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## Tempo and Scale in the Evolution of Social Complexity in Western North America: Four Case Studies

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The evolution of complex human societies, including permanent social inequality, is a central issue confronting archaeology. Within the last 30 years, considerable effort has focused on the evolution of social complexity among hunter-gatherers. This chapter does not directly attempt to explain the evolution of complex hunter-gatherer societies; it is a preliminary attempt at establishing appropriate temporal and spatial scales for explanation by comparing the evolutionary sequences of four regions in western North America over the last 12,000 years: Kodiak Island, the Northwest Coast, the Intermontane Plateau, and the Southern California Bight (Figure 3.1). These regions were selected because social and economic complexity evolved in all four and they have relatively well-known cultural sequences. This chapter's focus, and the framework for evaluating possible causes, is the tempo and the scale of change: how fast or slowly did changes occur, in what patterns, and at what geographic and temporal scales?

### **Cultural Evolution: Causes, Preconditions, and Tempo**

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This chapter is conceptualized within an evolutionary framework. It is beyond its scope to explain or defend this approach beyond a few comments. The interested reader is referred to Boyd and Richerson (1985), Bettinger (1991), Maschner (1996), Barton and Clark (1997), O'Brien and Lyman (2000), and Shennan (2002). Controversy exists among archaeologists over how (and even if) evolutionary theory ought to be employed and the form it should take when applied to socio-cultural change (cf. Pauketat and Loren, this volume). However, certain crucial matters can be fruitfully addressed without resolving the debates.

Evolutionary theory recognizes a two-level hierarchy of causation: ultimate causes and proximate causes. We can identify a third level: necessary conditions that

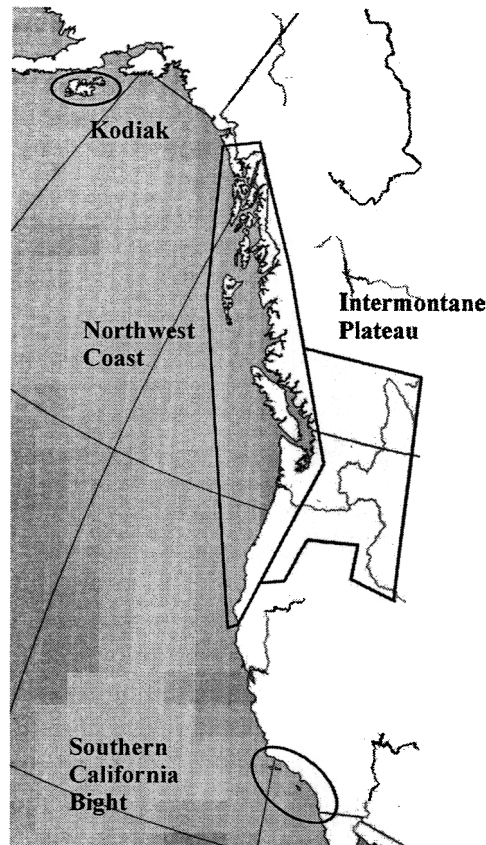


Figure 3.1 Map of western North America showing regions

do not cause change, but which must be present for the change to occur. Ultimate and proximate causes are central to evolutionary accounts to establish the scope and scale of explanation. An example makes the distinction clear (e.g., Mayr 1982). As I type, my eyes read my computer screen. A proximate explanation of that ability describes how light striking the retina is translated into nerve impulses that move into my brain and are turned into visual images. An ultimate explanation specifies the evolutionary mechanisms, including natural selection, that produced my eye. Necessary conditions are "necessary but not sufficient." For example, Testart (1982) argued food storage caused inequality among hunter-gatherers. However, many groups that store foods do not have permanent inequality although many groups with permanent inequality store food. Thus food storage does not inevitably cause inequality, but it often appears to be part of the conditions required for inequality to evolve.

#### *Tempo and scale*

Evolution's tempo is its speed. In biological evolution there is significant debate over tempo. Darwin and his successors assumed evolution is gradual, with new traits

slowly accumulating through time, although not precluding rapid and abrupt – quantum – changes or a mosaic of tempos (Mayr 1982). The modern debate over tempo was fueled by the theory of punctuated equilibrium that postulates significant evolutionary change occurs very rapidly in isolated populations (Gould 2002). These relatively rare events unpredictably punctuate long periods of stability or stasis during which little change occurs.

This debate also concerns causal connections between levels of evolutionary phenomena. Gradualism maintains macroevolution is the sum of microevolutionary processes, while Gould and others argue macroevolution is processually distinct. Most theories of cultural evolution are microevolutionary (e.g., Boyd and Richerson 1992). An underlying question here concerns the temporal and spatial scales at which such processes must work. Archaeologists are generally little interested in tempo. Richerson and Boyd (2000) suggest tempo is regulated by four broad factors: (1) geography, including population size; (2) climate change; (3) coevolutionary forces; and (4) cultural evolutionary forces. They speculate tempo is potentially faster in large geographic regions with large populations, extensive interaction among groups, and a geography facilitating interactions. Under these conditions innovations are more likely to arise and spread. Conversely, change will be slow in small isolated groups.<sup>1</sup> They see a minor role for climate changes and significant roles for coevolutionary forces, including disease patterns and environmental limitations. They assign greatest importance to cultural evolutionary processes, arguing new technologies and economic and social institutions “evolve with difficulty” and rates of economic and social innovation are the most important for regulating the tempo of cultural evolution. They imply changes will be slow, but accelerate through time.

