The Evolution of Complex Hunter-Gatherers on the Kodiak Archipelago

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Hunter-Gatherers of the North Pacific Rim
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This article presents a model for the emergence of complex hunter-gatherers and evaluates it with archaeological evidence from the Kodiak Archipelago in the Alaskan North Pacific. Taking a socio-ecological perspective grounded in evolutionary ecology, the model makes predictions about the evolution of increasingly sedentary and aggregated hunter-gatherer life-ways and the emergence of institutionalized social inequality, prestige economics, warfare and elite trade on the North Pacific Rim. The Kodiak Archipelago was colonized more than 7000 years ago by maritime oriented hunter-gatherers with relatively generalized technologies for harvesting sea mammals, birds, fish, and shellfish. Over the following several thousand years, Kodiak hunter-gatherer populations expanded and technologies changed in ways that resulted in increased social and political complexity. Aggregation and social competition appear to have resulted from the greater structuring of the resource environment with technological change and population growth. Institutional inequalities (ranking and stratification), inter-regional warfare, alliance, trade, and slavery were established within the last millennium prior to Russian contact in AD 1784.

The Kodiak trajectory is not unlike many other North Pacific prehistoric sequences, and it provides a means for evaluating common arguments about the causes of emergent complexity and social inequality. The long interval between colonization and the establishment of significant levels of complexity calls into question models that suggest resource abundance is a necessary and sufficient condition for emergent complexity. On the other hand, scarcity is also an insufficient motivation for organizational complexity. Rather, as is argued here, the emergence of complexity requires a variable landscape with productive, stable and defendable resource patches punctuated by less productive and stable zones. The Kodiak case illustrates the importance of technology and demographic characteristics in the creation of such an environment. Ultimately, it is political competition (physical and symbolic) and not a direct form of population pressure that facilitates the establishment of ranked and stratified societies.

In explaining the Kodiak case, I resurrect several "war horses" of social evolution: population growth, intensification, circumscription, sedentism, storage, and warfare. Unlike previous models, however, the Kodiak model is informed by evolutionary ecological principles that escape many of the more critical failings of the older models that it echoes. In the present case, social evolution is seen as the result of individually motivated behaviors. In this, my model is similar to recent attempts oriented in practice theory. Unlike these approaches, however, my model situates the direction of change in a universal biological propensity to pursue reproductive fitness through behavioral adjustments in a spatially and temporally variable environment. Explaining the evolution of complex hunter-gatherers becomes a matter of identifying the ecological (social and physical) conditions under which self-interested individuals would find it most advantageous to compete for status, attempt to control or amass resources, willingly undergo subordination, or adopt any other potentially hazardous position in an evolving social system.

COMPLEX HUNTER-GATHERERS

In the two decades following the publication of *Affluent Foragers: Pacific Coasts East and West*, the study of complex hunter-gatherers has expanded [see ARNOLD 1996a, 1996b; PRICE and BROWN 1985; PRICE and FEINMAN 1995], and scholars are increasingly interested in variation in past and present hunter-gatherer economies, social organization, and political structure [e.g., KELLY 1995]. With this increased awareness, there have developed two related goals for hunter-gatherer study. The first is the desire to describe and explain the evolution of social and political complexity within hunting and gathering evolutionary trajectories. The second and broader goal is the integration of hunter-gatherer social evolution into general and inclusive anthropological models of social change [see ARNOLD 1996a].

The first goal has led hunter-gatherer specialists to turn to historical and comparative datasets to systematize hunter-gatherer variation and put that variation into processual or evolutionary relationships, where possible. This paper provides an example of this approach, in that my primary goal in these pages is to evaluate a model for the evolution of increasingly complex hunter-gatherers with a temporal record from one location (Alaska's Kodiak Archipelago).

The second goal, of integrating hunter-gatherers into general evolutionary models, has generated some controversy as hunter-gatherer researchers have claimed more significant roles for their subjects in trajectories of general cultural evolution [see ARNOLD 1996a, 1996b; FEINMAN 1995; PRICE and BROWN 1985]. Proponents of traditional models that view food production as the key to emergent complexity find it difficult to make room in their models for hunter-gatherers with high population densities, sedentary residence patterns, stratified and hierarchical social structures, sophisticated military organization, or private property. Or perhaps more accurately, they find such occurrences insignificant in the face of "general cultural evolution" [*sensu* SAHLINS 1960] and the evolution of states and empires.

This paper seeks to address the second goal through demonstration that significant change in the direction of cultural complexity can and has occurred in this as in other cases of hunter-gatherer social evolution. It is not my goal, however, to argue that all "more complex" societies, necessarily passed through a "complex hunter-gatherer stage", nor do I wish to imply that the complexity observed among the Kodiak Alutiiq and their neighbors around the North Pacific Rim is somehow comparable to "complexity" as often attributed to so-called complex chiefdoms and states. The confusion that has arisen with "complex hunter-gatherer" studies most likely relates to different usages of the complexity concept.

Definitions

I believe that a truly processual model of social evolution must recognize that complexity is not a threshold characteristic, but a scalar one. And for the purposes of this paper, I define *emerging complexity* as a demonstrable trend towards increased social integration and social differentiation within a single historical trajectory or cultural lineage. *Social integration* is generated by increased economic, social, and political interdependence, and can be measured with reference to such factors as co-residential group size, coordinated land-use patterns, specialization and exchange. *Social differentiation* relates to variation in horizontal and vertical dimensions of status and power. The horizontal dimension can be tracked with reference to patterned variation in tool assemblages, features, activity locations, and evidence of craft specialization. The vertical dimension is measured through variation in the quality and quantity of materials across populations (at several scales from household to village to region). While many of these measures reach their greatest expression only among agricultural populations, hunter-gatherers have achieved greater degrees of complexity than has been recognized in the past.

One point of divergence between my view and those of others common in the literature on emergent complexity is the notion of thresholds. Arnold [1993, 1996a: 91-92] has recently argued that explanations of emergent complexity should isolate threshold conditions capable of discriminating significant social organizational modes. While punctuated evolution [*sensu* ELDRIDGE and GOULD 1972] may characterize social change, building thresholds into our models is methodologically problematic. At best they are heuristic devices for measuring *degrees* of complexity and at worst a form of typological segmentation that obscures incremental changes or variability [DUNNELL 1986; FEINMAN and NEITZEL 1984; O'SHEA and BARKER 1996]. Threshold models are convenient for drawing cross-cultural comparisons because they provide a simple scale on which to argue for membership in a class (e.g., "complex hunter gatherers"), but they can obscure processual relationships in the evolution of complexity in any particular case. I believe the scalar definition is better able to deal with variability in the archaeological and ethnographic records.

I note also, that while social inequality is a component of complexity as I have defined it (embedded especially in the concept of social differentiation: see also Johnson [1982]), social inequality is *not* synonymous with complexity. Recent treatments of emergent complexity, especially with regard to the evolution of complex hunter gatherers, have focused more on the evolution of institutional inequality and social hierarchy than on the broader issue of complexity [e.g., AMES 1994, 1995; ARNOLD 1993, 1996b; HAYDEN 1994; MASCHNER 1991, 1992, 1997; MASCHNER and PATTON 1996; PRICE and FEINMAN 1995]. This may reflect a general feeling that complexity is too messy a concept to be analytically useful, as it embraces a number of economic, social, and political variables whose internal relationships are as yet poorly understood. The change also certainly derives from a general shift away from systemic questions to questions of agency and power in social evolution [see BRUMFIEL 1992]. Breaking emergent complexity into its component variables and seeking to explain each on its own terms is pragmatic [see FITZHUGH 1996]; giving priority to any one variable by fiat of definition, however, is likely to be misleading. Given that political structure can influence social and economic relationships as readily as the reverse, a holistic view of emergent complexity is to be preferred over an exclusively political one.

Critical Variables in the Emergence of Complexity

A host of variables have been proposed in processual models of emergent complexity [see BURCH and ELLANA 1994: 220-221]. These include, among others, population growth [CARNIERO 1970; HAYDEN 1994, 1995], population pressure [COHEN 1981, 1985; Keeley 1988], shifts in patterns of residential and logistical mobility (including sedentism) [BINFORD 1980; KELLY 1991, 1995], development of storage mechanisms [BARNARD and WOODBURN 1988; TESTART 1982; WOODBURN 1982], resource abundance [HAYDEN 1994, 1995], environmental variability [HALSTEAD and O'SHEA 1982; SCHALK 1977, 1981; YESNER 1994], information management [AMES 1981, 1985; JOHNSON 1982], warfare [COUPLAND 1988], and control over non-kin labor [ARNOLD 1993, 1996a, 1996b; HAYDEN 1995]. Some models have emphasized group-level adaptation to environmental stress, while others have posited internal conflict and competition [FITZHUGH 2000]. Summaries and comparisons of these models can be found in Ames [1994], Arnold [1996a], and Maschner [1991, 1992].

