyer (1998:108-110); the model is derived and adapted to a large extent from the work of Yehudi Cohen (1968, 1969, 1983). Cohen postulates that every society—by virtue of living in contact with other societies—is characterized by two sets of processes: "inside culture" and "boundary culture."

Inside culture corresponds to the traditional concept of culture and might be placed under the rubric "lifeways." Boundary culture, on the other hand, represents the processes involved in the interaction between interdependent societies, and is conceived as being organized to regulate, control, or administer the movement of goods and ideas between societies. While both inside and boundary culture have characteristic role relationships and statuses, the organization of social relations embodied in a group's inside culture will reflect the group's boundary-culture relations. From this perspective, hunter-gatherer complexity and dynamics can be understood in terms of more than such basic constructs as mobility patterns, subsistence economy, and technology. Organization of the adaptive system also involves relationships with neighboring groups who control resources not available in the home territory due to natural absence or local crop failure.

Once centrally administered exchange systems emerge, positive feedback emphasizes their importance over time, with boundary personnel—through their administrative function—gaining social influence and administrative power. Since roles of social influence and political power frequently carry with them material representations such as wealth and status objects, it is possible archaeologically to observe the parallel development of exchange systems and social differentiation based upon wealth, and ultimately the appearance and maintenance of tribelet structure with its resultant occupation specialization, institutional differentiation, and overall social complexity.

The model predicts that, due to the pressure to administer resources to visitors, boundary-culture developments should have been most accelerated in those settings where localized (usually seasonal) resource surpluses existed. The model was developed for such resource-rich areas as Clear Lake and San Francisco Bay. What role would the indigenous people of the PRNS, the Marin Headlands, Angel Island, the Presidio area, the San Francisco coast, and the Sweeny Ridge in San Mateo (to name only a few) play in such a system? More detailed studies would be necessary to better characterize the resource value of these areas and the potential for abundant resources at some seasons. Comparing Point Reyes and even Tomales Bay with the apparently more resource-rich Bodega Bay to the north, opportunities to develop a more complex social system appear much greater in the latter area. Although evidence of exchange is clear in PRNS archaeological sites, the need for a complex suite of administrative positions during the Emergent period is not.

RESEARCH ISSUES ON SOCIAL ORGANIZATION, INTERACTION, AND COMPLEXITY

SOCIAL ORGANIZATION

1. What evidence is there in PRNS–GGNRA site assemblages for the growth in status ascription and rise in specialization? Are reflections of social stratification indicated in earlier (Middle or Upper Archaic) cemeteries or site clusters?
2. Where data from cemeteries and human graves are available, is there evidence of differential treatment of burials in accordance with age, sex, or inheritance? Do osteological data indicate differential nutrition or health care? Can specialized occupations be identified, and are specialists treated differentially?
3. Can hierarchical village organization be demonstrated through analysis of site spatial distributions? Might buried sites contain more intact features related to village structure? Based on environmental reconstructions, do differently ranked sites exhibit differential access to resources? Are there elements of the site's setting, such as commanding views, that suggest expressions of status or other intra- or inter-group symbolic communication? Are these suggestions borne out by other archaeological evidence?
4. What indications are there of interaction with other groups? Can reproductive interaction with other groups be inferred from osteological data, or do clusters of distinctive traits suggest endogamy?

Data Requirements

- Archaeological deposits with adequate quantity and diversity of artifacts to address issues related to status and craft specialization, or variation in the relation between sociopolitical status and exchange wealth.
- Archaeological deposits with features such as living surfaces, house floors, domestic and external work areas, refuse piles and pits, or other markers of sedentary residential activity; comparative analysis of such features to track differential access to resources and facilities.
- Environmental reconstruction to determine resource value of site location.

STRESS REDUCTION IN SEDENTARY CONTEXTS

1. Are there reflections of increased need to manage information overload (e.g., distinctive patterns or styles in common artifacts) for greater control through symbolic means?
2. Do site distributions provide evidence for population fission, with creation of daughter populations in less productive environments? Is the operation of this scenario evident in artifact assemblages that show differential exchange goods in associated communities—evidence of small-scale, direct exchange systems?
3. Are there stylistic markers that indicate these inter-tribelet relationships? Can these traits to seen as serving to separate or join associated groups?

Data Requirements

- Suites of archaeological sites in a range of adjacent environmental settings, with clear assemblages to allow identification of stylistic markers.
- Assemblages with adequate quantity and diversity of artifacts to address issues related to small-scale trade; good floral and faunal preservation that will allow identification of resource use in proposed parent and daughter communities.

THE ROLE OF EXCHANGE SYSTEMS

1. In what ways do obsidian and other exotic goods pattern in study-area archaeological sites? Can they be seen as the result of ad hoc acquisition or more formal exchange? Is there a progression toward formality through time, or can a return toward local materials be seen in the Late period?
2. Do markers of tribelet structure (greater sedentism, status differentiation, and specialization) and evidence for the existence of production for exchange (such as features related to storage of surplus) co-occur with evidence of intensive exchange?
3. Did areas within the PRNS/GGNRA serve as centers for the production and exchange of clam disc beads? Is there evidence for specialization, in terms of

individuals or sites? How do sites with bead-manufacturing evidence differ from those without? Do they contain evidence of full social units and a diversity of activities? Do they possess more or fewer exotic exchange items?

4. In what ways would the development of boundary culture be evidenced in study-area sites? Did the need to administer resource use in relation to other groups arise in PRNS–GGNRA settings ? Can the resource value of parkland sites be estimated based on both environmental criteria and presumed indigenous values? Do artifact assemblages suggest that study-area people may have been visitors to other procurement areas that may have required social management?
5. Is there evidence of warfare or other intergroup violence in study-area mortuary populations? Are there other indicators of violent activity, such as increased quantities of weapons? Is evidence of reduced or increased mobility (see Settlement and Subsistence) associated with warfare?

Data Requirements for Addressing Exchange:

- Assemblages of obsidian artifacts over time.
- Archaeological deposits containing artifacts identifiable as trade or exchange markers (e.g., obsidian, other foreign stone, shell beads).
- Archaeological features indicative of greater sedentism, such as living surfaces, house floors, domestic and external work areas, refuse piles, and pits.
- Archaeological features and assemblages that reflect sociopolitical organization and ethnic affiliation.

Chapter 6 – Culture Change: Historic-Period Native American Archaeological Research

INTRODUCTION

RESEARCH APPROACH

In the first archaeological management plan for the newly fledged Point Reyes National Seashore in 1969, archaeologist Charles Bohannon established the primary archaeological theme for the PRNS: "the complete story of Northern California Indians … from prehistoric, through European contact, to recent times" (1969:1). Taking this seamless approach to Native American history—instead of segmenting history into prehistoric and ethnohistoric periods—was well ahead of its time. Only recently did the National Park Service produce its Revised Thematic Framework, which proposes that such themes as Peopling Places, Creating Cultural Institutions and Movements, and Expressing Cultural Values be used to address all times and cultures (NPS 2003).

As a standard component of archaeological research, ethnographic studies have used to identify direct analogies to lifeways and processes in the prehistoric past. This approach treats the native group as static—little changed from decades, or even centuries, of Euroamerican presence. More recently, archaeologists have come to view ethnographic analogy with considerable mistrust. Lightfoot, Wake, and Schiff, in their study of Fort Ross, argue for a different approach:

> Rather than employing ethnographic observations to flesh out the prehistoric past, we advocate their use as part to the "direct historical approach" to develop a diachronic framework for comparing and contrasting native societies before, during, and after contact with European and American colonial institutions. It is important not to confuse the direct historical approach with direct historic analogy, as do most current textbooks…. The former is a straightforward study of cultural change, while the latter evokes analogy based upon the assumption of cultural continuity [1991:7].

Their approach is similar to what Bohannon proposed for the PRNS more than 30 years ago and is in keeping with the new thematic framework. It is an especially valuable approach in the PRNS–GGNRA, where no detailed ethnographic information was gathered by anthropologists from people with close (two generations or fewer) links back to traditional lifeways. Because of the early and intensive interaction between native people and European colonists and American settlers, however, there is much information for studying cultural change. There is also much information to recover for Coast Miwok and Ohlone descendants who are less interested in the interpretation of culture change and more interested in their own history. The approach taken in this general research design separates out the ethnohistoric period from prehistory because of the nature of the data base, the organizational needs of this document, and the differences in archaeological method for prehistoric and historic-period contexts. Whether one chooses to organize

research issues thematically or chronologically, the focus on cultural change that the Fort Ross researchers advocate above will be an effective one and appears to be most in accordance with the NPS Revised Thematic Framework.

THEORETICAL ISSUES AND ARCHAEOLOGICAL APPROACHES

The archaeology of acculturation is a large field that has shifted its perspective over the years. When *acculturation* first appeared in 19th-century anthropology, and for decades thereafter, the term referred to "the merging of cultures through prolonged contact, with the active interchange of cultural traits and material items" (Allen 1998:5). Then, in the many studies of culture contact in the mid-20th century, acculturation came to mean "that a subordinate group assumed the identity and values of a dominant, colonizing culture" (Allen 1998:5). The term, along with its near synonym *assimilation*, "connotes images of a people passively accepting European ideas and material culture" (Allen 1998:6) and, consequently, has fallen out of favor with many anthropologists. The phrase *culture change*, while not so specific in implied historical trajectory, more accurately reflects the reciprocal relationship between groups.