Other researchers looking at these same factors come to different conclusions. Bettinger (1999) argues subsistence and technological systems are functionally well integrated, and cannot change slowly; they can only change through massive reorganization or replacement, producing sudden rapid change. Many see high levels of subsistence risk accelerating culture change (e.g., Arnold 2001a; Fitzhugh 2001). In contrast, Hayden (2001) theorizes high levels of subsistence risk slow culture change and stable, productive resource bases accelerate it. Arnold (1996, 2001b), Clark and Blake (1994), Hayden (2001), and Maschner (1992), among others, agree the activities of self-interested aggressive individuals – aggrandizers – accelerate culture change, under the right conditions.

What is slow and fast change? The answer depends partly on the length of the evolutionary sequence. In an evolutionary history many millions of years long, a change requiring 200,000 years is rapid, while a change requiring 30,000 years in a history 50,000 years long is slow. In determining evolutionary tempo in North America, it is necessary to examine the full 12,500-year sequence.

It is also important to identify the appropriate evolutionary unit. In cultural evolution, it is generally accepted to be a “cultural tradition” (O’Brien and Lyman 2000; Shennan 2002). There is debate over what a cultural tradition is and how to define it (cf. Pauketat and Loren, this volume). Here, this question is addressed for each case study based on the geographic and social scale of events (Ames 1991a).

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The case studies represent different geographic scales: the Northwest Coast and Intermontane Plateau are sub-continental in size while Kodiak Island and the Santa Barbara channel are smaller.

### Social Complexity

For present purposes, complexity has two important qualities: the degree to which a society is differentiated (the number of parts) and the interrelationships among the parts (Kauffmann 1993). Complexity also involves power, for which Wolf (1999) identifies four scales: individual, social, tactical, and organizational. People in all societies exercise individual and social power, but tactical and organizational power are financed, entailing the development of a political economy to control labor and sustain the emerging elite (Arnold 1993, 1996; Donald 1997). Currently, the concept "complex societies" includes "middle-range" or "transegalitarian" societies with permanent social inequality and institutionalized leadership, but often lacking class systems and the political, bureaucratic, and power apparatus of states. These include hunter-gatherer societies, which vary greatly from small, egalitarian social groups (with fluid membership, little or no personal property, high mobility, and no food storage) to more complex hunter-gatherers (see Arnold 1996; Rowley-Conwy 2001).

This chapter does not discuss the full array of secondary causes and preconditions scholars advance to explain social complexity. It focuses on those that either are most often proposed, or play the greatest role in explanations of the evolution of complexity in western North America. The expectation is that, as preconditions or secondary causes are present, evolutionary tempo should increase. For example, if maritime or aquatic economies develop, complexity should evolve faster than in terrestrial cases. Likewise, the evolution of logistical mobility patterns should be followed by accelerating culture change. If Hayden is correct, the evolution of inequality will accelerate with greater subsistence stability; if Arnold is correct, permanent inequality will develop rapidly in times of significant stress.

### Case Studies

The case studies come from western North America (Figure 3.1) and the sequences are discussed using Early, Middle, and Late subdivisions of the Holocene (Figure 3.2, see also Lightfoot 1993; Moss and Erlandson 1992). The earliest sites among the case studies date to about 12,500 years ago and are located in the Intermontane Plateau. The earliest sites along the coast are somewhat younger, post-dating 9000 B.C.

The Late Pleistocene (LP) and the Early Holocene (EH) were environmentally unstable, although generally the climate became warmer and drier (e.g., Hu et al. 1999). Plant and animal distributions shifted to accommodate climatic fluctuations

Radiocarbon Years	Calendar Years	Geological Periods	Kodiak Island	Northwest Coast	Intermontane Plateau	Southern California
0	A.D. 1950	Late Holocene	Alutiq	Modern	Modern	Late
500	A.D. 1450		Koniag	Late Pacific	Late Pacific	
1000	A.D. 1000		Late Kachemak			Middle Pacific
1500	A.D. 500			Middle		
2000	A.D. 1					
2500	500 B.C.					
3000	1250 B.C.		Early Kachemak			
3500	1850 B.C.	Middle Holocene	Ocean Bay II	Early Pacific	Early Pacific	Early
4000	2500 B.C.		Ocean Bay I			
4500	3300 B.C.					
5000	3850 B.C.					
5500	4300 B.C.					
6000	4850 B.C.					
6500	5400 B.C.					
7000	5700 B.C.	Early Holocene		Archaic	Archaic	Milling Stone
7500	5950 B.C.					
8000	6450 B.C.					
8500	7100 B.C.					
9000	7650 B.C.					
9500	8200 B.C.					
10000	8950 B.C.	Terminal Pleistocene		Paleo-Coastal ?	Paleo-Archaic	Paleo-Coastal
10500	9800 B.C.					
11000	10500 B.C.					
11500	11100 B.C.					
12000	11500 B.C.					

