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Exchange Systems and Sociopolitical Complexity in the Central Sierra Nevada: Perspectives on the Impact of Coastal Colonization on Inland Communities

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Diachronically oriented anthropologists have long studied the consequences of culture contact and the impact of previously separated cultural systems upon the structures and functions of each other. Colonization forms an important subset of such interactions (see, for example, Lightfoot 1995; Lightfoot and Martinet 1995). Relatively less attention has been paid to the effects of the commencement of colonization on societies lying outside of newly established colonial systems. This is such a case and and looks to understand it from several theoretical perspectives.

The case in question concerns California's Sierra Nevada in the late 18th and early 19th centuries. Particular emphasis is given to the Central Sierra Nevada, the traditional ethnographic territory of the Miwok people, where the writer has done archaeological fieldwork during the last 15 years or so. Unlike California's coast, which began to be colonized by Spain starting in 1769, the gear bulk of the Sierra Nevada did not come under the formal control of European or Euro-American culture until the onset of the 1848-1849 Gold Rush.

The Sierra Nevada remained under the ostensible control of Native American societies during the eighty-year timespan between the onset of coastal colonization and the Gold Rush. Nevertheless, it is suggested that the those indigenous Sierra Nevadan societies were profoundly affected by the consequences of colonialism along the Pacific Coast (see Phillips 1993 for a fuller discussion). The present discussion attempts to indicate the nature and magnitude of that impact, and to consider some possible ways that the impact can be understood in terms of more general principles.

MODELS OF CALIFORNIA SOCIOPOLITICAL COMPLEXITY

This discussion begins with a brief consideration of some changing perspectives on the nature of sociopolitical complexity in aboriginal California. Probably the most comprehensive overview of California ethnography in recent years has been Volume 8 of the HANDBOOK OF NORTH AMERICAN INDIANS (Heizer 1978). Understandings of California sociopolitical systems presented in that collection were developed by several dozen different authors and reflect a good deal of prevailing opinion at the time. They, in turn, reflect models stemming from the work of Alfred L. Kroeber, his

students and colleagues during the first half of the twentieth century (e.g., Kroeber 1925). This point should scarcely be surprising, since Kroeber and his students trained a good many of the authors of Heizer's 1978 volume.

The Kroeberian view stemmed from ethnographic accounts gained from Native Californian informants whose own adult experiences extended no farther back in time than to the second half of the nineteenth century, with rare exceptions. They also were influenced by prevailing understandings derived ultimately from the evolutionary perspectives of Herbert Spencer and Lewis Henry Morgan that cultural evolution in the past had been toward greater complexity over time (see Harris 1968, for example).

The resulting perspective has two central elements of particular relevance that this point. The first is that Native Californian societies never developed any serious degree of sociopolitical complexity. The reconstructions presented by Kroeber (1925) and Heizer (1978), for example, indicate that aboriginal California consisted of more than 100 ethnic peoples. These groups were generally understood to have lacked any forms of sociopolitical organization that united entire ethnic groups [an interesting exception, discussed by Kroeber (1925) on pp. 726-728, was that of the Mohave, a Colorado River people which did use tribal organization in some respects such as warfare]. Instead, the ethnicity of Native California cultures was identified particularly by the shared language spoken among unaffiliated communities. These communities, in turn, were usually interpreted as displaying little or no degree of the traits of complex societies, such as internal ranking, political power, or other marks of social differentiation and inequality.

The other element of note is the assumption that indigenous California societies reached their greatest degrees of sociopolitical complexity at the end of prehistory, and that whatever trajectory they were on toward greater complexity was cut off by European colonization. This view also is reflected in more recent syntheses of California prehistory (see Chartkoff and Chartkoff 1984; Moratto 1984, for example), as well as in various ethnographic and ethnohistoric analyses. One can see in S.F. Cook's population estimates for Native California, for example, the unquestioned assumption that population levels had reached their greatest figures at the eve of the historic era (e.g., Cook 1976).

That this viewpoint need not be true is shown elsewhere in North America in the archaeological record. A thousand years ago, for example, communities with populations of 20,000 or more could be found at Mississippian centers such as Cahokia, Moundville, Etowah and Spiro. In the Southwest at the same time, similarly large populations lived together in Chaco Canyon. By the time Europeans arrived 5-6 centuries later, there were no Native American population concentrations of that size anywhere north of Mexico. Similarly, there were no communities in the 16th or 17th centuries that exhibited the degree of sociopolitical ranking expressed architecturally at the Mississippian centers, or the regional water control systems such as the Hohokam had developed in the Southwest (see Fidel 1992, for example).

The patterns revealed through recent archaeological research in several other parts of North America suggests that systems with substantial populations and marked degrees of sociopolitical complexity developed there in prehistoric times, and had declined to smaller, simpler levels by the time of European arrival. The possibility that prehistoric California also might have had greater degrees of sociopolitical complexity than described in the Kroeberian model has come to be considered by a number of scholars in recent years, especially starting with Bean and King (1974:3-18) and Bean and Blackburn (1976: 45-48; 99-124; 289-318). Arnold (1993) has made a strong case, based on archaeological evidence, for the occurrence of chiefdom levels of complexity along the California coast.

The Kroeberian assumption that California societies were all egalitarian can now be challenged, it should also be appropriate to examine the companion assumption, that the

greatest levels of size and complexity were achieved only at the end of prehistory. As a step in that direction, this paper considers the possibility that ethnographic descriptions of Sierran cultures such as the Miwok describe systems that had already become reduced. It is argued that the major cause of any such reduction would have been the prior breakdown of regional systems of interaction which occurred when coastal peoples had become colonized by Spain and Mexico.