My approach to emergent complexity on the Kodiak Archipelago draws deeply on a number of previous models and most of the variables mentioned above. In the pages that follow, I will outline aspects of a model for the emergence of increasing economic, social and political complexity of hunting and gathering populations along the North Pacific Rim. This model relies on insights from evolutionary ecology, including optimal foraging theory [e.g., BROUGHTON 1994; KAPLAN and HILL 1992; STEPHENS and KREBS 1986] and social competition theory [cf., BOONE 1992]. It is also consistent with some aspects of other models that posit social change as a result of cooperative "adaptive" behavior [e.g., BINFORD 1980; HALSTEAD and O'SHEA 1989; SCHALK 1977, 1981] and competitive social and ideological behavior [e.g., CLARK and BLAKE 1994; FRANKENSTEIN and ROWLAND 1978; GILMAN 1991]. And while it is not framed in the terms of agency and action and downplays the role of ideology in favor of ecology, the model is consistent with aspects of practice theory that situate change in the self-interested behavior of individuals in a dynamically iterative environment [cf., BRUMFIEL 1994; CLARK and BLAKE 1994; DOBRES and HOFFMAN 1994, see also FITZHUGH 2000; ORTNER 1994]. This model should apply anywhere that hunter-gatherers colonize a highly seasonal and patchy environment as they did along the North Pacific Rim.

MODELLING EMERGENT COMPLEXITY FOR THE NORTH PACIFIC RIM

The model outlined here addresses two dimensions of emergent complexity: economic (integration and diversification of subsistence pursuits and the emergence of symbolic currencies or "prestige economics") and socio-political (integration and differentiation of members of social groups). While these two dimensions are not locked into a deterministic relationship, they are integrally connected.

Expansion Phase

For some period of time after a population colonizes a relatively productive habitat, populations should grow and expand across the landscape until reaching a point at which resource return rates diminish substantially and/or population densities inhibit mobility [ERLANDSON *et al.* 1992; cf., DUMOND 1965; ROGERS 1992; VOLAND 1998]. The expansion phase should be relatively protracted for these hunter-gatherers whose fertility and mortality are conditioned by seasonal resource impoverishment and the absence of storage strategies for extending resources through the lean season. Spatio-temporal variability in resource productivity and the vulnerability of particular patches to predatory depletion would be dealt with by means of logistical and residential mobility during the expansion phase [FITZHUGH 2002; see also BINFORD 1980; BROWN 1985]. During this period, the most significant challenges to the colonizers and their descendents would be mastering the new environment and adapting or innovating technologies and strategies appropriate to it. So long as expansion into adjacent territory is relatively inexpensive (patches are close together and similar to each other), there should be little pressure for evolutionary changes in the degree of economic, social, or political complexity.

Predictions for the earliest stage include low population densities (low site densities), small co-residential group sizes (small sites), and mobility dictated by foraging concerns and unconstrained by human population density. Residential mobility could be low or high, depending on the productivity and sustainability of logistically accessible patches, but should be relatively high during seasons of low productivity in the absence of substantial storage technology [FITZHUGH 2002]. At an archaeological scale, I expect to find people maintaining maximal flexibility to move to previously uninhabited locations, which should be reflected archaeologically through a lack of evidence of energetically expensive non-portable facilities and technologies.

Effects of Circumscription

All populations can be expected to grow when unconstrained by resource availability (variability) and territory in which to expand. However, once constraints are realized, two of the first changes should be a contraction of foraging ranges. Foraging patches (especially those with high ranked prey) and settlement locations should be re-used more often and more predictably by the same groups compared with the expansion phase.

Increased foraging pressure should lead to resource depression (decline in productivity as a result of predation) of slowly reproducing species, which also are typically the larger and more highly ranked species in mobile hunter-gatherer diets [BAYHAM 1979; BROUGHTON 1994; GRAYSON and CANNON 1999].[1)] When slowly reproducing species are over-harvested, they also tend to become unstable [WINTERHALDER *et al.* 1988], and predators will experience increasing variability in returns over time. This effect will be amplified for predictably located and isolated populations of high ranked prey patches. Over time, predation could diminish the size of these populations to the limits of viability or, alternatively, force them to relocate in areas less accessible to human predation [see HILDEBRANDT and JONES 1992]. Either development would adversely affect foragers, exposing them to more frequent but unpredictable declines in resource harvests.

While decreased mobility is known to increase the fertility of reproductively aged women in certain contexts [KELLY 1995: 256], other factors are likely to work against significant population growth at this point. Life history models show that individuals will often shift reproductive strategies when subsistence opportunities are limited, choosing to invest in the survivorship of fewer offspring [VOLAND 1998 and references]. This effect is matched by decreased fertility and increased mortality under conditions of increased nutritional stress [ELLISON 1994; KELLY 1995: 249-250; WILMSEN 1982]. The end result is reduced population growth, which may or may not stabilize at some equilibrium size [ROGERS 1992; WINTERHALDER *et al.* 1988; WOOD 1998].

When high-ranking resources decrease in availability, hunter-gatherers typically expand their diet to include resources of lower post-encounter return rate [KAPLAN and HILL 1992]. Optimal foraging models specify the economic logic presumed to underlie shifts in diet breadth [WINTERHALDER and SMITH 1981; KAPLAN and HILL 1992]. One result of the inclusion of lower ranking resources into the diet with resource depression of higher ranked resources is an incremental shift to species that commonly can better withstand predation, but that have higher individual processing costs [see HAYDEN 1981]. Without modifications in harvesting and processing technology, these species are more expensive to harvest than higher ranked resources, and for this reason, expanding diet breadth cannot by itself relieve constraints on forager population growth. It will, however, help to buffer populations from the increased exposure to variability in returns of high ranked resources, tending to dampen oscillations in forager populations and supporting the establishment of an equilibrium population size.

While economic inequality can emerge in low density populations where stable and productive resources are clumped and defendable [see LEGROS 1985], the absence of methods for producing and/or extending productive resources for the winter would tend to diminish the utility of resource hoarding or defense. Occasional winter residential mobility (within the newly confined range) would remain a better strategy for buffering spatio-temporal resource failure, and sharing would probably be encouraged as well [see BLURTON JONES 1987; HAWKES 1992; HALSTEAD and O'SHEA 1989; WINTERHALDER 1986, 1996.]

Several predictions arise for this phase of the model. 1) Range contraction and decreased residential mobility (repetitive re-use of camps and foraging patches) should be apparent as an increase in durable constructions and non-portable technologies. 2) Resource depression should be observed in the faunal record of larger mammals (especially those predictably located in clearly defined locations; e.g., sea mammals), with an increase in the relative dietary contribution of smaller prey of higher processing cost [BROUGHTON 1994]. 3) Site deposits should be thicker and more dense due to a greater frequency of site re-utilization and increased intensity of site construction. 4) No significant change of residential group size is expected, because this size is controlled by the limits of resource productivity within limited ranges during lean seasons. Aggregation for social purposes would be most likely during summer months when resources are sufficiently plentiful to support such gatherings [WOBST 1974]. Aggregation sites might include evidence of multiple portable dwellings, and could include evidence of a core population of more permanent residential structures belonging to the host group. 5) No significant evidence of mass harvesting or storage should be observed. And 6) I expect little evidence of vertical social differentiation (house size variation, etc.), competition (military tools or installations), or prestige symbols (elaborate ornamentation, monuments, labor-intensive crafts).

This state of affairs could persist indefinitely with little change in subsistence economy, population densities, social integration or differentiation. On the other hand, I have argued elsewhere that people tend to be more prone to inventiveness when they find themselves increasingly vulnerable to variance in subsistence returns [FITZHUGH 2001], as they would with increasing social circumscription. While many innovations are likely to fail, the tendency towards increased inventiveness in times of stress should lead often to technological evolution [see DUMOND 1965]. And it is technological evolution (defined broadly) that is needed to promote further economic, social and political complexity.

Advances in Technological Efficiency and Population Growth

Storage is a reasonable alternative to mobility in maintaining access to resources of synchronized and predictable temporal variation, especially at the annual or sub-annual scale [cf., GOLAND 1991; O'SHEA and HALSTEAD 1989]. But to extend resources effectively through a lean season, techniques must be available to harvest sufficient resources during the productive seasons [cf., TESTART 1982; WOODBURN 1982]. Short-term strategies might include increased effort in foraging at a loss of efficiency (labor intensification [BOSERUP 1965, 1981; see BROUGHTON 1994]) and technological modifications that increase the efficiency of foraging (technological intensification). In the longer term, however, intensification (in labor or technology) on slowly reproducing species (e.g., seals and sea mammals) would accelerate resource depression [cf., BROUGHTON 1994] and risk throwing the foraging population into a demographic crash [see WINTERHALDER *et al.* 1988]. Technological changes that reduce the effects of resource depression by altering the foraging efficiency of small, aggregated, and rapid recruitment species ("r-selected" species like salmon and herring) would support a shift to a storage-based approach and simultaneously increase the potential for increased population densities. The development/adoption of mass-capture technologies and rapid processing methods would accomplish such a restructuring [MADSEN and SCHMITT 1998; cf., HAYDEN 1981]. This will in turn support the establishment of more sedentary settlements, and the development of larger co-residential units ("villages") for the first time.