Figure 3.2 Archaeological sequences in the four case studies

(e.g., Whitlock 1992). Deglaciation after 18,000 years ago was rapid (Clague et al. 2004) and sea levels rose swiftly until about 5000 B.C. (Stanley and Warne 1997). The Middle Holocene (MH) was marked by a change first to a warmer, moister climate and then to a moister, cooler climate (e.g., Ames and Maschner 1999; Glassow 1997a; Kennett and Kennett 2000; Mann et al. 1998; Steig 1999). A major cooling trend, the Neoglacial, began around 2500 B.C., initiating a series of warmer/cooler oscillations. Sea levels rose more slowly, from perhaps -10 m to within -4 m 5,000 years ago (Stanley and Warne 1997).

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The Late Holocene (LH) may be climatically more variable. The warmer/drier, cooler/wetter fluctuations continued, including the Medieval Warm Period (A.D. 900–1350) and the Little Ice Age (A.D. 1350–1900) (e.g., Box et al. 1999; Mann et al. 1998).

### *The Kodiak Archipelago*

The Kodiak Archipelago lies off Alaska's Pacific Coast. Kodiak Island is its principal island. The islands are the traditional territory of Alutiiq (formerly Koniag) peoples who, at contact, lived in large settlements, had a permanent elite, and held slaves. The archipelago's waters are highly productive and the island's long, extremely complex coastline increased environmental productivity while its terrestrial environments were rather impoverished. The archaeological record contains several seemingly abrupt changes suggesting population replacements to some, but the current view, followed here, is that there has been long-term cultural continuity (e.g., Clark 1998; Fitzhugh 1996).

At present, MH "Ocean Bay" peoples are Kodiak's first archaeologically visible occupation. Probably maritime foragers, they exploited both marine and terrestrial mammals and fish (Clark 1998; Fitzhugh 1996, 2002, 2003). They had no specialized maritime gear, just hooks and lines, and harpoons and lances armed with chipped stone points; however, by the late MH there is some evidence of specialized marine hunting tools. Doubtless, they had seaworthy boats capable of carrying all group members. Their populations and settlements were small and dispersed, but grew during the MH. Residential structures were tents only 2–3 m in diameter, indicating small domestic groups. Small pit houses replaced the tents around 2000 B.C. (Fitzhugh 1996).

The LH contains four cultural periods: the Early Kachemak (1850–500 B.C.), Late Kachemak (500 B.C.–A.D. 1200), Koniag (A.D. 1200 to contact with Europeans) and Alutiiq (Modern). During the first period, mobility patterns shifted from residential (i.e. foragers) to logistical (i.e. collectors). Houses were small (ca. 15 m<sup>2</sup>). Some residential sites have multiple houses, suggesting either reoccupation with rebuilding of houses (implying increased investment), or larger community sizes. Technological and subsistence changes indicate increased efficiency in taking marine/littoral resources (toggling harpoons, netweights, ground slate points), bulk harvesting, (nets), and increased efficiency at processing foods (ulus – a distinctive form of chopping/slicing knife) for storage (Clark 1997, 1998; Fitzhugh 1996, 2002, 2003).

Late Kachemak populations were relatively large. Mobility patterns became increasingly logistical as some community sizes increased, with settlements having one to 10 houses. Clay-lined pits and internal storage facilities in some houses indicate storage (Partlow 2000). Households may have been corporate groups with multi-generational control of property (Hayden and Cannon 1982). Mortuary practices were elaborate, and included grave goods and defleshing of individuals (Simon and Steffian 1994). Likewise, the presence of lip labrets suggests increased social

differentiation (Keddie 1981; Steffian and Saltenstall 2001).<sup>2</sup> There was increasing craft specialization, particularly labrets and oil lamps, indicating greater labor investment and greater residential stability (Steffian 1992; see also Clark 1998; Fitzhugh 1996). Warfare probably intensified and refuge sites are common after A.D. 800. Dietary stress appears to have been widespread (Steffian and Simon 1994).

Despite technological continuity between the Late Kachemak and the Koniag periods, marked and seemingly rapid changes occurred (Clark 1998). Populations peaked during the Koniag period and house and settlement sizes increased markedly, suggesting social ranking. These new large houses were also architecturally elaborate and the volume of storage features increased sharply. They were pit-dwellings with rectangular central sections and smaller circular features, or "lobes" connected to them by short tunnels. Villages shifted to Kodiak Island's outer coast at this time, perhaps for better access to whales and improved defense (Fitzhugh 1996). There is also evidence of intensified salmon fishing, food production and processing specializations, exchange, and investment in carpentry (wood or perhaps whalebone, since large trees are rare on Kodiak) (Clark 1998; Fitzhugh 2002).

### *The Northwest Coast*

The Northwest Coast extends from southeast Alaska to northern California, and from the Pacific to the Cascade/Coast range crest (Ames 1994, 2003; Ames and Maschner 1999). Its wet, mild climate supported a temperate rainforest that produced crucial raw materials while ecologically productive waters supported a vast array of fish and sea mammals.

The coast was densely populated. Its economy depended on stored foods, particularly salmon. Society was stratified into two classes, including a hereditary elite. There was some production specialization, as well as long-distance trade and intense interaction. Warfare was widespread. The Northwest Coast is treated here as a single cultural tradition, although there were several interacting traditions and population shifts (Cybulski 2001; McMillan 2003; Suttles 1990). Addressing these is unnecessary here.