Agency and Culture Change

A traditional interpretation that views subordinate groups as subjects with little or no ability to affect their own history has been countered in recent years by an emphasis on individual and group agency (Dobres and Robb 2000). Contrary to popular notions of culture contact, native people who have been thrust into subordinate positions by newly dominant cultures do not quietly submit to the new conditions. When behavior is interpreted from this perspective, native Californians may be seen as interacting with and affecting individuals and institutions of the dominant culture, and altering situations to their best advantage. The degree to which indigenous people could act independently to further their own goals, however, was restricted by the settings in which they found themselves: in early California, most contact settings were characterized by loss of rights to native lands, deterioration of the resource base, desecration of the cultural and spiritual landscape, physical confinement, monotony of activity, and in the worst cases, a total loss of autonomy. Early on in some mission settings, however, a "mutual accommodation" prevailed, wherein Indian men were free to hunt and fish and women worked in groups as they had traditionally (Milliken 1995:86-89).

Based on archaeological investigations at the Santa Cruz Mission, Allen (1998:97) finds that native people at the mission established their own economic network based on on-site shell-bead manufacture, which enabled them to maintain a separate cultural identity apart from the colonizers. While they also retained many traditional tools and ornaments despite the apparent availability of Hispanic substitutes, many other elements of the dominant culture at the missions were accepted. Looking at the archaeological and historical record through the perspective of agency can allow a new assessment of the effectiveness of native people's responses to colonization and, ultimately, to modern industrial society. As Lightfoot, Wake, and Schiff (1991) have demonstrated at Fort Ross, this is a dynamic relationship affecting the dominant culture as well as the subaltern one.

Historic and Prehistoric Archaeology

While different field techniques are sometimes employed at historic-period vs. prehistoric archaeological deposits, the principles of good stratigraphic analysis are appropriate to both. Perhaps the greatest concern in investigating multicomponent sites is to assure that the potentially significant aspects of both components of a site are appropriately addressed in the research design. Early archaeological work at the PRNS provides a clear example of what can go wrong when only one discipline's goals are considered; Compas (1998) notes that excavation of Exploration-period components paid only minimal attention to Native American components, especially subsistence data, due to research biases in favor of European artifacts, specifically time-markers (Compas 1998; Moratto 1974:61). In addition, a clear understanding of the artifact assemblages of both cultural components must be well understood to avoid misinterpretation; what appears to be intrusive mixture may be contemporaneous use of native and Euroamerican materials, while some apparent co-use may in fact be unlikely or impossible based on the nature of time-markers. Compas advocates taking a team approach to multi-component sites in the future, in order to assure that each component is appropriately identified and treated.

Although many of the same techniques are employed in both prehistoric and historical archaeology, there is at least one aspect of the latter that is unique: the availability of precise dates of occupation, specific names and employment information, information on the sources and pricing of various consumer items in the assemblage, and even historic maps depicting the locations of structures and possible artifact-filled features. While the ability to securely associate an intact and diverse assemblage with a specific household is relatively rare, there is tremendous interpretive potential when these elements co-occur. In fact, an archaeological deposit can often be informative when the association can be made only to the level of the probable ethnic identity of the household. With U.S. Census lists of names and ages of Indian households in the community—along with archival information, including photographs of people and places and data on employment and land use—the archaeologically recovered information can be especially vital. This access to more detailed personal information also serves as an avenue into the less material dynamics of human interaction, since motivation and outcome of actions can often be discerned from documentary sources.

RESOURCES

There are innumerable references on the process of acculturation and the interpretation of culture change among native peoples; a review of the literature on contact-period archaeology will provide further sources (e.g., Barker, Allen, and Costello 1995). Focused studies of culture change in contact-period sites have been relatively rare in or near the study area. Among the exceptions are those briefly reviewed here and below (e.g., Allen 1998; Dietz 1976; Lightfoot, Wake, and Schiff 1997; and Silliman 2000, 2001).

A significant resource to guide indigenous historic-period archaeology on the California coast is forthcoming. The fourth volume in the California coastal series produced by the University of California at Los Angeles is being planned by Jon Erlandson and Kent Lightfoot "to deal explicitly with the archaeological approaches to the study of the

Protohistoric and Historic periods in Alta California, and the dramatic sociopolitical, economic, and demographic changes that occurred as California was increasingly integrated into a global economy" (Erlandson and Jones 2003:vi).

THIS CHAPTER

To illustrate the long and rich historical contact between native people and Europeans and other entrepreneurs and settlers in the PRNS–GGNRA, there follows a brief summary of post-contact indigenous history in the study area. An overview is then presented of the relatively few archaeologically focused studies of historic-period Native Americans in north-central coastal California. Finally, research issues are posed for each of the broad research domains considered for the prehistoric element of this study.

INDIGENOUS HISTORY OF THE STUDY AREA

If the prevailing belief that Francis Drake careened the *Golden Hind* at Drakes Bay is correct, then the PRNS is the site of the oldest point of contact between Europeans and Indians on the West Coast, dating to more than four hundred years ago. News of the event in 1579 may have traveled quickly, and native people could have made the trip to Drakes Bay from all over the Marin peninsula and beyond during the Englishmen's six-week stay. Contact during such a lengthy sojourn would have made a profound impression on the local Coast Miwok, although probably for reasons other than surmised by Drake's chaplain, who interpreted the natives' actions as adulation of the foreigners (Lightfoot and Simmons 1998). The location of Cermeño's storm-battered galleon S*an Agustin* at the entrance to Drakes Bay 16 years later is more secure. There, 70 men and a dog encamped for three weeks (Gilliam and Hyde 1962:31-33); the stay was also long enough to have afforded some interaction between natives and the Spanish crew. After they departed, their abandoned cargo was a source of material that has been recovered from at least six archaeological sites on Point Reyes and vicinity. Researchers suggest that Indians made regular use of the site as a source of ceramics and spikes as well as boards from the ship's hull. In the two-century hiatus that followed, some elements of the English and Spanish visits would likely have been retained and incorporated into the oral history of the tribe.

To define the archaeological assemblage of the Protohistoric period, Beardsley (1954:16-18), compiled a list of native artifacts from a review of English and Spanish diaries and other historic accounts. The material culture of the Coast Miwok, as described in these early reports, was essentially the same as that in place at the time of first Spanish settlement in the late 1770s—prompting archaeologists to date the beginning of the Protohistoric period (or the Upper Emergent period) to just before Drake's arrival, or ca. A.D. 1500 (King 1978:58).

Pedro Fages's expedition of 1772 to the San Francisco Bay focused on the East Bay and did not come in contact with GGNRA lands. The first direct bayshore contact between the native people of Marin and Europeans occurred in 1775 in the territory of the *Huimen*—the Coast Miwok group that held the southern tip of the Marin peninsula, including

GGNRA lands. The occasion was the Ayala expedition on San Francisco Bay and the coastline to the north, in preparation for the founding of California's second mission and presidio. The Spanish explorers remained for a period of more than one month, an event that was documented in the Spanish diaries (Milliken 1995:41-51). During the night of 6 August 1775, the expedition entered San Francisco Bay in the *San Carlos*, a 193-ton, two-masted brig, and anchored at the bottom of Richardson Bay near the Miwok village of *Liuaneglua*. The brig remained on the bay, just 1 mile north of today's Fort Baker in the GGNRA, until mid-September. During that time native people visited the vessel at its anchorage off Angel Island. Spanish crew members also visited numerous villages around San Francisco Bay during their efforts to chart it, but there is only one brief mention of Marin bayshore native residents. The Spanish diarists reported all interactions as friendly.

Shortly thereafter, in October 1775, Lieutenant Juan Francisco de la Bodega y Cuadro, on the schooner *Sonora*, accidentally discovered Bodega Bay. At Tomales Point, Indians came by tule boats to meet the visitors, giving gifts of "rosaries of bone, seeds, and plumes of feathers," and receiving in return "bugles, looking glasses, and pieces of cloth" (Hoover et al. 1990:180); they left the next day. It is possible that some of the Tomales Bay Indians who greeted Bodega had visited the *San Carlos* just a few weeks before on San Francisco Bay.

These events marked the beginning of sustained European/native contact in the PRNS–GGNRA parklands. The site of the Presidio of San Francisco was selected in March of the following year, and by late June the Mission San Francisco de Asís (aka Mission Dolores) was also established. Settlers and troops moved to the presidio, and it was formally dedicated in September 1776, just over a year from that first visit to Marin. While the mission system in California operated for less than 60 years, it had devastating and irreversible effects on the native people of San Francisco Bay in less than a third that time.

In San Francisco, the *Yelamu* (Costanoan/Ohlone), consisting of three semisedentary groups (living in four villages), encountered the new settlers on the day of their arrival, in June 1776 (Milliken 1995:62-63). The account from the Spaniards describes a group of 75 people—men, women, and children. The *Yelamu* began joining the mission in 1777; most of the local teenagers joined the first year, while most adults were baptized by 1787. The *Huimen* of Sausalito were the first group of Marin peninsula native people to go to the mission, beginning in 1783. People from the coast south of the Golden Gate were also taken in early. Not long thereafter, during the mid-1780s, Mission San Francisco's outstation of San Pedro was constructed on the coast immediately south of San Francisco at the village of *Pruristac* (Milliken 1995:251). All native groups from Marin, including the *Olema* (probably from the valley of that name near the PRNS) and the *Gualen* from around Bolinas, had been drawn into the system by around 1807. Milliken's (1995) *Time of Little Choice* presents a rich context followed by a detailed tribelet-by-tribelet description of the inexorable destruction of native lifeways in the Bay Area.