From this I predict that any increase in population density (recorded in increased contemporaneous sites densities and/or site sizes) will only occur after the development of mass-capture and mass-processing techniques focused on the harvesting and storage of aggregated and sustainable resources. Around the North Pacific, salmon, herring and other schooling fish are likely targets for technological intensification [SCHALK 1977, 1981]. For the first time, settlements should expand in size and include larger numbers of structures.

Risk and the Emergence of Socio-political Complexity

One common feature in models of increased social inequality is the assertion that subordinates should participate in systems of disenfranchisement only if such participation is deemed to be the best of available alternatives [Boone 1992; Clark and Blake 1994; Gilman 1991]. Where potential subordinates are able to "vote with their feet" and escape to environments with greater opportunities or "vote with their hands" and refuse to support "aggrandizers" or even depose them [cf., Boehm 1993, 1999], inequality should be kept to a minimum. Only where resources are structured in such a way that they can be controlled and defended can we expect people to tolerate subordination. Such an environment is said to be *despotic* [Boone 1992; Vehrencamp 1983].

Realization of a despotic environment requires a landscape characterized by a resource distribution with considerable spatial variability in the productivity and stability of resources [Dyson-Hudson and Smith 1978]. It also requires that the more productive patches and/or technologies be controlled and defended by a subset of the population. Growing population densities have the effect of increasing the structure in the environment by increasing the costs involved in moving from one area to another and increasing the intensity of competition over particularly attractive patches. If not curtailed by the limits of patch productivity (average yield) and stability (variance in yield), the end result of increased population density and patch competition is unequal access to quality resources. This is a situation in which those controlling the better resources have a distinctive advantage in competing with those who do not. Competition of this sort is called *contest competition* [Boone 1992]. Under these conditions, disenfranchised individuals have the choice of leaving (if there is anywhere to go) or trying to gain access to controlled resources through competition or subordination. As defined in micro-economics and evolutionary ecology, risk is exposure to unpredictable variability in some outcome [Fitzhugh 2001; Winterhalder 1986, 1997]. In a despotic environment, some individuals (those with access only to marginal resource patches) are exposed to greater risk than others who control the better patches. In certain conditions, the more risk sensitive people should be willing to subordinate themselves in return for a reduction in risk [O'Shea 1981].

In the early stages of developing inequality, I expect a considerable amount of status competition between individuals and families intent on controlling resource patches and avoiding disenfranchisement. With this development, tension should emerge between the competitive and cooperative strategies of resource production. Extended families or even non-related individuals might recognize benefits to cooperation in the harvest and control of quality patches. Within these groups competition should develop over rights to the dispensation of collective products. Competition for control over resources (and the status that would follow) could be expressed between individuals, families, or villages. And cooperation at these same levels could emerge as the unstable result of political accommodations in defense against outside competitors.

Early in the process of emergent inequality, competition should be expressed in two dimensions. First as kin groups scramble to defend rights to the most productive resource patches, we should see evidence of local rivalry. Larger corporate-kin groups would have an advantage in this competition over resource patches, and leaders best able to coordinate their kin into competitive factions would bring the greatest success to themselves and their corporate group. Within the kin group, rivalry is expected between potential leaders, with this rivalry eventually leading to an established system of social ranking. Stability in the ranking system will depend on the ability of resource controllers to maintain control of their estate (resource territory) and their social group.

Note that population density and a spatially patchy environment are the underlying variables leading to political hierarchy, *not* population pressure or universal resource stress [cf., COHEN 1977; KEELEY 1988] (although some members of the population do need to be ecologically disadvantaged to tolerate subordination), and not uniform abundance [cf., HAYDEN 1994, 1995] (although some members of the population must have differential access to relatively stable and productive patches).

Prestige economies can emerge in the context of differential control over resources and incipient status differentiation, as individuals seek a currency that can advertise relative competitive ability. Evolutionary ecological models of costly-signaling seek to account for this phenomenon [BOONE 1998; NEIMAN 1997; SMITH and BLEIGE-BIRD 2000; VEBLEN 1953]. These models recognize that evolution can favor the development of symbolic currencies whose sole reproductive benefit is the "honest" signaling of competitive advantage. Where physical competition over resources is energetically expensive and hazardous and where foregoing competition is even more hazardous to reproductive potential, individuals will benefit through their ability to predict the outcome of a contest prior to its engagement. If distinctive differences exist between the competitors, accurate reading of costly advertising will be advantageous to both contestants, and the physical engagement can be avoided.

Where humans are involved in competition in a productive but patchy environment, costly-signaling can lead to the emergence of symbolic economies based in the production of elaborately decorated or exotic items with little direct reproductive utility (in contrast to feeding more children, for example). Positive feedback can arise in such symbolic competitions between competitors with roughly comparable resource holding potentials. Displays of wealth, elaborate feasts, give-aways, and public destruction of property are mechanisms that serve to advertise competitive abilities. Unequal kin group competitors would be consolidated, and equal competitors at the local scale could establish mutually beneficial political alliances. Intra-group political coherence would nevertheless depend on demonstrations of military effectiveness and endemic warfare should result at the regional level. This warfare could also contribute slave labor to supplement production and fuel a developing prestige economy.

Individuals and groups unable to compete will be forced to subsist on marginal resources and/or support the emerging elite in return for access to food and defense in desperate times. At the same time, elites must recognize some advantage in supporting subordinates. Labor is one of the few services that subordinates could trade for food and defense that would be attractive to elites engaged in productive competitions with other elites. The prestige economy creates a market for labor in the production of surplus food, craft goods, and other commodities that can serve as symbols of security and control. Therein lies the emergence of patron-client relationships that solidify hierarchical social structures [see ARNOLD 1993; O'SHEA 1981].

Consolidation of Power, Expansion of Integration and Diversification

Since the function of the prestige economy is advertising the productivity and stability of the corporate group and its leadership (to attract/retain followers and to reduce challenges-

"costly-signaling"), value should be attached to displays that demonstrate 1) group productivity (in food and crafts), 2) aggressiveness (in raids, defense, and displays of military prowess), and 3) regional political support (in continued access to "expensive" trade goods). The prestige economy will provide motivation for increased levels of subsistence production, warfare, and trade (a positive feedback). In the absence of an economy of this sort, despotic resource owners might have little reason to support disadvantaged individuals, and could establish economic inequality (in differential access to subsistence goods) without sponsoring higher levels of social integration or complexity. With the prestige economy, the value of labor increases to fund surplus production above and beyond immediate subsistence needs.

Bravery in games, hunting, and warfare would also signal competitive ability and further fuel the prestige economy. Warfare in particular can result where individuals or groups of roughly equal competitive ability skirmish over resource access or as a means of advertising their power in a quest to attract subordinates. Subordinates in turn would recognize an advantage in allying with the most powerful elites. Such elites could afford to offer better benefits, and their strong reputations would discourage raids by all but the most audacious competitors [see HAYDEN 1995]. Warfare is expected to expand in scale as neighboring elites find it advantageous to make political allies with an expanding number of competitors. Such alliances would be unstable because of the dynamic tension between elites and their supporters and between potential allies/competitors. Endemic warfare thus develops both as a product of physical competition over resources and labor, and as a way to signal competitive ability.

The extent of inequality supported in the process described above will depend on the degree of difference in the productivity and stability of different patches. Where patches become overexploited, they will become less predictable and a poor foundation for competitive exclusion and ensuing inequality [see HAYDEN 1996]. On the other hand, if marginal environments become more productive and stable (due to climatic or technological change, for example), competition would decrease and inequality should also diminish. Thus, inequality is contingent on a particular kind of productive control: control over stable but defendable production. Unequal control over resources also requires that those controlling the patch must value increased productivity. Models of hunter-gatherer sharing behavior have shown that surplus production is often not worth defending if it can't be put to some particularly desirable use [BLURTON JONES 1987].

In this phase of the expansion of systems of social inequality and socio-political integration, rank and stratification should become solidified at the local level, the scale of physical competition and defense should expand to the regional level, and a developed system of craft production and trade in exotic goods should be evident. Exotic and labor intensive goods should be controlled by a subset of the population. Slavery can arise in this phase as an outgrowth of endemic warfare and the labor market (fueling the prestige economy). As Ames [1995] has argued, however, this level of complexity is regionally based, and political power should be limited by the competitive actions of neighboring corporate groups. We might add that the scale of political integration should be limited by the scale at which territorial claims can be defended, which is in turn a function of the size of supporting populations, and the ability of elites to attract and retain supporters.