The earliest known occupations, by mobile foragers, just post-date 10000 B.C. (Ames 2003; Ames and Maschner 1999). Sites are small, suggesting short-term occupations by small communities. A few sites were regularly reused. There is no evidence suggesting differentials in status or for conflict. Mobility was the primary means of coping with unstable, variable environments. Boats facilitated access to distant littoral and terrestrial resources and to small, widely scattered social groups. Technology on the northern coast was dominated by microblades after 9500 B.C. (Fedje 1997), while foliate bifaces and cobble tools were common on the central and southern coasts. Bone tools include barbed points or harpoons, wedges, and fish gorges. There is indirect evidence for fishhooks and lines and probably for nets.

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Middle Holocene residential patterns were more stable with some settlements reused regularly over lengthy periods, suggesting tethered foraging (e.g., Cannon 2002). This stability is marked in part by large shell middens. There is no evidence for houses until the end of the MH, when semi-subterranean houses dating to ca. 4000 and 3000 B.C. occur in southern British Columbia (Mason 1994). Terrestrial and aquatic resources were harvested, including marine mammals and fish such as salmon, flat fish, and herring; the herring implying bulk harvesting gear (Ames and Maschner 1999). Human bone chemistry indicates that virtually all dietary protein came from marine sources (Chisholm et al. 1982). The shell middens reflect intensification of intertidal resources. Ubiquitous large harpoon heads and ground slate points indicate increased sea mammal hunting efficiency. There is no evidence for storage. Other technological changes indicate expanded woodworking, probably including dugout canoes.

Burials and perhaps cemeteries are present by 4000 B.C. Cemeteries are clearly present by 2000 B.C. Some cemeteries were used over lengthy periods, suggesting long-lived, stable territorial social groups. Mortuary treatment differs among individuals. Grave goods range from utilitarian items to marine hunting gear, shell bowls, and carved antler spoons. Labrets are present by 4000 B.C. (Ames and Maschner 1999). These differences raise the possibility that inequality was present by 2000 B.C., although probably not permanent ranking.

Limited osteological analysis suggests relatively high levels of physiological stress on the southern coast (Dale 1994). Analysis of larger samples from the entire coast suggests good overall health during the Middle and Late Holocene (Cybulski 1994). Violence levels were high all along the coast.

Regional interaction spheres formed during the MH, if not earlier (Ames and Maschner 1999; Carlson 1994; Moss 1998; Suttles 1990). These spheres were the geographic framework for subsequent LH social and economic developments and the evolution of regional variants of the Northwest Coast art style.

Ames and Maschner (1999) divide the Late Holocene into three periods: Middle Pacific (MP) (1800 B.C.–A.D. 200/500), Late Pacific (A.D. 200/500–A.D. 1770), and the Modern period (A.D. 1770 to the present). MP population levels were higher than in preceding periods (Ames and Maschner 1999). Food production intensified, particularly between 2500 and 1000 B.C. This is indicated by increased numbers of net weights, toggling harpoons, and perhaps fish weirs, evidence for storage boxes, greater labor investment in woodworking, changing site distributions, and indirect evidence for boats hauling processed foods. Marine and terrestrial animals were harvested, although virtually all dietary protein was marine (Chisholm et al. 1982). Mobility was logistical, with residential sites used over long periods. Settlement sizes increased. Linear villages imply community-level social or political organization. Rectangular surface dwellings occur by the middle of the MH, although there is no firm evidence for them on the central coast until the end of the MP (e.g., Grier 2001). Households in some areas were corporate groups. Such households were the core Northwest Coast institution in the Early Modern period. Their development in the MP was probably the result of the labor demands of the changing economy (Ames 2003; Ames and Maschner 1999).



Labor organizational changes extend to craft specialization, including copper-working by 900 B.C. (Ames and Maschner 1999), and probably basket-making after 500 B.C. (Bernick 1998) and specialized food-harvesting within houses by ca. A.D. 500 (Chatters 1989; Grier 2001). The evolution of the Northwest Coast art style also suggests specialization (Ames and Maschner 1999). The introduction of slavery is another possible change in labor organization. It may date to the beginning of the MP (Ames 2001).

Permanent social ranking emerged at the beginning of the MP if not somewhat earlier. Households and communities may have been ranked, at least on the northern coast (Ames 2001). Ranking was not yet expressed in house sizes. Cemeteries and dwellings were used for periods ranging from a few centuries to over a millennium, suggesting long-lived corporate groups (e.g., Ames 1996; Grier 2001).

The regional interaction spheres continued through the MP (Ames and Maschner 1999). The status system developed a regional dimension as labret-wearing became restricted to the northern coast, replaced on the central and southern coasts by cranial deformation. Warfare levels remained high in the north, but declined in the south (Cybulski 1994).