At the same time that Marin native villages were being decimated or abandoned, in the first decade of the 19th century, Russian fur-trading companies made their first exploratory visits to the Sonoma Coast. Soon after, the new Russian colonists and their Aleut workers began establishing agricultural outposts along the Marin and Sonoma coast in 1812. Russian documents indicate that a few Coast Miwok who escaped missionization

made alliances with the Russian fur trappers in Bodega Bay and Fort Ross, including the trading of some of their lands to the Russians in return for their protection from the Spanish. Forty-two of the 71 women at the Fort Ross settlement were California Indians, and of these 9 were "Bodegin" Coast Miwok (Farris 1989:489); for these women from Bodega Bay (and possibly from further south within the parklands), marriage to the foreigners at Fort Ross served as a refuge from missionization.

During this period, several epidemics swept through the missions and the few remaining settlements in the countryside, abruptly reducing populations and especially affecting women and young children. The mission at San Rafael had been established in 1817 to provide a more healthful environment. Soon many Indians were being moved further north to Sonoma, where a new mission was established in 1823 following Mexico's independence from Spain (Hoover et al. 1990:174, 476). When secularization of the mission system and distribution of its lands took place in the mid-1830s, native people from all over the Bay Area, who had been brought together to live in mixed groups for two generations, were unceremoniously turned out of their mission homes.

Native Americans who had survived the epidemics of the missions encountered a markedly changed world, where tribelet territories were claimed by others and former hunting and gathering places were overrun with livestock. Some people leaving the mission found work at ranches on the Marin peninsula and at Fort Ross, or at the vast ranchos ringing the Bay and beyond. For many, there may have been a loss of tribal identity through the two-generation-long incarceration, and many individuals merged with other Indian groups or blended into the Hispanic population after secularization. Others, including some groups of Coast Miwok near the PRNS, reconfirmed their cultural unity for a time.

Although the initial stated intention of the mission system was to promote Indian self-sufficiency and landownership, and several attempts to grant lands to native groups were made in the Marin area, only one land grant was ever confirmed to a Native American in California—Rancho Olómpoli, patented to Camilo Ynitia (Hoover et al. 1990:179). Among the failed attempts was the Nicasio landgrant, which had been bequeathed to the Indians of San Rafael in 1835, at Mariano Vallejo's order. The grant was roughly 20 square leagues (80,000 acres) and "bounded on the southwest by Tomales Bay, on the northwest by the estero de Tomales, on the north by the laguna San Antonio, on the northeast by the Ranchos of Mesa, Martin, Fernando Feliz, Pacheco and Timothy Murphy" (Dietz 1976:19, citing Richardson's testimony at the U.S. Land Commission). Initially, the experiment was successful, and the native population of Nicasio Valley grew to between 300 and 500 by 1836. Then the smallpox epidemic of 1837 devastated the North Bay Indians; approximately 300 people were buried in Nicasio by 1838. Concluding that the claim was not being well-used, Vallejo—with no real authority to do so—reclaimed the property. After many years of litigation, the only land that was given back to the native population was one square league located in the southwest corner of the grant, where the 400-year-old village of *Echa-tamal* was still occupied (Dietz 1976:27-28).

Meanwhile mission lands were being divided up among an array of foreigners, and the rancho system was underway. Virtually all of the study-area lands fell under Spanish or Mexican landgrants, with the exception of the Presidio, which remained in government

hands until it was taken over by the U.S. military in 1846. As American towns developed and population grew under United States tenure, the descendants of the Coast Miwok and Costanoan/Ohlone of the PRNS–GGNRA became a disenfranchised part of the general population.

POST-CONTACT SETTLEMENT IN MARIN

The indigenous archaeology of post-contact PRNS is the subject of a 1998 master's thesis by Lynn Compas, which takes the direct historical approach advocated for Fort Ross by Lightfoot, Wake, and Schiff (1991). In addition to an analysis of settlement pattern and resource procurement, Compas provides a management plan that includes an assessment of natural and cultural processes affecting contact-period archaeological sites and ranks the sites in terms of their vulnerability. She divides the Point Reyes indigenous history into five eras: Prehistoric, Exploration period, Spanish period, Mexican period, and American period. A review of the ethnographic sites identified by Compas in the PRNS and a summary of her findings for each historic period are given below.

SOME ETHNOGRAPHIC SITES IN THE PRNS

Compas (1998) identified seven villages within or near the study area in the ethnographic literature, while historic sources refer to additional locations. Cermeño and his men identified seven different villages near the anchorage of the *San Agustin,* while Drake only noted "several," which were located "here and there" (Lightfoot and Simmons 1998:164); some of these 16th-century villages may be represented in the list below. A few of the villages were not inhabited until well after contact, while others probably had prehistoric components. The following villages were in or near the PRNS:

- *Olemaloque,* along Bear Valley Creek, may have been occupied during the Exploration period according to Slaymaker, who provides evidence that this may have been the village of 150 or more inhabitants visited by Cermeño on 2 December 1595 (1982:337, cited by Compas 1998:47). According to Milliken (1995:349), the relationship between *Olemaloque, Olema, Olema-tamal*, and *Libantone*—all of whom are probably from the Point Reyes-Inverness-Olema area—can be sorted out through family reconstitution research.
- *Sholomko-wi,* outside the GGNRA on the east side of Tomales Bay at Toms Point south of Dillon Beach, was inhabited after secularization of the mission in 1832.
- *Ec-a kulum,* also outside the GGNRA near Marconi Cove, was also inhabited after secularization.
- *Otroomiah*, possibly near the southern end of Tomales Bay, was referred to as Coyote's first rancheria in early ethnographies (Barrett 1908a; Kroeber 1925:Figure 22; Merriam 1907:356); elders interviewed for Compas's thesis had heard of the rancheria but did not know when it was occupied.

- *Sakloki*, east of Toms Point, is not precisely located and is of unknown date.
- *Tocaloma*, east of Olema—date and location unknown.
- *Bauli-n*, somewhere on the east side of Bolinas Bay, possibly within the GGNRA, of unknown date.

Although some of these villages may in fact be represented by recorded archaeological sites, these associations have not been verified.

POST-CONTACT CHRONOLOGY

Exploration Period

Of the sites excavated in the Point Reyes vicinity, nearly half exhibit historical components dating to the Exploration period: CA-MRN-232/H, 301/H, 271/H, 236/H, 242/H, 274/H excavated by Heizer and Beardsley and CA-MRN-216/H and 298/H at Limantour Spit excavated by King and Upson (1970). This suggests that a fair number of uninvestigated sites in the PRNS will likely have components dating to that period as well. Several of the sites with European/Asian materials are on Limantour Spit and Drakes Estero, but one important one, MRN-378/H, is in Bear Valley.

Spanish Period (includes Russian)

The *Guaulen*, a Coast Miwok tribe centered at Bolinas Bay, contributed 112 people to the mission at San Francisco between 1801 and 1803 (Milliken 1995:242). A few years later, in 1807, 25 adults from "Olemalocoe" were baptized. Native occupation in Point Reyes during the Spanish period has not been confirmed archaeologically, although mission records attest to Coast Miwok people living here up to 1810.

Archaeologically, it would be difficult to identify Russian influence on Spanish-period Native American sites. Farris notes that "the Russian-American Company relied on the importation of goods through American and British merchants who plied the west coast of America," resulting in a similar pattern of supplies at all the ports on the Pacific Coast (1989:492). At Fort Ross itself, Lightfoot, Wake, and Schiff (1997) found relatively few Russian items, which they considered as possible evidence of trading the materials out. Compas (1998:96) calls for a "comparison between the historic documents and material remains between sites located at Point Reyes, the Farallon Islands, at Bodega Bay, and at Fort Ross," in order to further our knowledge of the relationship between the Coast Miwok and the Russian mercantile colonies.

The number of study-area Indian people who avoided missionization is unknown, but was probably quite low. Richard Beardsley speculated that Point Reyes may have served as a refuge, "because it was difficult to reach from Spanish settlements" (1954:19). These refugees, however, would have lived in severely reduced numbers and under reduced economic circumstances, since the precontact exchange networks were no longer operating, while the limited work force would have required eliminating some activities. Thus their camps and work sites might have very low visibility archaeologically.

For a better understanding of settlement patterns, Compas calls for a reanalysis of mission-period baptismal records to include not only the settlement, but the year, names,

and number of individuals from each settlement. Milliken (1995) has demonstrated that a much broader understanding beyond settlement pattern can be achieved from such research.

Mexican Period

As was the case with the previous period, no archaeological sites in the Point Reyes study area have been specifically dated to the Mexican period. While many Coast Miwok had initially gone from the missions to *Echa-tamal*, others went straight from the mission to Tomales Bay, according to anthropologist and Coast Miwok tribal member David Peri (Compas 1998:70). Most of the PRNS was taken up in huge ranchos with thousands of head of cattle. Coast Miwok returning from the missions found work, and often a place to live, at the ranchos. While some rancheros might have simply been tolerant of the presence of native rancherias on what had become their land, most wanted to congregate the local Indian people in order to have a ready labor force. Often the desired results were achieved by slave raiding, for which Compas (1998:72) found documentation in the Point Reyes area.