Synopsis

This model suggests an ordered sequence of events in the development of increasingly complex hunter-gatherer societies. These include 1) colonization, expansion, 2) reduced foraging ranges and territoriality, 3) technological changes to overcome seasonal variation, increased population density and village aggregation, 4) increased structuring of residential populations into corporate groups, localized competition, emergence of inequality and ranking, 5) expansion of political alliances, trade, and warfare, and the emergence of a system of symbolic value capable of discriminating individuals on the basis of their access to resources, labor, and networks of power.

While not specifically addressed in the model, changes in the physical parameters of the environment (e.g., climate) should influence the trajectory of change by making spatial or temporal resource variability either more or less pronounced. At any stage of this developmental process, subsequent steps could be retarded or the process reversed. In environments of lower seasonal or spatial variability and/or less defendable resource patches, for example, different trajectories would be predicted [cf., BLANTON *et al.* 1996; HAYDEN 1995].

CASE STUDY: SOCIAL EVOLUTION ON ALASKA'S KODIAK ARCHIPELAGO

In the pages that follow, the model just outlined is explored using a case study from the Alaskan Kodiak Archipelago that spans the 7000 year interval between the earliest known archaeological remains to the Russian contact period near the end of the 18th century. It is necessary to survey this range to get an understanding of the pace of change and the variables involved in the emergence of complexity in this case. This case study draws on published reports as well as survey and excavation research conducted by the author on the southeast side of the Kodiak Archipelago between 1993 and 1999 [FITZHUGH 1996, 2001].

Environmental Background

The Kodiak archipelago is a tight cluster of islands in the northern Gulf of Alaska (Figure 2.1). The islands are situated above a major subduction zone that produces frequent earthquakes and related events throughout the archipelago (e.g., faulting, folding, lithological metamorphosis, tsunamis, and relative sea level changes). Volcanic eruptions on the Alaska Peninsula occasionally spew clouds of tephra ash that can settle on Kodiak, temporarily incapacitating and then rejuvenating land, stream, and near-shore habitats [DUMOND 1979]. Kodiak's mountainous landscape and convoluted coast-line were further shaped by Pleistocene glaciation and Holocene stream erosion. Kodiak weather is dominated in winter by wind and rain storms spawned by the Aleutian Low Pressure System [WILSON and OVERLAND 1986]. In summer, weather tends to be calmer and less wet.

Ecologically, Kodiak has a fairly impoverished terrestrial flora and fauna, in contrast to highly diverse and productive riverine, littoral, and marine habitats. Vegetation is dominated by subarctic tundra supplemented by recent incursion of coniferous forest at the north end of the Archipelago. Only seven terrestrial mammals are known to have been indigenous to the

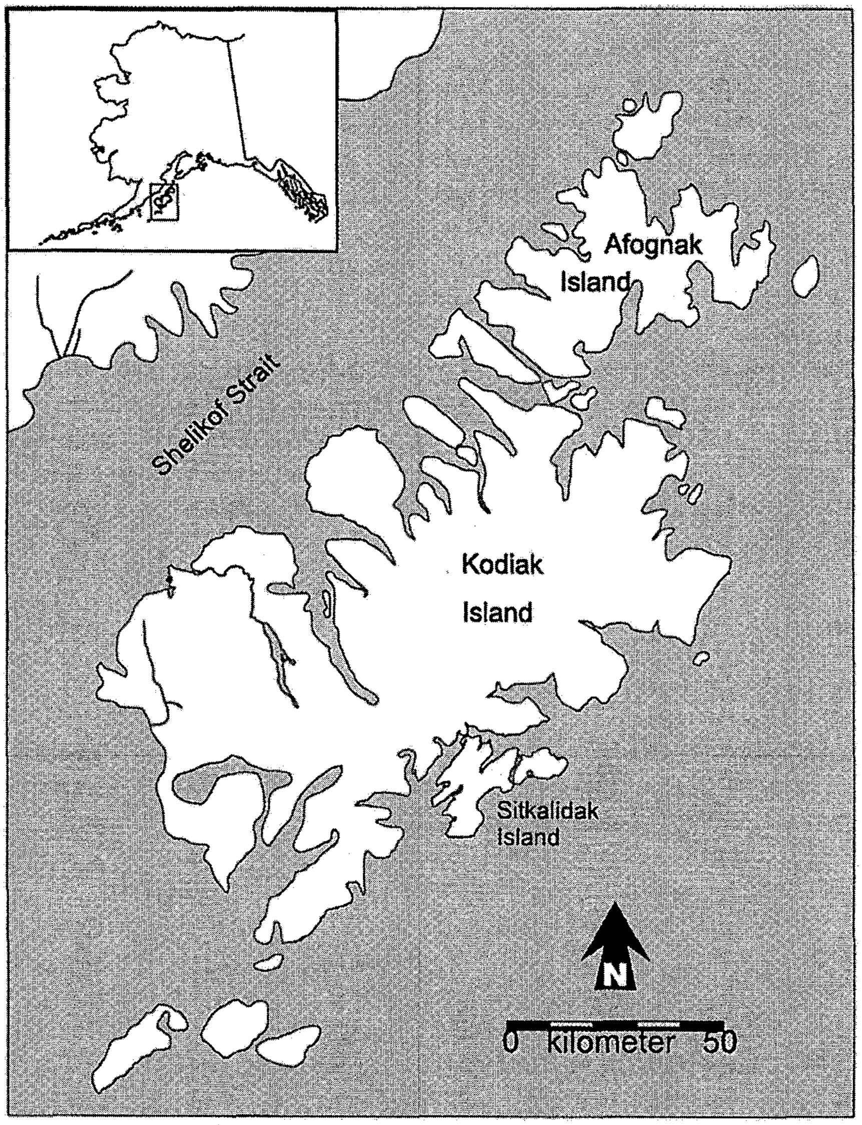

Figure 2.1 Map of the Kodiak Archipelago, showing Sitkalidak Island, where the author has conducted surveys and excavations since 1993.

archipelago, and only a few of these were economically important (bear, fox, otter, squirrel). In contrast to the terrestrial environment but similar to North Pacific coasts in general, high marine productivity supports seasonally abundant stocks of fish (halibut, salmon, cod), birds (resident and migratory), sea mammals (seals, sea lions, whales), and shellfish. Geographic variation in stream flow, near-shore salinity, tidal range, and exposure to wind and wave energy across short distances of coast result in a high degree of micro-environmental variation and concentration of diverse resource patches in close proximity. Seasonal variation in resource availability adds a twist on this productivity and diversity, making winter a particularly lean season in contrast to the summer glut.

Stage 0 Colonization

The oldest archaeological radiocarbon dates place people on the Kodiak Archipelago just prior to 7000 calendar years ago [Fitzhugh 1996]. While earlier sites may remain undiscovered [Clark 1998], I make the working assumption that the original colonists arrived on Kodiak not much before 7,500 cal BP. This assumption is supported by circumstantial evidence, elaborated elsewhere [Fitzhugh 1996]. The colonizers brought with them core and blade technology and affinities for raw materials from the Alaska Peninsula/Aleutian volcanic arc [Fitzhugh 2001]. The water-bound nature of Kodiak and its relatively impoverished terrestrial fauna further suggest that these colonists were proficient seafarers and accomplished maritime hunters and fishers, as were their putative ancestors from the Eastern Aleutians some one thousand years earlier [Aigner and Del Bene 1982; Dumond 1977].

Stages 1-2 Making Hay and Going Hungry in the Garden of Eden: The Ocean Bay Period

Kodiak prehistory is divided into three periods and five phases on the basis of assemblage changes in artifact typologies and other characteristics (Table 2.1). The Ocean Bay period represents the earliest of these periods, dating from around 5500 BC until roughly 1700 BC. Early Ocean Bay technology includes a focus on chipped stone tools (microblades, bifaces, scrapers, flake tools). Flaked stone technology is eclipsed late in the period by the development of a ground slate technology for hunting and cutting implements [Clark 1982; Fitzhugh 2001]. Organic remains from the Rice Ridge site (KOD 363) indicate a reliance on barbed harpoon technology, bone fish-hooks, and a suite of fish and animal resources nominally similar to later periods [Haggarty *et al.* 1991; Haussler-Knecht 1993]. These data indicate that Ocean Bay peoples were actively employed in hook and line fishing, harpooning, and lancing of prey. These are all fairly generalized technologies for hunting and fishing for maritime resources.