Populations peaked at some point in the Late Pacific period. Intensification of food production continued. Logistical mobility patterns are clearly evident (e.g., Coupland 1998; Townsend 1978). Specialized tackle proliferated, and hunting and fishing gear became more uniform along the coast (Ames and Maschner 1999). Woodworking intensified. Plankhouses and linear villages were present everywhere along the coast. Houses varied markedly in size, reflecting differences in household status (Acheson 1991; Archer 2001; Maschner 1992) and suggesting political inequalities by A.D. 500 (Grier 2001). Mortuary practices changed dramatically. Burial mounds appeared on the southern coast. While many were small and simple, some were large, elaborate, and richly furnished (e.g., Lepofsky et al. 2002). Midden burial virtually ceased by ca. A.D. 1000–1200. The regional interaction spheres remained stable. Warfare intensified along the coast. Fortifications became increasingly common after ca. A.D. 800 (Moss and Erlandson 1992).

### *The Intermontane Plateau*

The Intermontane Plateau lies between the Cascade/Coast ranges on the west and the northern/Canadian Rockies on the east (Ames et al. 1998). The climate is continental, with cold winters and hot summers. It is dry. Principal resources included salmon, a range of herbivores (elk, deer, and antelope) and geophytes.

Contact-era populations were lower than on the coast, settlements smaller, and mobility levels higher. Early ethnographers regarded Plateau societies as egalitarian, but recent work challenges that view (e.g., Hayden and Spafford 1993). While archaeologists generally assume cultural continuity during the Holocene, controversy exists over whether the region's earliest inhabitants were biologically or culturally ancestral to later peoples (e.g., Ames 2000; Chatters 2001; Leonhardy and Rice 1970).

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The Plateau's earliest cultural manifestation may be widely and thinly scattered Paleoindian Clovis material (Adovasio and Pedler, this volume; Fiedel 1999). The earliest radiocarbon samples date Paleoarchaic Windust materials, clustering between ca. 11500 and 9600 B.C. (Ames 2000; Beck and Jones 1997). LP/EH economies focused on moist-wet environments, harvesting fauna from rabbits and bison to fish, although primarily targeting large mammals.<sup>3</sup> Periodic food shortages occurred (Green et al. 1998). Windust people were foragers with some logistical movement; population densities were low (Ames 1988, 2000; Ames et al. 1998; Connolly 1999). Technology was geared to high mobility.

Middle Holocene residential patterns are controversial, and the records for houses, mobility patterns, and subsistence and mortuary patterns are rather contradictory. Some scholars suggest very stable tethered foraging patterns in which residential camps were reused over many years without depleting adjacent resources. Others argue long-term residential stability on the Plateau is only possible with logistical mobility and storage. Presently, however, evidence for storage is nil and for logistical mobility weak. The oldest substantial residential structure dates between 5500 and 4300 B.C. (Pettigrew and Hodges 1995). Such dwellings are distributed from central British Columbia to southwestern Idaho (Ames 2000). Although settlements were small, houses were substantial, with internal areas of some 70 m<sup>2</sup>, suggesting six to 10 residents (Ames 1991b). Houses disappear for a time after 2800 B.C.

Elaborate cemeteries dating between ca. 5000 and 2500 B.C. are found in some areas. While cemeteries and houses overlap in time, they only partially overlap in space, particularly in southwestern Idaho, where the cemeteries constitute the "Southwest Idaho Burial Complex" (Pavesic 1985). Individuals were interred flexed, and may have been moved and reburied after exposure and possibly defleshing (Reid and Chatters 1997). Associated grave goods imply differential access to social or spiritual resources but not ranking (Pavesic 1985; Reid and Chatters 1997).

Middle Holocene people harvested elk, deer, and antelope, a range of plant resources, and fish, including salmon. The most visible technological changes are the replacement of lanceolate projectile points by side- and corner-notched points just before the MH, and the widespread presence in early houses of mortars, pestles, and hopper mortar bases. These are often substantial, representing significant investments of time and labor (Ames 2000; Ames et al. 1998). Long-distance interaction was primarily oriented to the south and west, perhaps as far as southern California (Erickson 1990; Galm 1994). There is no evidence bearing on violence and competition until the subsequent Late Holocene period.

The Late Holocene is divided into the Middle Pacific (1850 B.C.–A.D. 200/500), Late Pacific (A.D. 200/500–1720) and the Modern period (Early Modern 1720–1855, Late Modern 1855 to the present). MP populations were larger than in previous periods. Pithouses were again present, but were less substantial than previously (Ames 1991b). Storage was practiced. Subsistence appears focused on salmon, roots, and large mammals. Intensification of fishing is indicated by increasing numbers of net weights and the introduction of toggling harpoons by A.D. 200

(Ames 2000). Logistical mobility patterns were clearly present. However, occupations of residential sites were brief, lasting perhaps a few years. While settlements were small, villages had cemeteries, suggesting long-term social and territorial ties to village locations (Ames 2000). High mobility, coupled with cemeteries, suggests residential sites shifted regularly through a defined territory. Regional interaction, shifting towards the Northwest Coast, increased as territory sizes declined (Connolly 1999; Hess 1997).