A safe haven was Toms Point south of Dillon Beach, where Tom Woods (aka Tom Vaquero)—who arrived there in 1841 and married a Coast Miwok woman—was a trader in hide and tallow, game, and produce. According to a report in the *Marin Independent* (1916:73), Woods had native people supplying him with goods while he saw that they were fed and entertained. His post was said to be a "shipping and trading point for all the Spanish, Russian, French and English trading coasters.… During the summers of 1845-1846 it was not an uncommon sight to see 1000 Indians along the bay shore. They would come overland [from Marin, Sonoma, and Solano counties] with their supplies of hides, tallow and skins, and would wait for weeks for the arrival of a vessel (cited in Compas 1998:72-73). The site at Toms Point, CA-MRN-201, was only minimally excavated, and only for its prehistoric (Estero-aspect) values. It is unknown whether the site has discernible historical deposits.

American Period

The manuscript U.S. Census population schedules for western Marin townships (Compas 1998: Table 5.6) list 13 native people living in or near the study area in 1860, 47 in 1870, 48 in 1880, 22 in 1910, and 19 in 1920. In each year except for 1870, a higher Indian population is probable, since not all townships were counted. The figures also do not include those native individuals or families who represented themselves as another nationality (usually Spanish or Mexican) in order to avoid the widespread prejudice against Native Americans.

According to both the archaeological record and the Coast Miwok descendants that Compas interviewed, only four native sites dating to the American period are known in the Point Reyes National Seashore:

Site Trinomial	**Family Name**
CA-MRN-247/H	Ouse/Jewell/Frescia
CA-MRN-249/H	Alcantra
CA-MRN-263/H	Pensoti
CA-MRN-387/H	Campili

The archaeological sites with American-period components known to the elders are located "in coves along Drakes Bay, near sources of fresh water, and in places that are sheltered from weather extremes" (Compas 1998:41). Like sites from the Pre-contact and Exploration periods, they were located in areas where marine and terrestrial environments could easily be exploited; in fact, according to the "/H" designations provided by Compas, each of the four sites has a prehistoric component. Compas (1998:97) reported that a study specific to Coast Miwok occupation at Lairds Landing was currently underway, while the rest of the sites have not been studied. Interview data indicate that, on American-period Tomales Bay, boats were an important part of Coast Miwok daily life and almost every family owned one—from one-person rowboats to barges used to transport goods.

Noting that artifacts used during the late Mexican and early American periods were a mix of European and traditional native manufacture (Dietz 1976), Compas concluded that, archaeologically, "a Coast Miwok household may look like that of a non-Native settler, and caution must be exercised when identifying occupation during this period so that a site is not automatically thought of as Euroamerican when it is not" (1998:96). This is especially the case in disturbed contexts, such as occur throughout much of the Point Reyes area, where any Native American artifacts in a historic site could be seen as representing an earlier occupation.

The Point Reyes area had become multiethnic by the American period. Thus it is an excellent setting for studying multicultural interactions—through further research, oral interviews, and analysis of material remains.

BOTANICAL REFLECTIONS

A broad-reaching study of botanical alterations occurring in the initial and later contact period in southern Marin County was conducted by Duncan (1992) using pollen-core data and ethnographic and archaeological information from the PRNS and surrounding locales, including China Camp, a GGNRA-administered unit. Her study concludes that "the cumulative impacts of introduced plants, shifts in land management from Miwok to Euroamerican-dominated resource procurement and subsistence practices, and ecological responses of plant species suggest that the contact period might better be defined on ecological terms rather than by purely material cultural or ethnographic definitions" (1992:17). She documented the inclusion of weedy native and introduced plants into the traditional diet and the use of traditional management techniques to enhance exotic species (Duncan 1992:357).

Duncan's dissertation incorporated original ethnographic and ethnohistorical documents not available to previous archaeologists working in the region, and serves as a rich compendium of data for indigenous archaeology in southern Marin.

STUDIES IN HISTORIC-PERIOD INDIGENOUS ARCHAEOLOGY

CULTURE CONTACT IN PROTOHISTORIC CALIFORNIA

Lightfoot and Simmons (1998) present an intriguing study of the initial encounters (A.D. 1542 to 1603) between natives and Europeans along the California coast. After summarizing the principal expeditions and voyages on land and sea, they focus on the encounter between Drake and his crew of more than 100 men and the Coast Miwok at Point Reyes. From the chronicles of these voyages, they discover a pattern of public ceremonies and rituals that mediate encounters between the two groups, communicating values and meanings and attempting to make sense of the "other" (Lightfoot and Simmons 1998:148). "One can view the encounter at Nova Albion as a classic case of clashing ideologies and world views as manifested by public ceremonial practices—as the women committed their bloody sacrifices [scratching their faces] in front of the voyagers, the English looked to the heavens, prayed, sang Psalms, and read the Bible" (1998:150). Their actions are in accord with the behavior appropriate to the June celebrations of the Kuksu cult; Lightfoot and Simmons suggest that the strangers may have been perceived not as gods or supernatural beings, but as individuals who had come to participate in the ritual performances. Cermeño, in contrast, saw none of these activities during his November visit 16 years later.

Material culture plays a complex role in contact situations. Lightfoot and Simmons (1998:158) propose that, while many items came from direct contact, most European/Asian goods that entered California in protohistoric times were acquired by scavenging shipwrecks and/or came from long-distance exchange. The scavenging of the shipwreck *Frolic* on the Northern Pomo coast in 1850 has been demonstrated by Layton (1990, 1997), while similar activities are assumed in the 16th century from the distribution of foreign goods at Point Reyes sites. Ceramic sherds and iron ship's spikes are the most commonly found items. Lightfoot and Simmons (1998:160) contend that the ceramic sherds themselves, rather than whole artifacts, might have been what the Coast Miwok were seeking, noting that there are no whole vessels, that many vessels are represented by a single sherd, and that matching sherds are often found at great distances. The Coast Miwok may have been collecting these items, the authors suggest, not as materials to be re-fashioned for further use, but because "they were valued as symbolic referents of previous encounters and as materials that signified unknown worlds" (Lightfoot and Simmons 1998:160); while they have not been widely found as grave goods, only a few definitive 16th- and early 17th-century graves have been excavated at Drakes Bay.

Finally, Lightfoot and Simmons' review of the voyager chronicles reveals that many of the material goods passed from foreigners to native people were potential vectors for disease. While direct contact with the Europeans would have been one certain conduit, accounts show that items of clothing were one of the primary gifts to natives on all five voyages tracked. The references to clothing and other perishable goods also document that many foreign goods of value to the Coast Miwok may not appear in the archaeological record (Lightfoot and Simmons 1998:162).

Lightfoot and Simmons present a call for intensifying the study of early contact settings:

> It is clear that the study of culture contact in protohistoric California needs to be reconceptualized for those places where early encounters took place and broadened well beyond the coastal regions where European ships first anchored. … It is only through detailed studies of archaeological deposits dating to protohistoric times, compared systematically with earlier prehistoric and later historical sites, that we can begin to critically evaluate the meaning of foreign goods, as well as the broader implications of early encounters and trade, including evidence for epidemics [1998:165].

The research issues in the concluding portion of this chapter attempt to put Lightfoot and Simmons' proposal to work in the way the authors have suggested: by the close comparative analysis of materials from well-controlled archaeological contexts.

ARCHAEOLOGY AND ETHNOHISTORY AT FORT ROSS

Many prehistoric archaeologists across North America have turned to investigating post-contact Native Americans in the past few decades. In California, archaeological studies of mission life have had a long tenure, while the scouring of Native American middens for evidence of early European contact has been especially highlighted at the PRNS. Studies that focus on Native American culture change using the direct historical approach described above are relatively recent, with the most significant being Lightfoot's investigations at Fort Ross, approximately 30 miles north of the study area in Kashaya Pomo territory. Lightfoot, Wake, and Schiff describe their focus as an examination of how Pacific Coast hunter-gatherers responded to the mercantile practices of the Russian-American Company that administered Fort Ross from 1812 to 1841.

> The close interaction of ethnic groups from many different homelands represents a fertile ground for stimulating cultural exchange of architectural styles, material goods, methods of craft production, subsistence practices, diet, dress, and ceremonies. Furthermore, the company's payment of commodities or script to its work force provided them with access to various European, American and Asian goods in the company store [1991:147].

The economic and historical specifics of the multiethnic community at Fort Ross were unique to that location and the few Russian agricultural outposts elsewhere in Sonoma County. The research issues that Lightfoot, Wake, and Schiff identify, however, are germane to all historic-period archaeology of indigenous people in the PRNS–GGNRA, including "the effects that mercantile labor and inter-ethnic relationships had on the acculturation process of native workers" (1991:147). The researchers note that they are especially interested in

> … whether some components of native societies, such as diet, technology, material culture, architectural styles, sociopolitical organizations, religious practices, and gender relations are more receptive to change than others in mercantile communities.… [and] in identifying those cultural components that are more conservative and resistant to change under these colonial conditions [Lightfoot, Wake, and Schiff 1991:9].

An unusually insightful context for the area is presented in the 1991 introductory volume, while their second volume (Lightfoot, Wake, and Schiff 1997) details the excavations by U.C. Berkeley and California State Parks crews at two important archaeological sites and provides an extensive interpretation of culture change and persistence in the daily lifeways of interethnic households.

Among the findings from these investigations was the identification of a major regional exchange network at Fort Ross, whereby Kashaya Pomo workers took in obsidian and other items from Kashaya living in the interior and provided these independent kin with Asian and European materials scavenged at Fort Ross. While a few of these objects were reshaped and reused at the native villages at Fort Ross, Lightfoot, Wake, and Schiff suggest that "the most desirable ceramic sherds, glass pieces, and metal objects were traded to surrounding communities where they disappeared into the back country" (1997:428). Some aspects of the marital relationships between Native Alaskan men and Native Californian women were inferred by the archaeologists from their analysis of village layout and the extensive faunal remains from the site. It appears, for example, that each member of a couple attempted to maintain a separate identity while making accommodations for his or her spouse:

> Kashaya Pomo conventions are most noticeable in day-to-day practices involving cooking, the reuse of obsidian, ceramic and glass materials, and the maintenance of the house and adjacent extramural space. Native Alaskan practices are best observed in the settlement layout, in the marine orientation, and in the production and maintenance of sophisticated maritime hunting and fishing tool kits [Lightfoot, Wake, and Schiff 1997:429].