Few Ocean Bay period sites have been excavated, making it difficult to draw conclusions on the nature of settlement sizes and occupation intensity. The two sites (KOD 363 and KOD 481) that have been investigated in detail (and not yet fully reported) are fairly large (several hundred square meters) and stratigraphically complex. At a minimum, it appears that these two sites were revisited many times through their occupation histories and their size may be best understood as a result of repeated occupation, not large co-residential groups. Excavations at the Tanginak Spring site (KOD 481) in 1998 and 1999 indicate that the site supported at most three small dwelling structures per occupation [Fitzhugh, field notes].

Based on intensive survey of the southeastern portion of the archipelago in which a minimum of 10 Ocean Bay sites were documented [Fitzhugh 1996], Ocean Bay sites are consistently small with thin occupation layers (often less than 1 cm vertical thickness). This is in distinct comparison to later period settlements, which are often larger with much thicker accumulations. The limited scale and depositional thickness of Ocean Bay sites suggests small co-residential populations who regularly abandoned camps after relatively short intervals of

Table 2.1 Kodiak archaeological periods and common characteristics.

Period	Phase	Radiocarbon ages [a]	Calendar ages [a]	Diagnostic traits
Ocean Bay	I	6700-4500	5500 B.C. - 3200 B.C.	Core and blade technology, flaked tools, ochre floors
	II	4500-3400	3200 B.C. - 1700 B.C.	Ground slate tools, semi-subterranean sod houses
Kachemak	Early	3400-2200	1700 B.C. - 200 B.C.	Toggling harpoon, notched pebbles, semilunar knife
	Late	2200-750	200 B.C. - A.D. 1200	Notched pebbles, coal labrets, decorated lamps, corpse modification
Koniag		750-165	A.D. 1200 - A.D. 1784	Multi-room houses, pottery (localized)
Historic			A.D. 1784 - present	Glass beads, iron, porcelain

Note:
[a]Radiocarbon and calendar ages are mean values and central intercept values, respectively, based on data published in MILLS (1994, Table 1d). Phase breaks were determined by averaging differences between the most proximal dates of two adjacent phases and rounding to the nearest 100.

occupation (whether days, seasons, or years, remains to be determined).

Consistent with the vision of small, semi-nomadic groups, early Ocean Bay structures appear to have been small (ca. 2-3 m in diameter). One of the distinctive features of Ocean Bay structures prior to about 2000 BC are floors coated in red ochre. Ethnohistoric and actualistic data indicate that red ochre is useful in the treatment of hides [JEWITT 1987; PHILIBERT 1994], and ochre surfaces may indicate that treated skin tents were once used. While there is some question about the nature of Ocean Bay I structures at the Rice Ridge site [Donald W. CLARK personal communication 1996], most evidence suggests that semisubterranean sod houses appear only in the in the Ocean Bay II phase [HAGGARTY *et al.* 1991: 120-121; cf., CLARK 1979: 138]. Together, these patterns suggest that Ocean Bay I populations used portable structures (tents) that would have been carried from campsite to campsite without great difficulty.

The suggested abandonment of tents around 2000 BC is significant as a possible indicator of increased population density, reduced residential mobility, and increased territoriality, as predicted at the end of a colonization and expansion phase. Portable structures are efficient for semi-nomadic groups seeking to maintain residential flexibility. When populations become sufficiently crowded, however, permanent facilities make better investments. Durability, insulation, and territorial claims are some of the anticipated benefits.

The semi-nomadic nature of the Ocean Bay people is further supported by the predominance of portable technologies. One measure of the mobility of a culture should be the extent to which labor-intensive implements are portable. Pecked stone lamps are one of the most labor-intensive of tools made throughout Kodiak prehistory (Figure 2.2). In Ocean Bay times, these lamps are universally small, just slightly larger than an adult fist, while in later periods they more closely approximate the size of a small sink (weighing up to 40 kg

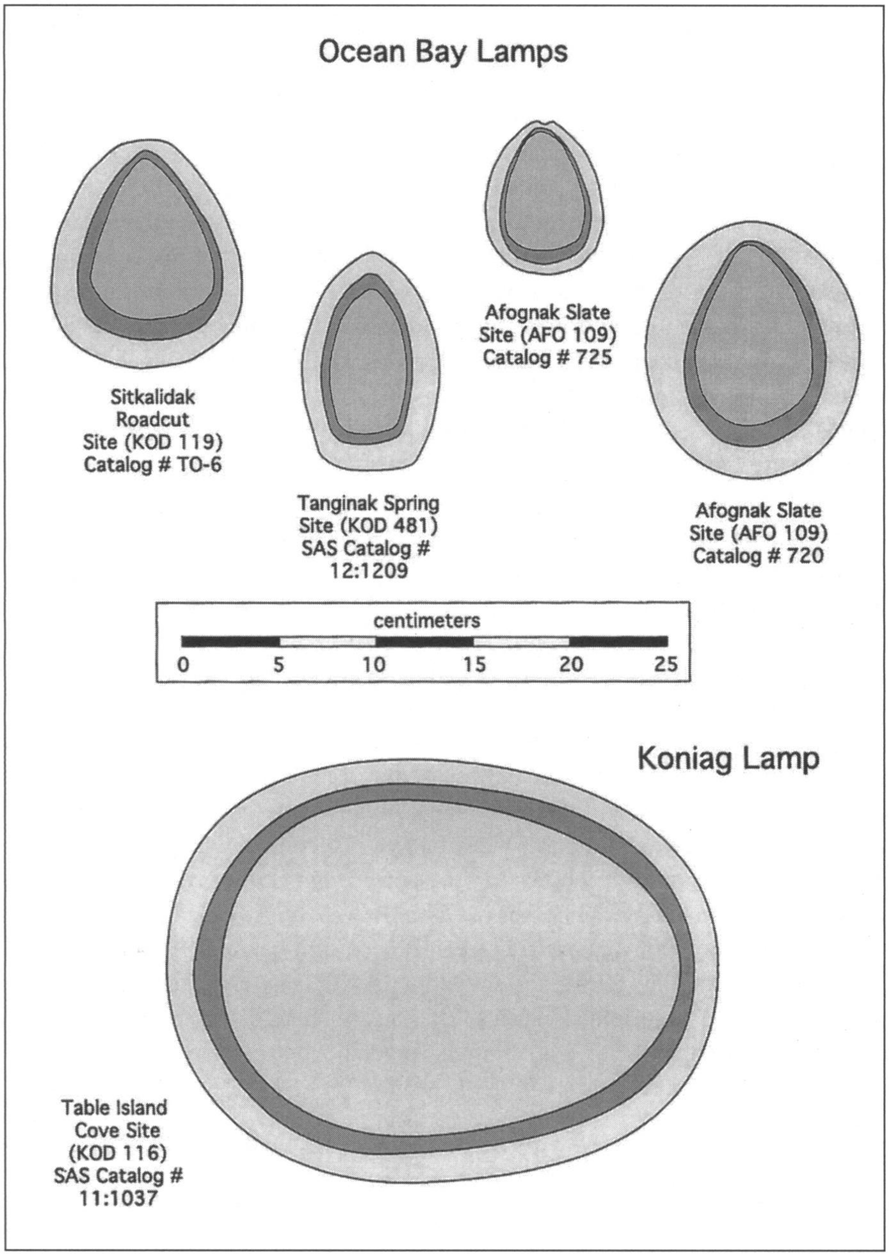

Figure 2.2 Variation in maximal lamp size between Ocean Bay and Koniag periods. Kachemak lamps (not shown) are similar in size to Koniag examples. Small lamps continue to be made throughout prehistory while larger lamps appear first in the Kachemak period. (Lamps with SAS catalog numbers are in the Old Harbor Native Corporation collection [on loan to the University of Washington]; Other lamps are illustrated in CLARK 1979: plates 3j, 23d, 24a.)

[CLARK1998]). Small lamps could be carried easily, while larger lamps were apparently permanent features in houses of later periods.

The settlement pattern of Ocean Bay sites found in southeast Kodiak, suggests that Ocean Bay people preferred to live on semi-protected shores [FITZHUGH 1996, 2002]. They positioned their camps roughly mid-way between the exposed outer coastal zone where sea mammal rookeries and haul-outs could be exploited and where they could reach resources of the middle and inner bays as necessary. These locations afforded maximal logistical flexibility for day to day foraging. There can be little doubt that these groups occasionally camped near productive salmon streams, but the absence of archaeological remains in these locations suggests that they were not involved in the intensive harvesting and processing activities that would have been necessary to sustain a winter store of these resources. This conclusion suggests that resident species were harvested throughout the winter. Despite enhanced storminess and poor visibility, winter foraging near camp would have been more feasible for the small Ocean Bay populations than it would have for later groups, but this winter foraging would have forced the occasionally movement of camp in response to local resource depression [*sensu* BROUGHTON 1994]. Also, warmer conditions during the Ocean Bay I may have translated into reduced storminess during this initial archaeological phase.