Populations peaked during the Late Pacific period. Mobility patterns became increasingly logistical. On the Columbia Plateau, pithouses were gradually replaced by mat-lodges, a flexible house form of poles covered with mats that accommodates rapid alterations in household size (Ames 1991b, 2000; Rice 1985). Settlements varied from quite small to very large, with perhaps several hundred people. Very large settlements with community cemeteries and extensive storage features are a distinctive feature of the LP. Intensification of food production may have led to greater reliance on salmon and roots and a widening of the diet (Ames 1991b). Bison were exploited for the first time since the Early Holocene; the bow and arrow gradually replaced the atlatl over a millennium.

During the LP, there is some evidence of ranking and increasing social inequality (Ames et al. 1998; Schulting 1995). The Keatley Creek site in south-central British Columbia provides an excellent example of a large LP aggregation and of the evidence for increasing inequality. The village formed ca. A.D. 300 and flourished until ca. A.D. 1150 (Prentiss et al. 2003). It contains several score pit-dwellings varying markedly in size, which may reflect differential household prestige and status (Hayden and Schulting 1997). The cause of abandonment is controversial, but all agree the Keatley Creek pattern of large villages was replaced by small settlements in this part of the Plateau (e.g., Hayden and Ryder 1991, 2003; Kuijt 1999; Prentiss et al. 2003). Hayden and Schulting (1997) suggest that a Plateau Interaction sphere formed during the LH, but this happened much earlier, by 1500 B.C. (Ames 2000; Erickson 1990; Galm 1994). The Plateau Interaction sphere involved the movement of a wide range of prestige goods. At the same time, warfare intensified, peaking between ca. A.D. 500 and 1000 (Chatters 1988).

### *The Southern California Bight*

The Southern California Bight includes California's semi-arid coastline from Point Conception to Mexico, the offshore Channel Islands, and the Santa Barbara Channel. Terrestrial environments are topographically variable, ranging from a narrow coastal plain in places to the rugged coast range. Strong ecological contrasts between the Channel Islands and the mainland profoundly affected cultural evolution (Vellanoweth and Grenda 2002). Offshore aquatic environments were productive and ranged from coastal estuaries to deep, pelagic waters, and supported a diverse array of animals and intertidal mollusks. The Channel Islands differ in size and ecology; most importantly, only the largest have year-round fresh water.

The region includes the traditional territories of the Chumash, Gabrieliño, and other groups. The Chumash and Gabrieliño, although speaking unrelated

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languages, were culturally similar. The contact-era Chumash and Gabrieliño epitomize hunter-gatherer complexity: large, dense populations, sedentism, and a permanent elite. The Chumash were apparently organized into a series of small polities, each with one or more chiefs whose power extended beyond the household.

A good sample of sites gives a picture of EH life (Erlandson 1994; Erlandson and Colton 1991). Mollusks, rather than terrestrial mammals, marine mammals, or fish, appear to have been the primary protein source (Rick and Erlandson 1999, 2000; Rick et al. 2001). Fish were more important on the Channel Islands, where seed-bearing plants were uncommon or absent. Seeds were collected and, by 7500 B.C., processed using small milling stones (Jones et al. 2002).

The area's earliest inhabitants were probably foragers, living in small fluid communities. Analysis of human skeletons suggests people were healthy, especially relative to the LH (Lambert 1994). There were low levels of person-to-person violence. LP/EH settlements were generally small and short-term (Erlandson 1994). By the end of the EH, residential patterns appear to become more stable and settlements were reoccupied regularly (Erlandson 1994; Glassow 1995; Kennett 1998). This stability, as well as the presence of cemeteries, may point to the evolution of logistical mobility patterns, but it could also reflect tethered foraging.

The MH spans much of the "Early" period in the regional chronology. The southern California MH is reminiscent of this period on the Plateau, both areas sharing elaboration of mortuary practices and ambiguous settlement patterns. Generally, it appears that MH peoples in the region were foragers linked with others via extensive interaction networks (Erickson 1990; Howard and Raab 1993; Raab 1997). Burials contain a range of grave goods, but most particularly abalone (*Haliotis* sp.) shell beads and pendants. Variations in the numbers and the likely value of grave goods may point to differential access to leadership and wealth, although societies were likely still "egalitarian" (King 1990). Sites are small, lacking evidence for prolonged occupation, although large, deep sites do occur, suggesting the possibility of tethered foraging and semi-permanent occupation, or some degree of logistical mobility (Erlandson 1997; Glassow 1997a, 1997b; Kennett 1998; Kennett and Kennett 2000; King 1990). Houses are rare, but the Nursery site on San Clemente Island is a dramatic exception (Raab 1997). There, a number of pit houses – probably with whalebone superstructures – occur between 3100 and 2100 B.C. (contemporary with the peak of house construction on the Plateau and the earliest structures in southern British Columbia).

Technological innovations include ground stone mortars and pestles as early as 4700 B.C., earlier than on the Columbia Plateau (Glassow 1996, 1999; Jones et al. 2002). These tools indicate increased investment in food-processing, perhaps for storage. Increased fishing efficiency is indicated by the apparent development of compound bone fishhooks and new forms of net weights (Glassow 1999). Shellfish continued to be important protein sources, as they were during the EH (Glassow 1999).