MARIN COUNTY/SOUTHERN SONOMA COUNTY STUDIES

Echa-tamal – A Study of Acculturation

CA-MRN-402, the ethnographic village of *Echa-tamal* near Nicasio, was the subject of a study of acculturation, or culture change, in Coast Miwok territory. From excavations, ethnographic data, and historic documents, Dietz (1976) followed the occupation of the village through four periods, noting the changing interactions between village occupants and the outside. The first documented occupation corresponds to just prior to the Emergent period, ca. A.D. 1400. The site may have been unoccupied from the period between Drake's visit and the establishment of the mission (A.D. 1579 to 1776), as no artifacts associated with this period were recovered; on the other hand, the absence of artifacts may indicate that people from the Nicasio area were not in close contact with Tomales Bay people at that time. The village had probably been reoccupied by the early mission period. Precise identification of the occupants of *Echa-tamal* with mission records has not been possible, but they were possibly among the 170 neophytes identified as *Tamal* in mission records between 1802 and 1810 (Milliken 1995:255). Secularization saw the return of the Indians to the area and the granting of the Nicasio landgrant to a group of Coast Miwok men (see above). A series of events, including decimation of the population from epidemic disease and loss of the land grant, led to a hiatus of occupation at the site. While these periods can be tracked in the documentary record, they are not well represented archaeologically.

The bulk of the historic-period artifacts recovered from the site date to the 1850s or later, after the new legal owner allowed the Coast Miwok group's return to their village. In 1868 Maria Copa, one of two primary informants of ethnographer Isabel Kelly, was born at *Echa-tamal*. The site continued as a Coast Miwok village until 1884, when a series of events, including the death of the community leader, resulted in its abandonment. Datable artifacts are of pre-1900 manufacture, suggesting that there was little or no occupation of the site after the Indians departed. Euroamerican artifacts include trade beads, glass fragments, nails, personal equipment (including a metal bangle modified with a Miwok design), horse tack, and domestic items. While not drawing explicit conclusions from his study, Dietz presented a wealth of data for future application of "theoretical models that deal with acculturation and which may help to explain processes of change brought about by culture contact" (1976:2).

Marin Tribelet Studies

Investigations of a cluster of nine sties on Miller Creek near San Pablo Bay were undertaken by Slaymaker (1977) between 1968 and 1971 to test his hypothesis that Coast Miwok tribelet organization could be identified in the archaeological record. The largest of the sites, CA-MRN-138/H, was over 10 feet deep, containing relatively rare, Lower Berkeley-pattern deposits overlain by later prehistoric deposits. This site was proposed to be the ethnographic Coast Miwok village of S*hotomoko-cha*, but no conclusively contact-period material was recovered.

Slaymaker's focus on contact-period political structure and ethnogeography later shifted to the ethnographic village of O*lompali* (CA-MRN-193), expanding on the earlier excavations by Treganza at the State Historic Park. The archaeological site covered an area of some 320,000 square meters, making it the largest known village site in Coast Miwok territory. Excavations between 1961 and 1977 revealed several housefloors and both cremations and burials. While some early Emergent-period remains were recovered, there were also 16th- to 19th-century finds, represented by glass trade beads, square nails, bottle glass, and three items that may represent Drake's or Cermeño's visits to California: two sherds of Asian porcelain and an English sixpence struck in 1567 (Moratto 1984:273).

Using mission baptismal records dating from 1776 to 1834, Slaymaker (1982) identified 14 tribelets within the Coast Miwok area in his doctoral dissertation. Portions of two of these, *Tamales* and *Guaulen*, were located within the PRNS. The Tamales tribelet was the larger of the two, extending "between the Estero Americano on the south, and the area just north of Bolinas Bay on the north. This territory included inland areas from the Chileno Valley southward to Hicks Mountain, Nicasio and Forest Knolls" (Slaymaker 1982:333). Slaymaker proposed that Edwards' three PRNS tribelet areas (see Chapter 4) may have been present during the pre-contact period; the large size of the Tamales tribelet identified in mission records, however, may represent the aggregation, some time after contact, of Edwards' three tribelet areas into one (Compas 1998:64).

Petaluma Adobe

The Petaluma Adobe Archaeological Project was designed and implemented by Stephen Silliman as dissertation research on the Coast Miwok and Pomo Indians who lived and worked at the adobe in the 19th century. The Petaluma Adobe State Historic

Park in south-central Sonoma County is the last remnant of the immense (66,000-acre) Rancho Petaluma granted to Mariano Vallejo in 1834. Until 1848 Vallejo operated the rancho primarily with Native American labor—possibly engaging as many as 600 individuals—with the dual goal of rancho autonomy and external sale and trade. Despite this huge native work force, there is relatively little documentary information on Indian lifeways at the rancho or on labor relations. Thus Silliman's two primary research goals were "To help recover the voices of native actors in this historical drama, and to study how colonial labor affected the daily practices of California Indians working on the rancho" (1998:3).

Previous archaeological excavations, conducted in the late 1950s at the historic park by Treganza, had recovered a mix of apparently aboriginal and historic-period artifacts that were never analyzed or reported. Subsequent excavations by Gebhardt (1962) recovered historical artifacts, including trade beads and the possible remains of an Indian dwelling (Schuyler 1978:77). No work was done in the intervening three-and-a-half decades until Silliman's research. His investigations commenced in 1996 with a season of pedestrian and geophysical surveys and shovel tests; followed by a season of surface collection and test excavations; and another season of expanded excavations that involved 21 student workers. The investigated midden deposits contained a wealth of 19th-century artifacts—including hundreds of glass trade beads, thousands of dietary bone fragments, obsidian flakes and tools, groundstone, fire-affected rock, burned wood, and other cultural remains (Silliman 1998:3). Analysis and interpretation of the studies are presented in Silliman's (2000) dissertation, while he used the findings from these excavations to consider the continuity of lithic technologies in this secular colonial setting (Silliman 2001).

Other Sites North of the Golden Gate

Several other archaeological sites known in the PRNS and GGNRA holdings or administered lands north of the Golden Gate have been associated with ethnographic sites or have yielded appropriately dated materials. Duncan (1992:Table 3.1) lists nearly 80 sites in Coast Miwok territory that have protohistoric components; only 5 of these are associated with ethnographic names—including *Echa-tamal, Olompoli*, and *Cotomko'ta*, discussed above. MRN-378, *Olemaloke* (Upson 1977), and MRN-380, *Espenet* (Moratto 1974), are the other two mentioned; neither has been excavated. Among the excavated sites is CA-MRN-43, the Quarry Point Site on Angel Island (Hine 1983, cited in Duncan 1992). Of the 80 sites reviewed by Duncan (1992:131), only 6 had artifacts and associated radiocarbon dates from relatively undisturbed stratigraphic contexts. No archaeological studies focusing on culture change, other than Slaymaker's and Dietz's investigations, were identified for the northern study area.

SOUTH OF THE GOLDEN GATE

The locations of the four ethnographic Costanoan/Ohlone sites in San Francisco identified in mission records have not been determined; two (*Sitlintac* and *Chutchui*) are believed to have been only a mile or two apart near Mission Creek and would have been used seasonally by the same group, while there is no information on the location of *Amuctac.* The fourth village, *Petlenuc*, may be near the site of the Spanish presidio compound (Milliken 1995:260). According to NPS archaeologist Leo Barker (pers. comm., 2003), there

is also mention of the Beach of the Presidio as a contact-period site, while El Presidio site includes a substantial midden with shell just outside the ca. 1815 front of the quadrangle, with several fired-clay tobacco pipes (conical chilums) and other artifacts suggesting an early 19th-century native occupation area. Only the Presidio site has been archaeologically identified and investigated, and studies at that site did not focus on the Native American component.

The site of the Costanoan-speaking village of *Pruristac,* CA-SMA-70, is a mile or two from the San Mateo County coast, in the San Pedro Valley, while *Timigtac* was just a few miles north at the present town of Rockaway Beach. Numerous individuals were brought to the mission from *Pruristac,* suggesting that it had an early historic (and perhaps prehistoric) occupation. Milliken (1995:251) proposes that the name may refer to a group of independent bands rather than a large, multi-village tribe. The Mission San Francisco outstation of San Pedro was constructed at *Pruristac* during the mid-1780s, after which the site was the living area for neophytes who had been brought to the mission outpost as laborers. The outpost operated until some time between 1791 and 1794 (Salzman 1983:70). "The mission outpost was staffed and inhabited by an Indian population which still lived somewhat and sometimes in the aboriginal style" (Milliken 1983, cited in Salzman 1983:70). There was apparently some overlap of activities between the outpost and adjacent Sanchez Adobe, which adjoins shell midden CA-SMA-71. If the existing archaeological deposits retain good physical integrity, the sites have excellent potential for studies of culture change, providing yet another perspective on Native American participation as labor in Euroamerican agricultural and mercantile enterprises, as well as contributing to an understanding of how individuals selected elements of the foreign culture to incorporate into their more traditional practices.