In summary, the Ocean Bay period appears to represent small hunter-gatherer bands, whose mobility was logistical on a daily basis and residential on a seasonal or semi-annual basis. They hunted and fished using fairly generalized tools and did not develop intensive harvesting strategies that could translate summer productivity effectively into the winter lean period. Nevertheless, these groups harvested most of the same resources that would dominate subsistence throughout prehistory, and they must have become quite experienced in exploiting resources across a wide range of micro-habitats. Finally there is evidence that populations expanded through this period, ultimately leading to a reduction in the opportunity to practice unrestricted residential mobility by late in the period. This crowding is inferred from the development of semi-subterranean houses in Ocean Bay II. The colonization of the Kachemak Bay area of the Kenai Peninsula by late Ocean Bay culture-bearers [WORKMAN 1998] may reflect reduced opportunities for expansion within the Kodiak archipelago by about 4500 bp. Resource depression of large animals, such as seals and sea lions, is expected late in Ocean Bay times, but faunal data suitable for evaluating this prediction have yet to be analyzed.

Stage 3 Density Dependence, Marginal Gains, and Technological Change: Early Kachemak

The Early Kachemak phase (1700 BC to 200 BC) is the least documented of the prehistoric phases on Kodiak. Nevertheless, recent research and publications have brought the Early Kachemak into clearer focus [CLARK 1996, 1997; STEFFIAN *et al.* 1998]. Among other findings, this work has made a clear case for cultural continuity between Ocean Bay and Kachemak populations [CLARK 1998]. The Kachemak tradition is known as well from the adjacent Outer Cook Inlet and Kachemak Bay area, where it was first reported [DE LAGUNA 1975; WORKMAN 1980, 1998]

Changes that occur during the early Kachemak are both technological and structural.

Toggling harpoon technology entered the Kodiak tool kit with the beginning of the Kachemak period, and this should have increased both post-encounter return rates for sea mammals and hastened resource depression in these taxa. Two other technological changes appear to have facilitated a restructuring of resource ranking and increased population growth. The first of these is the innovation of mass-harvesting technology in the form of nets. Flat, notched stones (shingles) show up early in this phase and are ubiquitous throughout the Kachemak period (Figure 2.3). While other forms of notched stones are seen throughout prehistory in low frequency, Kachemak sites often contain hundreds of notched shingles in middens and on adjacent beaches [CLARK 1984]. While the inferred function of notched shingles has yet to be confirmed, association with nets appears likely given their high frequencies relative to other tool forms. Other developments in the technology, settlement patterns, and demographic trends support the inferred function of notched shingles.

Another notable technological change is the invention of the semi-lunar knife, or *ulu* (Figure 2.3). This tool, compared to stemmed knives of the preceding Ocean Bay II phase, would have decreased wrist strain and increased processing efficiency. Such a development would have provided a distinct advantage in the processing of mass-captured resources with short pre-processing shelf-life. Herring and salmon could have been captured in large quantities in nets placed off beaches and along streams from late spring to fall. Efficient processing techniques would make it possible to store some of these resources into the lean months of late fall and winter. In turn, winter would cease to impose as stringent a bottleneck on population density.

Apparently these technological changes had the effects predicted in phase 3 of the model. First, we see evidence of population aggregation in villages (thought to be occupied most intensively in winter) [HAGGARTY *et al.* 1991]. We also see a consistent shift in settlement patterns with significant settlements established near stream mouths and along the larger rivers [FITZHUGH 1996, 2002; JORDAN and KNECHT 1988; KNECHT 1995]. Unfortunately, the prediction of increased population growth in the Early Kachemak is difficult to evaluate given the probability of site loss from this time period (perhaps due to sea level rise: Gary CARVER, personal communication [1999]). Nevertheless, the pattern for the later Kachemak is consistent with dramatic increases in demographic potential following the invention of mass harvesting and processing technology.

Stage 4 Contest Competition and Incipient Inequality in the Late Kachemak

The Late Kachemak phase on Kodiak fits the initial stages of emerging inequality as elaborated in the model above. This phase dates from about 200 BC to 1200 AD. It witnesses the first significant development of elaborate artistic decoration in a number of different forms. The earliest evidence of 'expensive' bodily decoration is seen in the manufacture and use of labrets worn in holes in the cheeks or lower lip. Most Late Kachemak labrets recovered are fashioned out of coal ("jet") from sources on the Alaska Peninsula [STEFFIAN 1992a] and fashioned in styles that seem indicative of regional affiliation [STEFFIAN and SALTONSTALL 1995]. This practice is consistent with an emerging sense of the importance of group membership, an expected development as social competition begins to intensifies.

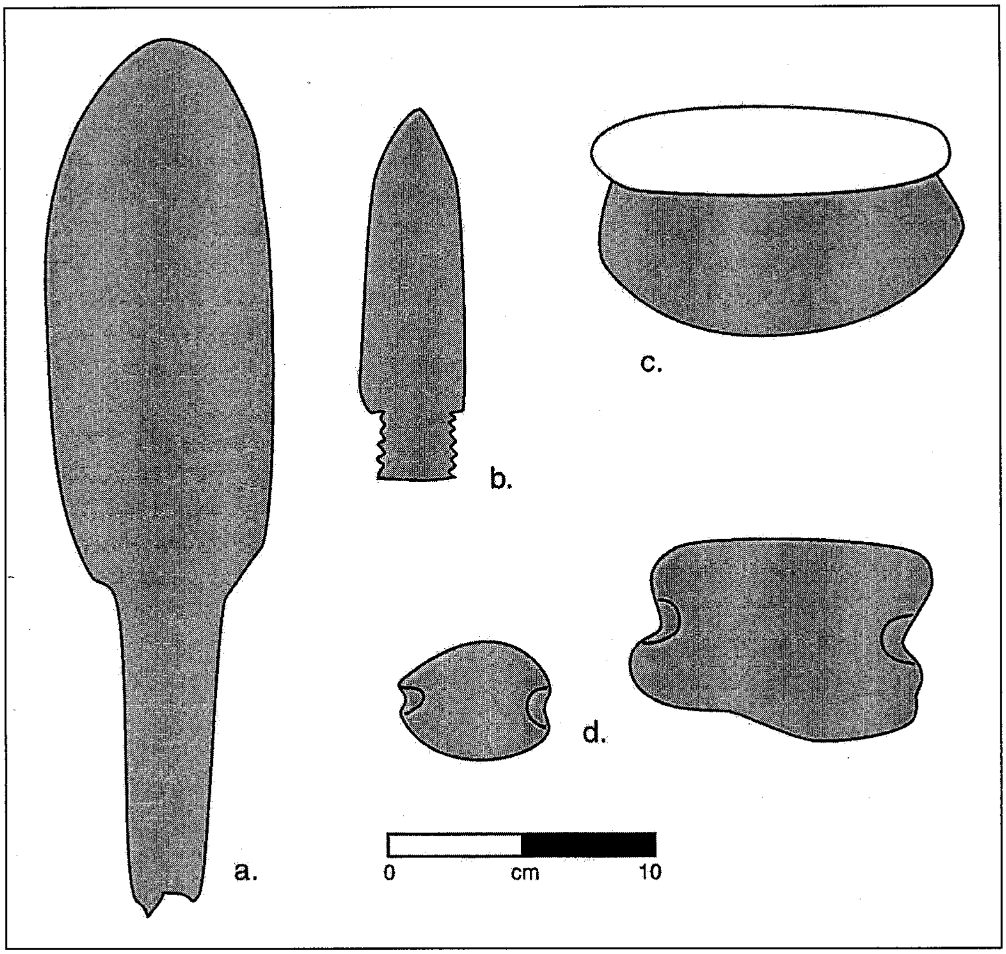

Figure 2.3 Technological change between Ocean Bay II and Early Kachemak Periods.

a) Late Ocean Bay stemmed ground slate knife from Clark's AFO-109 (shown in CLARK 1979: plate 19d). b) Terminal Ocean Bay and Early Kachemak serrated-stemmed knife (schematic). c) Schematic of a semi-lunar knive (ulu), first used in the Kachemak Period (portrayed with handle). d) Notched beach pebbles/shingles, a dominant artifact type from the Early and Late Kachemak phases.

Lamp decorations are also distinctive in the Late Kachemak phase. In contrast to the oil burning lamps of earlier and later phases, Late Kachemak lamps often include intricate relief sculptures of whales, body parts or seated figures. The labor investment involved and the highly visual nature of Late Kachemak lamps is consistent with a costly-signaling model of prestige competition. It may also indicate the development part-time craft specialization in the production of prestige symbols.

Two additional lines of evidence support the growth of social competition in the Late Kachemak. First, we see the development of a mortuary tradition indicative of the emergence of ancestor worship [SIMON and STEFFIAN 1994; URCID 1994; WORKMAN 1992]. This tradition included the defleshing and partial reconstruction of some skeletons which seem to indicate preservation and display of the dead. This practice can be linked to increased attention to descent and claims over the importance of lineages. By Russian contact, Kodiak families had well-established traditions for the preservation and display of important ancestors [HOLMBERG1985: 49]. Based on the Late Kachemak mortuary evidence, aspects of this tradition dates back at least 1000 years.