Populations grew steadily through the Late Holocene, peaking after ca. A.D. 1000. Stress levels and violence increased and overall health declined, reaching a nadir around ca. A.D. 600–1200 before the population peaked. The stable Middle

Holocene settlement patterns changed by ca. 1000 B.C., if not earlier, becoming clearly logistical. On the Channel Islands, people located residential bases on the coast and exploited the interior logistically. Houses are rare, but large houses of the type built by the Chumash were present by A.D. 1300. Technological innovations include shell fishhooks ("J" hooks), compound barbed bone points, and the tomol, a seaworthy plank canoe made from beached redwood logs (Gamble 2002). The tomol, capable of longer trips, provided access to new marine habitats, and had important freight-hauling capacity, facilitating exchange among the islands and between the islands and the mainland. Changes in settlement patterns and technology (such as net weights) are part of a general intensification of marine resources, including shellfish, fish, and marine mammals from littoral and sublittoral habitats (e.g., Kennett 1998).

The tempo of social, economic, and political changes in the Bight, particularly on the Channel Islands between A.D. 600 and 1300, is the subject of intense debate among archaeologists (e.g., Arnold 2001a, 2001b; Erlandson 2004; Kennett 1998; Raab and Larsen 1997). Some see ranking and control of specialized labor as developing late (Arnold 2001b), while others argue that ranking had greater antiquity (e.g., Arnold and Green 2002; Kennett 1998; King 1990; Gamble et al. 2001, 2002). These developments may be related to the invention of the tomol, its control by emerging elites, and intensification of the production of shell beads on the islands. Shell bead-making, and the manufacture of stone drill bits for bead-making, was intensified particularly around A.D. 900. Arnold (1995) sees specialization in bead- and drill-making by A.D. 1150–1200 as part of a developing political economy. Shell beads were part of social exchanges with the mainland, and functioned as a kind of currency in the Early Modern period.

Settlement patterns shifted at this time, with sites occupied since the MH being abandoned and new residential sites established. There are suggestions that the islands themselves were briefly abandoned, or at least suffered a short period of population decline (e.g., Arnold 2001b; Kennett 1998). These events may be due to environmental stress. Arnold (2001a, 2001b) attributes this sudden development to the impact of a severe El Niño event on the productivity of the marine waters around the Channel Islands. Others argue that the cause was drought. Still others dispute both the chronology of and the evidence for the El Niño event (Erlandson 2004; Gamble et al. 2001; Kennett and Conlee 2004; Kennett and Kennett 2000; Raab and Larson 1997). Be that as it may, there were rapid social, economic, and political developments in the Santa Barbara Bight between ca. A.D. 600 and 1300. While evidence suggests that poor health and violence peaked before A.D. 1000, and some degree of ranking and specialization existed earlier, there was a major sociopolitical reorganization after A.D. 1100.

## Discussion

The tempos of developmental patterns summarized above were mosaics: some changes proceeded slowly while others were swift and abrupt. There are two periods

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of particularly rapid change: one between ca. 1800 and 800–300 B.C. and a second between ca. A.D. 500 and A.D. 1300–1400. The first period is marked by the appearance of logistically oriented collectors in all study areas, widespread intensification of food production, and important technological innovations. The second period is marked by increased warfare and violence in all four areas, significant physiological stress in California, dietary stress on Kodiak Island, the formation of larger settlements in all areas, intensification of specialist production in California, increasing wealth differentials in many areas, significant demographic disruptions toward the end of the period in many areas, and sociopolitical reorganization everywhere. In some places, such as the Santa Barbara Bight and Kodiak Island, elites appear to have been present by the end of the period. On the Northwest Coast, household and elite organization changed, but inequality did not disappear.

All regions share “a muddle in the middle” – the Middle Holocene – marked by residential mobility patterns not readily described by the collector/forager dichotomy. These appear to be tethered or stable foraging patterns with enough residential stability to permit the construction of houses, a practice that seems to peak everywhere around 3000–2800 B.C. These mobility patterns are coupled with relatively elaborate mortuary practices, suggesting some forms of territoriality and perhaps social distinctions.

Pinpointing when permanent inequality and ranking first evolved remains controversial in most areas. On the Plateau, evidence suggests increasing levels of inequality during the Late Holocene, but not rapid, quantum changes. On the Northwest Coast, permanent status differences may have preceded the economic and social reorganization of the late Middle Holocene, but social ranking seems to have developed as part of that rapid reorganization.

When inequality emerged in California is uncertain. Part of this may reflect an analytical confusion between inequality and political economy, the latter but not the former implying tactical power. The economic reorganizations associated with the development of a political economy and tactical power appear to have happened relatively rapidly on the Northwest Coast at the end of the Middle Holocene and very rapidly in California in the Late Holocene. This suggests that political economies can evolve rapidly once inequality exists.

Late Holocene demographic disruptions, settlement pattern shifts, and major sociopolitical changes appear to have occurred at more or less the same time across western North America, strongly indicating common external causes (cf. Pauketat and Loren, this volume). The timing of these changes, around A.D. 1100–1300, suggests impacts of the end of the Medieval Warm Period and the onset of the Little Ice Age (e.g., Jones et al. 1999; Kennett et al. 1999; Mann et al. 1998; Raab and Larson 1997). The swiftness of the Late Holocene changes could be seen as punctuated equilibria. However, many (but not all) of the changes are anticipated by earlier developments; the changes are not unpredictable given what precedes them.