SUMMARY

Lightfoot and Simmons summed up their study of the Drake–Coast Miwok interaction with this important statement:

> By reanalyzing the voyager accounts and relevant archaeological materials to consider the nature of early culture contacts, we may evaluate how and why peoples from very different cultural backgrounds responded to each other, and begin to examine the implications of these early encounters with respect to cultural ideologies, ceremonial practices, gift giving, the meanings of foreign material culture, and disease [1998:164].

The potential to obtain precise dates and to associate specific names with elements of the archaeological record allows archaeologists to confidently address issues of individual choice, cognition, and the role of symbolism in culture change, as well as determining the effect of such variables as gender and status. Armed with this information, it will be possible to contextualize observations found in the historic literature and to refute misconceptions embedded there.

RESEARCH ISSUES FOR INDIGENOUS HISTORIC-PERIOD ARCHAEOLOGY

PROPERTY TYPES

From the discussion above, the possible property types representing the indigenous historic period in the PRNS–GGNRA include some or all of the following:

- **initial contact sites**, including late-16th-century villages, scavenging work camps, and cemeteries;
- **village sites** inhabited prior to, and during the early years of, missionization;
- **neophyte living quarters** at missions and the Presidio;
- **refuge living sites** and processing sites in remote locations that allowed residents to maintain traditional housing and some traditional resource use while living in attenuated social groups;
- **domestic and work sites** associated with Indian labor at mission outposts;
- **occupation and work sites** associated with Indian labor at Mexican-period ranchos;
- **post-secularization villages** housing traditional families as well as those working at outside establishments;
- **late-19th- and early-20th-century domestic sites** that represent marginalized positions in an increasingly complex and restrictive Euroamerican state.

Native Americans who took in the new ways and were able to use them to their advantage—maintaining traditional values to varying extents—would probably not have a distinctive archaeological signature.

RESEARCH THEMES, QUESTIONS, AND DATA NEEDS

The list of questions below, presented under the three basic themes of this general research design, are only broadly suggestive of the vast number of approaches and studies that could be taken when identifying, evaluating, treating, and interpreting Native American historic-period archaeological sites.

Chronology

1. What time-markers of the various stages in the historic period can be identified in the absence of precise indicators (e.g., coins, tightly dated beads)?. Can specific assemblages of mixed native and non-native artifacts be associated with particular periods?
2. Can the botanical indicators of contact identified by Duncan (1992) serve to date deposits that are otherwise indefinable?
3. Can new evidence of first encounters (e.g., Drake, Cermeño) be found through different ways of viewing culture change—away from the focus on Asian ceramics

and metal artifacts, to an attempt to see how new information transforms traditional materials? How does the coastal village assemblage change after 1579?

4. To what degree did cultural accommodation proceed at different rates in authoritarian settings (the missions and ranchos) versus relatively consensual contexts (e.g., Fort Ross, Toms Point, and refuge sites)?

Data Requirements:

- Extant archaeological assemblages with good frequency and diversity of materials from contact-period sites.
- Buried or otherwise preserved archaeological assemblages with Native American and European assemblages.
- Well-dated, intact archaeological deposits from different institutional or occupational contact-period settings.
- Historic-period Native American sites with abundant and intact faunal and macrobotanical assemblages; analysis of subsistence artifact assemblages.
- Assemblages of exotic materials in contact-period Native American sites.

Settlement and Subsistence

1. Can various archaeologically documented shifts in settlement and subsistence be attributed to the effects of first contact with Euroamericans?
2. What evidence is there for relocation or aggregation of native populations during the mission period? Can changes in resource use and seasonal movement be detected in the archaeologically derived settlement pattern?
3. Can native adjustments to a reduced resource base be identified in the archaeological record? Are new technologies and practices introduced as resources become restricted?
4. How did the physical organization of Native American settlements change after contact? Do innovations in internal site relationships (e.g., location of refuse disposal, and orientation of houses) reflect new ideas about proper village structure, social status, or occupational or gender-based accommodations?

Data Requirements:

- Suites of archaeological sites with good dating to specific intersections in the historic period.
- Historic-period sites with intact residential features.
- Individual historic-period sites with abundant and intact faunal and macrobotanical assemblages; similar dietary assemblages from multicomponent sites with stratified deposits.
- Analysis of subsistence artifact assemblages (food procuring, processing, and storing) and faunal/macrobotanical assemblages in remote locations.

Social Organization, Exchange, Interaction, and Symbolic Systems

1. Are changes in political alliances evident in the post-mission archaeological settlement pattern? Do changes in available exchange goods suggest these shifts?
2. Is there evidence of resistance to the dominant culture in native archaeological assemblages in various work settings (e.g., mission neophyte living quarters, mission outpost living sites; native domestic sites at ranchos)?
3. Is there evidence of a maintenance of separate traditional economic systems (e.g., clamshell disc bead manufacture) within the mission or rancho complex? Did this situation manifest at different levels in authoritarian settings (the missions and ranchos) versus relatively consensual contexts (e.g., Fort Ross, Toms Point, and refuge sites)?
4. Were native political and ceremonial activities and social roles maintained after contact? Are they more in evidence in consensual contexts or in restricted living settings, such as the missions?
5. How well did individuals from different social, cultural, and linguistic groups fare under enforced co-habitation? Were intra-institutional alliances made along individual, racial, economic, or other lines? How do these present themselves archaeologically?
6. In what ways and in what settings does multicultural contact present economic and other opportunities? How are these seen in the archaeological record?
7. Which elements of Coast Miwok and Ohlone culture seem more resistant to change than others? What was the role of material culture in this process of change and retention?
8. Following Lightfoot and Simmons, what evidence is there of the symbolic significance of Euroamerican artifacts from the earliest period of culture contact with native peoples? Did certain artifacts or artifact complexes become symbols (even icons) representing either "Indian-ness" or the endorsement of change? Conversely to what degree might changes in artifact use or style be isochrestic rather than symbolic variations?

Data Requirements:

- Suites of archaeological sites with good dating to specific intersections in the historic period.
- Historic-period sites with intact residential features.
- Individual historic-period sites with abundant and intact faunal and macrobotanical assemblages; similar dietary assemblages from multicomponent sites with stratified deposits.
- Analysis of subsistence artifact assemblages (food procuring, processing, and storing) and faunal/macrobotanical assemblages in remote locations.

Chapter 7 – Summary of Research Issues for Indigenous Archaeology in the PRNS–GGNRA

INTRODUCTION

The role of research designs in the manifold process of archaeological resource management has been described in some detail in Chapters 1 and 2, while the research issues that are pertinent to a study of indigenous archaeology in the PRNS–GGNRA are the focus of Chapters 3 through 6. The chapters were designed to amass information on indigenous archaeology in the study area, for use in developing specific research designs as they are needed. Chapter 7 is intended to summarize this study by presenting a brief discussion about the process of developing research designs, followed by the lists of research issues that are presented at the end of each chapter. This compilation should be useful when developing research specific designs.

The statements below regarding the development of research designs are general, intended to give an idea of the range of designs that might be needed. For specific guidance on developing research designs in a federal context, see DO-28, *Cultural Resource Management* Guideline (NPS 1998) and the Secretary of the Interior's Standards and Guidelines (NPS 1983). In addition, the Revised Thematic Framework (NPS 2003) can provide some ideas about framing historic contexts and research questions.

DEVELOPING RESEARCH DESIGNS

A research design is an important element in identification, documentation, evaluation, and treatment of archaeological resources. This document has provided context that will assist archaeologists and resource managers in developing research designs for these various stages. For identification, a recognition of the kinds of archaeological sites expected in the study area will help to determine survey strategy, while the context will be useful in documentation. Research designs for these first stages are generally limited to a review of the archaeological research context, an explication of anticipated property types, and a description of the proposed survey methods based on the study area's environmental setting and where the expected types might be located. Once sites are identified, it is often desirable to make an informal assessment of their research potential. This general research design assists in that exercise by identifying the kinds of studies that have been undertaken in the parklands and vicinity, and identifying the gaps in the database; it also helps to recognize the qualities that might be inherent in archaeological resources beyond data potential (e.g., heritage and aesthetic values).

CREATING HISTORIC CONTEXTS/THEMES

As a part of an eligibility evaluation for the National Register, it is necessary to identify the historic context—the themes, geographical limits, and chronological period—in order to provide a perspective from which to evaluate the property's significance. According to National Register Bulletin 15, "A theme is a means of organizing properties into coherent patterns, based on elements such as environment, social/ethnic groups, transportation networks, technology, or political developments that have influenced the development of an area during one or more periods of prehistory or history" (NSF 1991a:8). As noted in Chapter 2, the temporal and geographic scope of this document is too broad to identify the specific historic contexts or themes that might be useful. The preceding chapters, however, have elaborated on a number of issues that constitute important themes. For sites evaluated under Criterion D, the theme will usually be a research topic. Based on topics of discussion in the preceding chapters, the following list provides examples of research themes for the PRNS–GGNRA, which could be made more precise by specifying locations and time periods:

Subsistence Shifts on the California Coast

Adaptations to a Changing Environment

Changing Technology in Coastal Settings

Seasonality and Coastal/Interior Settlement

Environmental Stress and Population Movements

Political Complexity and Resource Intensification

Base Camps and Logistical Outposts in the Forager-Collector Continuum

Changing Demography and Settlement

Lithic Resources and Mobility

Social Status and Specialization

Warfare and Hostility

Clamshell Bead Manufacturing and Coastal Exchange Systems

Boundary Culture and Intergroup Resource Use

Culture Change at European Contact

Evolving Exchange Systems in Authoritarian Settings

Traditional Subsistence in Contact Settings

Stylistic Change and Native Resistance

Once selected, the historic context can provide a focus for the kinds of research questions that would be productive. As the questions are formed and the data requirements are recognized, specific field methods and avenues of analysis can be identified and developed.