Finally, towards the end of the Kachemak period, around 900 AD, we begin to see evidence of localized warfare in the use of small defendable landforms [FITZHUGH 1996]. These sites are generally composed of one to two semi-subterranean pit structures perched atop small, steep-sided islands and promontories. I recorded three such sites in the Sitkalidak Straits region of southeast Kodiak, whose initial occupations were dated between 900 and 1200 AD. In comparison to the large defensive villages established a few centuries later, these sites suggest the development of localized inter-family competition.

While several lines of evidence indicate that the Late Kachemak was a time of growing social competition and unrest, other evidence suggests that institutional social inequality was at best weakly established during this phase. Variation in house size is commonly used to explore the development of social inequality [COUPLAND 1996]. Such analysis is based on the assumptions that emerging elites will base their power on larger networks of co-residential kin and non-kin, that larger structures are needed to house these kin and support the productive activities of the group, and that larger structures require greater labor inputs. Large houses are thus both functional (as shelters for residential and productive activities) and representative of the power of a household and its leader (a reflection of costly-signaling).

Late Kachemak house-size variation, from a sample of 74 houses in 31 sites in southeastern Kodiak, is unimodal with only slight skewing towards larger sizes (Figures 2.4 and 2.5). While some sites are quite large by this time with an excess of 22 structures, most sites are smaller (mean = 4 structures), and the structures themselves are mostly only large enough to accommodate small, nuclear families. The sample does include a few significantly larger houses, as might befit a few emerging elite households in this phase. Late Kachemak houses also add one feature that reinforces the view of increased economic competition in this phase: they often include corner alcoves well suited to the internal defense of stored resources [JORDAN and KNECHT 1988; STEFFIAN 1992b; see WIESSNER 1982], as expected where resource hoarding and competition replace sharing and mobility as a mode of securing desired goods.

Stage 5 Consolidation of Political Power and Inequality: The Koniag Period

Historically, the relationship between the Kachemak and Koniag traditions has been a matter of debate [CLARK 1992a, 1992b, 1994, 1998; DUMOND 1988a, 1988b, 1994, 1998; HRDLICKA 1944; JORDAN and KNECHT 1988; KNECHT 1995; SCOTT 1991, 1992, 1994]. While the question of Koniag origins remains unresolved, recent archaeological evidence has shown a greater degree of continuity and gradual change than could support a rapid replacement scenario [JORDAN and KNECHT 1988; KNECHT 1995; see FITZHUGH 1996].

With the Koniag period, beginning about 1200 AD and continuing until Russian conquest in the late 18th century, political competition expands and inequalities become entrenched. Three characteristics of Koniag archaeology fit the model of increased complexity elaborated in phase 5 of the above model.

First, this period witnesses a major change in residential organization. Houses shift from small one-room structures with or without alcoves in the Late Kachemak to much larger multi-room structures in the Koniag (Figure 2.4). This shift brings Koniag residence in line with ethnohistoric accounts of multiple family residence of 18 or more people in single structures [LISIANKII 1814; see CLARK 1987]. Koniag houses are laid out with a large central room and several small rooms arrayed around it. Side rooms were used as family sleeping and sweat-bathing chambers. As illustrated in Figure 2.5, houses became larger, more variable, and positively skewed in the transition from Kachemak to Koniag phases. The pattern is consistent with the emergence of ranked and stratified households, coordinating domestic labor and with differential need for residential and entertainment space (represented by main-room areas).

A change in settlement patterns is also documented around Sitkalidak Island, where Koniag populations aggregated into large villages (2.5 times larger than Kachemak villages; data in Fitzhugh [1996]). These villages are typically situated on the exposed or semi-exposed coasts. This shift appears to reflect the addition of whale hunting in terminal Kachemak and Koniag times, with populations aggregating for the fall hunt and dispersing to fishing camps in late spring. Koniag village sites typically contain as many as 20 to 30 houses and are commonly

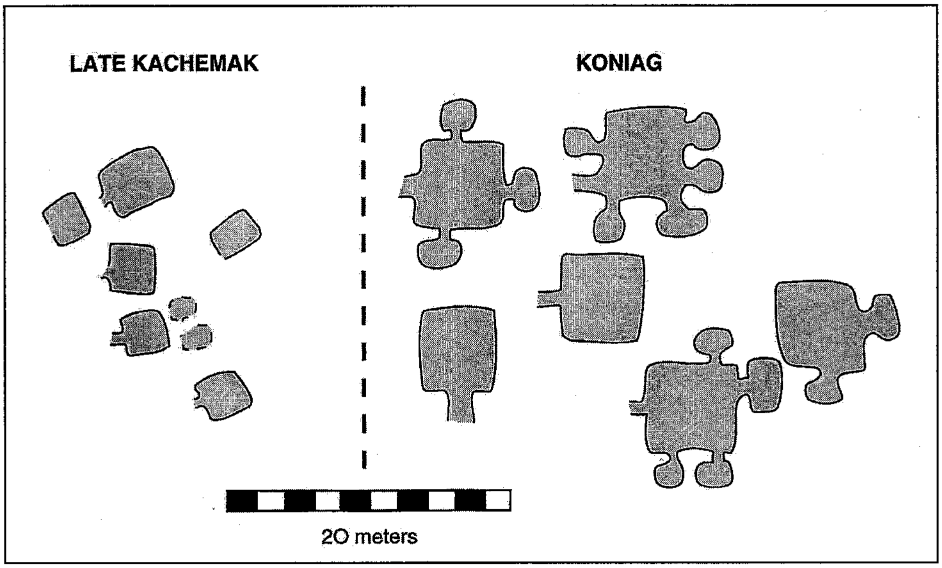

Figure 2.4 Comparison of Late Kachemak and Koniag house form and size (examples represent actual configurations in two village sites from Sitkalidak Island).

littered with whale bones.

Whale hunting is notable as a high-risk hunting venture with uncertain returns. While successful hunts were doubtless a huge boon to community subsistence, I suspect the hunt evolved as much for its potential to differentiate the competitive abilities of hunters (for description of Koniag whale hunting see Crowell [1994]). The whale hunt would have provided a powerful mechanism for status competition. Such a competition was doubtless supported by

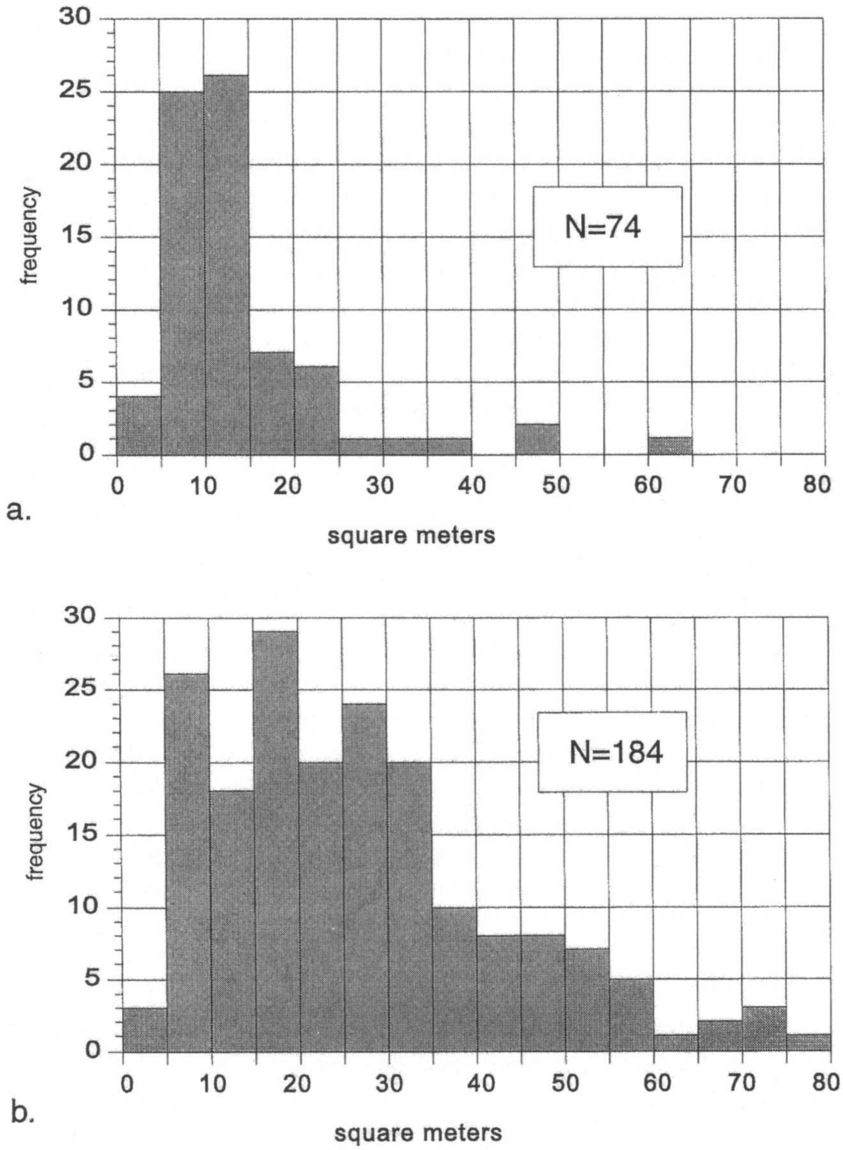

Figure 2.5 Metric variation in (a.)Kachemak and (b.)Koniag houses from the Sitkalidak region of Southeast Kodiak [FITZHUGH 1996].

community members eager for whale meat and oil.