Important differences exist among the case studies. Inequality, significant intensification of production, and storage appear to have evolved earliest on the Northwest Coast. On the Plateau, the Late Holocene event seems to have produced a reduction in complexity or inequality (which also may have happened to a much

lesser degree on the southern Northwest Coast). Why? It is plausible that the apparently more rapid evolution of complexity on the Northwest Coast is the result of its size, environmental diversity, and the relative ease of communication across vast distances using boats (see Ames 2002). These factors also suggest that the tempo of cultural evolution is controlled by difficulties inherent in technological and social changes. As noted above, major social changes do appear to have happened rapidly; however, they did not occur *de novo*.

The development of elites in the California Bight in the Late Holocene is the clearest example of this. The apparent rapid development of an elite and a political economy after A.D. 1100 appears rooted in developments that become archaeologically visible by A.D. 600. The pattern of slow incremental change followed by rapid social/political change could be due to (1) external causes or stresses happening at just the right moment, and (2) the accumulation of small changes (or secondary causes) to the point of criticality so that any additional change causes sudden, rapid, and major organizational change (e.g., Bentley 2003; Kauffmann 1993).

Taken together, these case studies seem to contradict Rowley-Conwy's (2001) claim that there is no general trend in hunter-gatherer social-cultural evolution from simple to complex. There clearly is more complexity at the end of the Holocene than at the beginning. However, scale is crucial here. Taken individually, the case studies do support his contention, with the clearest example being the Canadian Plateau, where the large aggregations represented by Keatley Creek disappeared.

## Conclusion

It is not possible to discuss all secondary causes and preconditions, but a few conclusions are in order. First, while it has been widely postulated that maritime economies accelerate the evolution of social complexity, these case studies indicate that exploitation of marine resources, by itself, does not produce the rapid development of sedentism, storage, or social inequality. The pace of change along the Santa Barbara Bight, the Intermontane Plateau, and Kodiak Island is similar.

Second, while there is evidence for the intensification of production in all case studies and for the initiation of storage in all but California, nowhere did major social changes follow immediately afterward. On the Northwest Coast, storage appears to have been part of the reorganization of production. On Kodiak Island and the Plateau, significant storage was part of the evolution of logistical mobility at about the same time, but perhaps 2,000 years before the evolution of inequality.

Third, while many argue that collector mobility was a critical precondition to the evolution of hunter-gatherer complexity, in three of the case studies reviewed here 1,500 to 2,000 years separate the appearance of collectors and clear evidence of permanent inequality in the Late Holocene.

Fourth, technological innovations can either have very quick effects or almost no visible effects. On the Northwest Coast, technological changes and innovations

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(storage boxes, rectangular houses, etc.) were part of the rapid changes between ca. 1850 and 300 B.C. At present, however, it is impossible to establish temporal priority (did the technological changes precede, accompany, or follow the social/economic changes?). However, none of the major technological innovations such as toggling harpoons and adzes seems to have inevitably sparked immediate or rapid changes that are visible in the archaeological record. The introduction of the bow and arrow, the tomol canoe, and heavy-duty ground stone food-processing equipment are cases in point. The complete replacement of the atlatl by the bow and arrow took at least a millennium on the Intermontane Plateau, as both were used simultaneously. This period (ca. A.D. 1–1000) was associated with high levels of warfare, although high levels of warfare also existed before the bow's introduction in some areas. The invention of the tomol canoe, assuming it was developed by ca. A.D. 700, may have significantly accelerated social and economic changes in the California Bight within the span of two or three centuries. Recently, Fagan (2004) has suggested that the tomol canoe, or canoes with equivalent maritime qualities, may have existed in the California Bight for at least 8,500 years. If so, then the initial, visible social impact of the tomol may have been nil.

Lastly, the rapid, punctuated evolution of social inequality on Kodiak and in the California Bight clearly relates to a sudden, large-scale climatic event or events. The issue becomes not the action of aggrandizers (they are everywhere) but which event or events offered them scope, or which secondary causes were in place to support their activities when their chance arrived. In short, the actions of aggrandizers do not appear to accelerate the tempo of cultural evolution. Explanation shifts away from aggrandizers to circumstances.

## ACKNOWLEDGMENTS

I would like to thank Timothy Pauketat and Diana Loren for the invitation to contribute to this volume and their extraordinary patience in waiting for this chapter. Many helped in its preparation, through discussion and providing manuscripts. I thank Michael Glassow, Patricia Lambert, Jon Erlandson, Douglas Kennett, Ben Fitzhugh, John Clague, Herbert Maschner, and William Prentiss. Gretchen Kennedy provided essential help with the bibliography. All errors are mine alone.

## NOTES

- 1 The theory of punctuated equilibrium postulates significant evolutionary change (speciation) occurs in small, isolated populations. If isolation breaks down, the new species can spread, displacing the ancestral species.

- 2 Labrets are stone or wood lip and cheek plugs. During the Early Modern period, they were worn only on the northern Northwest Coast by free women. The size of the labret reflected the woman's status.
- 3 The Kennewick remains are an exception to this. His 13C/12C ratio suggests that over half of his diet may have come from marine sources – salmon. However, it could also have come from bison, which were hunted on the Plateau during the EH.

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