FRAMING RESEARCH QUESTIONS

Evaluation conducted to determine a resource's National Register eligibility requires a formal research design. After providing a context for the study, the first issues to be addressed are pragmatic ones, dealing with gathering information on the site and its integrity; these goals are primarily management ones, but are also fundamental to any theoretical inquiry. The goals are described in an earlier chapter as follows: (1) determining site structure (the temporal and functional relationship of discrete site layers), both vertically and horizontally; (2) dating (at least to a broad, approximate range) the site or its components; and (3) identifying a sufficient sample of the site's contents (artifacts, features, dietary remains) to discern the nature of the site and what kind of research issues it might address. Some of this information can be recovered prior to excavation, from field observations and perhaps obsidian-hydration analysis or other study of surface finds. The research issues to use in evaluation are usually descriptive ones framed in what appears to be the site's context—from very general to more specific, depending on the information available from the site and the locality (e.g., What information can this site yield regarding Late-period settlement and subsistence? Does this site provide information on exchange systems on the northern San Francisco peninsula ? Can this site yield data on first occupation of the Marin County coast?). If, after analysis and interpretation of the findings, the resource is found to have retained integrity and to be capable of yielding important information on these and other research issues, it is considered eligible to the National Register of Historic Places. Data-recovery research designs, if such treatment is required, focus in on the specific qualities that have rendered the site eligible. At this stage, research questions are framed carefully, with the goal of maximizing the contributions that the resource can make.

The questions and data requirements compiled below will be useful in posing questions and identifying data requirements for a wide range of evaluation and data-recovery investigations.

RESEARCH ISSUES

CHRONOLOGY/CULTURE HISTORY IN THE PRNS–GGNRA

Chronometrics

1. What techniques will allow better definition of phases and time periods in PRNS-GGNRA archaeological sites? What opportunities are there for more aggressive dating efforts? Will AMS dating allow temporal control in situations that were previously thought to be undatable?
2. Can radiocarbon-dating shell samples from eroding sites yield useful settlement and chronological information? What variables must be controlled to enhance the value of this technique?
3. Are there extant collections containing ample obsidian and organic materials that might lead to refinement of dating techniques?

Data Requirements:

- Archaeological contexts with strongly associated datable pairs of shell and carbon for testing the Holocene changes in the reservoir effect.
- Archaeological contexts with strongly associated datable pairs of radiocarbon–obsidian specimen for testing the hydration curve.
- Curated collections from the study area with reasonably abundant obsidian items, datable organics, and typologically distinctive artifacts.

Earliest Occupation

1. Are there Early Holocene archaeological sites on accessible buried or submerged landforms in the PRNS–GGNRA?
2. What accounts for the recently recognized greater complexity and diversity of Early Holocene occupation in California? Is it the result of greater site integrity (e.g., buried or cave deposits that have been protected)? Has our recognition of earlier cultural complexity than previously anticipated allowed us to "see" older site more readily? Beyond seeking buried and inundated sites, what techniques might increase our inventory of older sites?
3. Will a re-examination of previously excavated assemblages reveal some "earlier" sites in the PRNS–GGNRA, once the greater complexity of the Early Holocene assemblage is recognized?

Data Requirements:

- Identification of paleosols that may contain Early Holocene archaeological deposits.
- Archaeological exploration of submerged locales that may contain Early Holocene archaeological deposits.
- Curated collections that may be candidates for Early Holocene reassignment.

Linguistic Prehistory

1. Is the appearance of the Berkeley pattern direct evidence of Miwokan expansion or of in situ development? Will Middle Archaic components in the PRNS–GGNRA, if identified, demonstrate the presence of Lower Berkeley affiliations in southern Marin County and the northern San Francisco peninsula?
2. What evidence is available in the PRNS–GGNRA for the social and environmental stresses of the "Middle/Late Transition period?" How will direct Patwin presence, vs. borrowed traits, be displayed in the archaeological record? Is a hiatus of occupation represented around the Middle/Late Transition period, or might the area have been outside the Patwin influence?

Data Requirements:

- A suite of archaeological occupation sites with secure dating to the time periods in question for testing dissemination of materials and ideas.

- Individual, stratified archaeological sites with secure dating to the time periods in question for testing in situ development.
- Artifact-rich deposits with diverse assemblages that will aid in determining the waxing and waning of various time-markers.

Refining the Chronological Sequence

1. In what ways might new dating techniques be used to sort out disparities in the archaeological record of the PRNS–GGNRA and environs? Will reassessment of time-markers based on new assignments help to interpret sites lacking in chronometric material?
2. Are some assemblages in the archaeological record better understood in terms of contemporaneous occupation of distinctive groups? Is this the case with the Mendoza aspect at Point Reyes, with its anomalous disjuncts?
3. Can refining the PRNS–GGNRA cultural sequence help in understanding culture-historical relationships in the greater Bay Area? Do inland–coastal patterns emerge from the new interpretation?
4. Will broader comparative research illuminate the population shifts in the PRNS? Will data from CA-SON-299 at Bodega Bay or other older Marin sites (e.g., the Pacheco Valle site, MRN-152) lead to new interpretations? Can newly discovered sites dating to the Middle Archaic/Upper Archaic transition period help to identify conditions at this time?
5. Can typologies for the study area (e.g., projectile points, mortars and pestles, etc.) be updated by new data and reanalysis of older finds?
6. Can the new theoretical focus on cultural variability and individual historical shifts open up new approaches to the chronological sequence.

Data Requirements:

- Archaeological deposits with chronometrically datable organics (in the form of charcoal, ash, bone, antler, shell, or soil humates), obsidian artifacts suitable for hydration analysis, or other chronometrically datable materials.
- Archaeological deposits with intact features with datable material (above) and stylistically distinctive artifacts that can serve as time-markers.
- A suite of archaeological sites that demonstrate a range of datable assemblages; individual stratified sites for identification of fine-grained variation.
- Re-analysis of curated collections or data to refresh old interpretations with new data and approaches.

SETTLEMENT AND SUBSISTENCE IN THE PRNS–GGNRA

The Nature of Shellmounds

1. What factors contributed to the variations in shell-midden structure in the study area? In what ways do shell middens in the PRNS contrast with those on the Bay? Are the differences related to temporal, functional, or geographic variables?
2. How does the structure of shell-processing sites differ from that of residential shell middens? Can structural differences in short- and long-term occupations be discerned in shell middens in the study area?
3. Can buried sites in San Francisco provide information on shell-midden formation that is missing from the current record?

Data Requirements:

- Paleosols in urban or other fill settings to test for buried shell middens; archaeological exploration of submerged locales that may contain early shell middens.
- Intact shell middens with stratigraphic integrity, especially deposits with datable assemblages of artifacts and dietary remains.
- Macrobotanical and zooarchaeological remains that allow reconstruction of environmental settings.

Coastal Settlement

1. What kinds of Early Holocene archaeological deposits occur on the submerged shelf adjacent to the PRNS-GGNRA or under the waters of Tomales Bay or Bolinas Lagoon? Are additional buried deposits present on the ocean terraces (such as the deep strata in the Duncans Cave site) and alluvial valleys? In what ways can this early chapter in coastal history be explored? (See Meyer, this volume.)
2. Can fuller assemblages from submerged or buried settings be used to make inferences about older surface sites with poor preservation?
3. In what ways might seasonal coastal sites relate to one another, and how can these relationships be viewed archaeologically? Is coastal settlement linked to inland land use—seasonally or as a regular part of the group's catchment?
4. During the Middle/Late transition period, were coastal settlements buffered from the environmental stresses evidenced inland in the Bay Area? Were portions of the coast considered non-contested areas at this time due to the new focus on terrestrial resources?

Data Requirements:

- Buried or submerged archaeological sites with intact and varied assemblages.
- Sites with secure dating for testing dissemination of materials and ideas.
- Artifact-rich deposits with diverse assemblages that will aid in determining shifts in resource base in terms of toolkit.

- Dietary assemblages from coastal sites that will aid in determining shifts in resource base in terms of inland and coastal resources; seasonal indicators from both inland and coastal sites.

Site-formation Processes and Subsistence

1. Can a shift from forager to collector be seen in the study-area archaeological record? How can the archaeological correlates for these strategies be tailored to the study-area? In what ways can these behavioral modes be distinguished from seasonal strategies?
2. What variables might be operating to make a difference in timing of the shift from foraging to collector in the study area? Are there portions of the PRNS–GGNRA that demonstrate a retention of foraging characteristics late in time, similar to findings to the north at Salt Point and south on the San Mateo/Santa Cruz coast? Would such a retention, rather than coastal site abandonment, explain the apparent absence of later sites in some localities? How might this retention be demonstrated in the archaeological record?
3. What is the environmental productivity in the various units in the parklands (patchy, or heterogeneous? homogeneous?). Do these assessments compare well with the site types represented?
4. What is the focus and/or breadth of prehistoric subsistence? Are subsistence systems intensive and selective, or broad-based? Is the variability reflective of different social groups, different functions, or different time periods?
5. How do the nature and breadth of subsistence activities and exploited resources correlate with environmental and archaeological patterns involving technologies, settlement, demography, and social organization?