Warfare on Kodiak would have been another avenue for status competition, but by the mid-Koniag period, all evidence suggests that warfare (or at least defense) was a community, rather than a household, affair. Koniag defensive sites, like those of Late Kachemak times, are situated on defendable cliff-faced islands. Unlike their predecessors, however, Koniag refuge sites are much larger, with as many as 50 structures, and strategically situated for defense from distant rather than local attackers [FITZHUGH 1996]. Ethnohistoric evidence [DAVYDOV 1976] indicates that Koniag warfare was typically practiced against distant enemies (some as far away as the Aleutians and American Northwest Coast). Large raiding parties of men and women would attempt to sack the villages of their enemies, killing all adult men and capturing women and children into slavery. The practice was duplicated by other groups throughout the northern Northwest Coast and Aleutians [DE LAGUNA 1983, 1990; EMMONS 1991; MITCHELL 1983; TOWNSEND 1983]. Research in these adjacent and more distant areas of the Gulf of Alaska, Aleutians and Northwest Coast indicate that large late prehistoric villages and defensive fortifications were used in these other areas as well [MASCHNER 1992; MASCHNER and REEDY-MASCHNER 1998; MOSS and ERLANDSON 1992].

Finally, the Koniag period witnessed a surge in population growth, no doubt supported by changes in technology that improved salmon harvesting in rivers, whale hunting on outer coasts, and regional specialization and exchange of staples across the archipelago and beyond [see FITZHUGH 2001]. Estimates of population for the Sitkalidak area, the Kodiak Archipelago, and the Gulf of Alaska region as a whole all show exponential population growth from the beginning of Late Kachemak to the end of the Koniag period [ERLANDSON *et al.* 1992; FITZHUGH 1996]. In general, this pattern is observed more broadly across the North Pacific Rim [see MASCHNER 1991, 1992, 1999, MOSS 1998].

By the contact period, Koniag individuals claimed ownership to most resources patches, such as sea mammal rookeries, salmon streams, egg collecting islands, shellfish beds, and raw material sources (like amber) [HOLMBERG 1985: 59-61]. They also had traditions of inherited rank, competitive feasting, and supra-village alliances [see FITZHUGH 1996: 25-42].

In general terms, the complexity observed in late prehistory on Kodiak was paralleled by developments around the North Pacific at least from the central Northwest Coast (Washington State) to the Eastern Aleutians. Kodiak appears to have been in the middle of an extensive late prehistoric interaction sphere in which populations had similar social organization and were compelled to participate in trade and warfare by a network of neighboring competitors [see TOWNSEND 1980; also AMES 1995; MOSS 1998; MOSS and ERANDSON 1995].

DISCUSSION AND CONCLUSION

If we scan the extent of Kodiak prehistory, we see a significant increase in complexity through time, measured on several dimensions of complexity (economic, social, political) and in both axes of integration and differentiation. Kodiak inhabitants started with relatively generalized technologies. Mass harvesting and processing of fish appears to have been the single most effective change in Kodiak subsistence. To this we can add the development of a prestige economy in the Late Kachemak phase that changes through the Koniag into a major inter-regional exchange network in subsistence products, furs, rare minerals, labor intensive crafts, and slaves [BURCH 1988]. Warfare expands in tandem with exchange from a localized interaction to pan-regional networks of allies and enemies. In Koniag times, we can see structural reorganization of residence patterns consistent with a change in social organization and the emergence of institutionalized, household based ranking. As on other parts of the Northwest Coast at contact, the Koniag had slaves, commoners and nobles [RUYLE 1973]. However, the distinction between commoners and nobles was probably not rigid, as the fortunes of families rose and fell based on their ability to out-produce their competitors [see AMES 1995].

The data presented here support the model outlined earlier in the paper for the evolution of complex hunter-gatherers on Kodiak and in similar circumstances around the North Pacific Rim. For each phase of the model, the data available appear supportive. This is particularly significant because the model was formulated prior to the collection of much of the data summarized here [FITZHUGH 1993]. Nevertheless, additional lines of evidence are desirable to better evaluate the model, and the role of external factors (such as climate change) must be considered [see FITZHUGH 1996]. In particular, faunal analysis from every phase of Kodiak prehistory will provide an independent test of the predictions of resource depression and changes in subsistence practices. More and more detailed excavations of sites of all periods are needed to assess the patterns inferred from a small number of excavations and surveys. The Ocean Bay and Early Kachemak phases remain the most in need of investigation. And for all phases, higher resolution chronological control will help us evaluate causal sequences in the evolution of complexity in this case.

The Kodiak evidence can be brought to bear on several models of emergent complexity and social inequality, which I will mention briefly here. A common claim of many modelers is that productivity is a necessary and sufficient condition for the emergence of complexity/inequality [e.g., HAYDEN 1995]. The long interval between colonization and the establishment of significant levels of complexity in this and other cases makes any simple relationship between complexity and environmental productivity unlikely [see also ARNOLD 1996a: 98]. On the other hand, absence of productivity would most certainly inhibit increased social complexity. Circumscribed abundance appears to be one critical factor [see BOONE 1992; MASCHNER n.d.]. As such, the evolution of inequality appears to require the development of a geographical landscape structured by peaks and valleys in productivity and resource stability. Linked to this physical space should be an "adaptive landscape" [*sensu* WRIGHT 1932] for which some individuals find it rational to subordinate themselves in return for distributive benefits from resource controllers, and where resource controllers find it rational to control stable and productive resources through competition and defense. Such control doubtless depends on the ability to organize supporters into competitive factions and will involve some combination of generosity and intimidation [CLARK and BLAKE 1994; HAYDEN 1995, 1996]. Emphasis in some recent models on corporate and networking modes of status competition also harmonize with the Kodiak model presented here [BLANTON *et al.* 1996; HAYDEN 1995].

Two points must be made in closing. First, while many recent models are consistent with the results reported here, older models are also echoed in the Kodiak trajectory outlined. Most conspicuous perhaps is the role of population pressure, realized through the prediction of resource depression in early stages and structured patch competition in later stages. I find it difficult to escape the importance of human demography in social evolution, but at the same time, it is important to recognize that population pressure occurs in particular situations, and has particular impacts on social processes.

For example, resource depression under egalitarian situations should be experienced by all members of a group or population, and it could do little to encourage inequality. On the other hand, the development of despotic control over productive patches could lead certain subgroups to experience resource scarcity while others do not. It is the degree of this separation that should translate into willing subordination, where controllers can realize benefits from patronage. The result should be the development of a dynamic set of relationships between competing elites and non-elites, that can promote prestige competition and symbolic economies, warfare, feasting, and slavery. While population pressure is present in this model, in no way does it insure a progressive march towards complexity — populations can and do remain stable or decline in the face of environmental constraints. And it is far from a prime mover of the model.

Finally, a closing reflection on the topic of this paper and volume is in order. In opening, I pointed out two areas in which complex hunter-gatherer studies have been pursued. Perhaps equally significant has been a shift away from studies of complexity to seemingly more tractable issues, such as inequality [e.g., PRICE and FEINMAN 1995]. I regard this as a result of adjustment in theoretical focus from systems and groups to individuals and their agency in evolutionary change [see BRUMFIEL and FOX 1994; SMITH and WINTERHALDER 1992]. I am firmly committed to seeking individual level mechanisms in social evolution (be they biological or cultural), and I worry about the messiness of concepts like complexity. Nevertheless, complexity remains a good umbrella under which to observe the conjunction of social variability and evolutionary process. While explanatory models may sometimes require the disarticulation of economic, social, and political dimensions, ultimately a full explanation requires that we look at the contextual relationships between all of these.

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NOTE

1) Exceedingly large animals such as whales are the most notable exceptions to the generalization that larger prey are more economically efficient forager targets. This result is due to the high handling costs associated with such species.

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