Data Requirements:

- Archaeological deposits with datable, artifact-rich deposits.
- Analysis of well-dated deposits in order to confirm or refute retention of cultural assemblages or co-existence of adaptively dissimilar groups.
- Information on seasonality for archaeological deposits based on the nature of recovered faunal and floral resources.
- Flaked-stone or other assemblages of tools for use in blood-residue analysis.
- Information from a suite of well-dated sites to determine patterns of foraging and collecting strategies and their archaeological correlates.

Technology

1. Will application of formal flaked-stone tool analysis raise new questions regarding technology in the study area? Are there extant collections that could be examined for identifying coastal central California traits?
2. Did coastal people have access to quality lithic resources, or were flaked-stone assemblages pieced together from less than optimum materials? Is this behavior

recognizable in the conservation of lithic materials and the modest nature of the toolkit?

3. Are there more local sources for the mortars found in the PRNS than the proposed 30-mile distant quarries of Sonoma County? If such long-distance importation of heavy stone did take place, what other factors (subsistence, social, or ritual) might have been related to this activity?

Data Requirements:

- Archaeological sites with well-developed flaked-stone assemblages; flaked-stone assemblages in curated collections.
- Geological analysis of the region to identify potential source locations.
- Identification of other exotic materials in the collection and their sources.

SOCIAL ORGANIZATION AND COMPLEXITY

Social Organization

1. What evidence is there in PRNS–GGNRA site assemblages for the growth in status ascription and rise in specialization? Are reflections of social stratification indicated in earlier (Middle or Upper Archaic) cemeteries or site clusters?
2. Where data from cemeteries and human graves are available, is there evidence of differential treatment of burials in accordance with age, sex, or inheritance? Do osteological data indicate differential nutrition or health care? Can specialized occupations be identified, and are specialists treated differentially?
3. Can hierarchical village organization be demonstrated through analysis of site spatial distributions? Might buried sites contain more intact features related to village structure? Based on environmental reconstructions, do differently ranked sites exhibit differential access to resources? Are there elements of the site's setting, such as commanding views, that suggest expressions of status or other intra- or inter-group symbolic communication? Are these suggestions borne out by other archaeological evidence?
4. What indications are there of interaction with other groups? Can reproductive interaction with other groups be inferred from osteological data, or do clusters of distinctive traits suggest endogamy?

Data Requirements

- Archaeological deposits with adequate quantity and diversity of artifacts to address issues related to status and craft specialization, or variation in the relation between sociopolitical status and exchange wealth.
- Archaeological deposits with features such as living surfaces, house floors, domestic and external work areas, refuse piles and pits, or other markers of sedentary residential activity; comparative analysis of such features to track differential access to resources and facilities.
- Environmental reconstruction to determine resource value of site location.

Stress Reduction in Sedentary Contexts

1. Are there reflections of increased need to manage information overload (e.g., distinctive patterns or styles in common artifacts) for greater control through symbolic means?
2. Do site distributions provide evidence for population fission, with creation of daughter populations in less productive environments? Is the operation of this scenario evident in artifact assemblages that show differential exchange goods in associated communities—evidence of small-scale, direct exchange systems?
3. Are there stylistic markers that indicate these inter-tribelet relationships? Can these traits to seen as serving to separate or join associated groups?

Data Requirements

- Suites of archaeological sites in a range of adjacent environmental settings, with clear assemblages to allow identification of stylistic markers.
- Assemblages with adequate quantity and diversity of artifacts to address issues related to small-scale trade; good floral and faunal preservation that will allow identification of resource use in proposed parent and daughter communities.

The Role of Exchange Systems

1. In what ways do obsidian and other exotic goods pattern in study-area archaeological sites? Can they be seen as the result of ad hoc acquisition or more formal exchange? Is there a progression toward formality through time, or can a return toward local materials be seen in the Late period?
2. Do markers of tribelet structure (greater sedentism, status differentiation, and specialization) and evidence for the existence of production for exchange (such as features related to storage of surplus) co-occur with evidence of intensive exchange?
3. Did areas within the PRNS/GGNRA serve as centers for the production and exchange of clam disc beads? Is there evidence for specialization, in terms of individuals or sites? How do sites with bead-manufacturing evidence differ from those without? Do they contain evidence of full social units and a diversity of activities? Do they possess more or fewer exotic exchange items?
4. In what ways would the development of boundary culture be evidenced in study-area sites? Did the need to administer resource use in relation to other groups arise in PRNS–GGNRA settings ? Can the resource value of parkland sites be estimated based on both environmental criteria and presumed indigenous values? Do artifact assemblages suggest that study-area people may have been visitors to other procurement areas that may have required social management?
5. Is there evidence of warfare or other intergroup violence in study-area mortuary populations? Are there other indicators of violent activity, such as increased quantities of weapons? Is evidence of reduced or increased mobility (see Settlement and Subsistence) associated with warfare?

Data Requirements for Addressing Exchange:

- Assemblages of obsidian artifacts over time.
- Archaeological deposits containing artifacts identifiable as trade or exchange markers (e.g., obsidian, other foreign stone, shell beads).
- Archaeological features indicative of greater sedentism, such as living surfaces, house floors, domestic and external work areas, refuse piles, and pits.
- Archaeological features and assemblages that reflect sociopolitical organization and ethnic affiliation.

CULTURE CHANGE: HISTORIC-PERIOD NATIVE AMERICAN ARCHAEOLOGICAL RESEARCH

Chronology

1. What time-markers of the various stages in the historic period can be identified in the absence of precise indicators (e.g., coins, tightly dated beads)?. Can specific assemblages of mixed native and non-native artifacts be associated with particular periods?
2. Can the botanical indicators of contact identified by Duncan (1992) serve to date deposits that are otherwise indefinable?
3. Can new evidence of first encounters (e.g., Drake, Cermeño) be found through different ways of viewing culture change—away from the focus on Asian ceramics and metal artifacts, to an attempt to see how new information transforms traditional materials? How does the coastal village assemblage change after 1579?
4. To what degree did cultural accommodation proceed at different rates in authoritarian settings (the missions and ranchos) versus relatively consensual contexts (e.g., Fort Ross, Toms Point, and refuge sites)?

Data Requirements:

- Extant archaeological assemblages with good frequency and diversity of materials from contact-period sites.
- Buried or otherwise preserved archaeological assemblages with Native American and European assemblages.
- Well-dated, intact archaeological deposits from different institutional or occupational contact-period settings.
- Historic-period Native American sites with abundant and intact faunal and macrobotanical assemblages; analysis of subsistence artifact assemblages.
- Assemblages of exotic materials in contact-period Native American sites.

Settlement and Subsistence

1. Can various archaeologically documented shifts in settlement and subsistence be attributed to the effects of first contact with Euroamericans?

2. What evidence is there for relocation or aggregation of native populations during the mission period? Can changes in resource use and seasonal movement be detected in the archaeologically derived settlement pattern?
3. Can native adjustments to a reduced resource base be identified in the archaeological record? Are new technologies and practices introduced as resources become restricted?
4. How did the physical organization of Native American settlements change after contact? Do innovations in internal site relationships (e.g., location of refuse disposal, and orientation of houses) reflect new ideas about proper village structure, social status, or occupational or gender-based accommodations?

Data Requirements:

- Suites of archaeological sites with good dating to specific intersections in the historic period.
- Historic-period sites with intact residential features.
- Individual historic-period sites with abundant and intact faunal and macrobotanical assemblages; similar dietary assemblages from multicomponent sites with stratified deposits.
- Analysis of subsistence artifact assemblages (food procuring, processing, and storing) and faunal/macrobotanical assemblages in remote locations.

Social Organization, Exchange, Interaction, and Symbolic Systems

1. Are changes in political alliances evident in the post-mission archaeological settlement pattern? Do changes in available exchange goods suggest these shifts?
2. Is there evidence of resistance to the dominant culture in native archaeological assemblages in various work settings (e.g., mission neophyte living quarters, mission outpost living sites; native domestic sites at ranchos)?
3. Is there evidence of a maintenance of separate traditional economic systems (e.g., clamshell disc bead manufacture) within the mission or rancho complex? Did this situation manifest at different levels in authoritarian settings (the missions and ranchos) versus relatively consensual contexts (e.g., Fort Ross, Toms Point, and refuge sites)?
4. Were native political and ceremonial activities and social roles maintained after contact? Are they more in evidence in consensual contexts or in restricted living settings, such as the missions?
5. How well did individuals from different social, cultural, and linguistic groups fare under enforced co-habitation? Were intra-institutional alliances made along individual, racial, economic, or other lines? How do these present themselves archaeologically?
6. In what ways and in what settings does multicultural contact present economic and other opportunities? How are these seen in the archaeological record?

7. Which elements of Coast Miwok and Ohlone culture seem more resistant to change than others? What was the role of material culture in this process of change and retention?
8. Following Lightfoot and Simmons, what evidence is there of the symbolic significance of Euroamerican artifacts from the earliest period of culture contact with native peoples? Did certain artifacts or artifact complexes become symbols (even icons) representing either "Indian-ness" or the endorsement of change? Conversely to what degree might changes in artifact use or style be isochrestic rather than symbolic variations?

Data Requirements:

- Suites of archaeological sites with good dating to specific intersections in the historic period.
- Historic-period sites with intact residential features.
- Individual historic-period sites with abundant and intact faunal and macrobotanical assemblages; similar dietary assemblages from multicomponent sites with stratified deposits.
- Analysis of subsistence artifact assemblages (food procuring, processing, and storing) and faunal/macrobotanical assemblages in remote locations.

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