THE SIERRA NEVADA AT CONTACT

At the onset of the 1848-49 Gold Rush, the California side of the Sierra Nevada was held mainly by societies which spoke Penutian languages. The Yokuts dominated much of the lower elevations of the southern Sierra Nevada, while the Miwok held the central Sierra and Maiduans occupied the northern Sierra and southern Cascade Range. Ethnographic studies of these cultures began to be developed by the end of the 19th century under the auspices of A.L. Kroeber and his program at the University of California-Berkeley. Kroeber, working from the knowledge and experiences of Native Californians who had grown up in the 19th century, characterized all these societies as semi-sedentary or sedentary bands with little in the way of ranking beyond the village headman. He recognized the Yokuts as having some structural relations among adjacent villages when he categorized their sociopolitical systems as "true tribes" (Kroeber 1925:474-484), although to recognize at least 40 tribes within the Yokuts language territory suggests something of the small scale intended by Kroeber (also see Kroeber 195 1 for a more succinct statement). In general, however, the picture of California societies that he and his students developed was one of small-scale communities with egalitarian social organizations within autonomous villages and supported by self- sufficient subsistence economies (see Riddell 1978: 70-386; Levy 1978 98-413; Spier 1978: 471-484, as examples).

INFLUENCE OF OBSIDIAN STUDIES

In recent years, some lines of research have developed new data bases that have prompted a serious revision of interpretations about Native Californian sociopolitical organization. These changed understandings are crucial to any interpretation of the impact of colonization on indigenous societies, because they provide radically different definitions of the starting point from which breakdown proceeded after the beginning of colonization.

Of recent lines of research, arguably none has been more influential than obsidian studies (see Hughes 1992; Markley and Day 1992, for example). Obsidian studies have used two methodologies to shed unique light on this important material. The first, trace element analysis, allows the identification of the source from which any piece of obsidian is derived. The post-quarrying transportation of the material thus can be reconstructed with a specificity not yet possible for virtually any other indigenously-used raw material.

The second, obsidian hydration measurement, allows an assessment of how long ago the working was done with obsidian to turn it into an artifact - something not possible yet with other tool-making raw materials. Taken together, these two methods allow analysts to map the distribution of obsidian over time and space from specific sources to specific consumer communities (for example, Bloomer 1993; Dowdall 1991; Jones and Beck 1990). Collectively, so many tens of thousands of obsidian specimens have now been sourced and have had their hydration rims measured that major regional patterns and pattern changes can start to be documented quantitatively. The most important factor limiting such reconstructions may be the fact that the obsidian samples that could be used for this purpose were not collected with this specific objective in mind, so the spatial distribution of samples may not always coincide with needs for regional pattern analysis.

Many tens of thousands of archaeological

sites now have been recorded in the state. In the Sierra Nevada, and on west to the Pacific Coast, a very high proportion of all prehistoric sites contain obsidian. At almost all these sites, the obsidian is exotic or imported. Current understanding is that the obsidian at such sites was acquired through exchange between communities in any of several possible patterns. Most has been traced to sources from east of the Sierra Nevada, although materials from sources near Clear Lake also occur in many Sierra Nevada sites. The most important point suggested here is the realization that many prehistoric communities across California participated in extensive exchange relationships which linked them together across regions in multidimensional networks.

Other lines of study have identified a variety of other, non-perishable commodities also exchanged in these systems. A few of the more prominent examples include steatite from Santa Catalina Island and the Sierra Nevada; banded chert from the South Coast Ranges; several kinds of shell from the Coast; and fused shale from Ventura County. Some traces of regional exchange can be found as far back as the Early Archaic Period, 10,000 years or so ago, or possibly even earlier.

By later prehistoric times, in the last 2500 years before colonization, regional exchange systems reached their two greatest peaks of volume, magnitude and complexity, and figured significantly in the functioning of California communities (see Arnold 1993, for example). The first high level occurred between 2500 and 1500 years ago, during the Middle Period in the traditional Central California taxonomy (Moratto 1984: 184). An even greater peak was reached starting about 700 years ago. As an interesting side-note, eastern North America saw a rather similar bimodal peaking of prehistoric exchange, rising first during the Early and Middle Woodland Periods (3000- 1600 B.P.) and then again during the Mississippian Period (1000-5000 B.P.) with a relative hiatus during the intervening Late Woodland Period (Jennings 1989: 230-275).

A SCENARIO OF THE IMPACT OF COASTAL COLONIZATION ON SIERRAN CULTURES

This view of cultural fluorescence involving the participation of many communities in regional iteration networks as represented by obsidian exchange provides a basis for asking what the impact was of the onset of colonization on the Sierra Nevada cultures of that time. The Sierra Nevada as a region is still less well-represented in the California archaeological literature than are a good many other parts of the state, so a comprehensive answer is not yet possible. Nevertheless, data from a number of sites suggest a pattern.

The author's concern for this topic began in the 1980s when he was involved in testing several sites at mid-Sierran locales at 1500-1800 meters elevation. At locations along Skunk Creek and Soldier Creek it became evident that summer seasonal campsites had developed and expanded during the Late Period after A.D. 1200 until the eve of the Historic Period (defined as starting after A.D. 1769), and then they ceased to be utilized, with no other locations in the area taken up to replace them (Chartkoff 1990; Chartkoff and Chartkoff 1988).

At Dry Meadow, a village-sized summer settlement (CA-Tuo-2604) was found to have been occupied until some time in the 18th century (based on obsidian hydration values and the absence of relevant Historic materials). At that point it was apparently abandoned, to be replaced by a single-household occupation in the late 19th or early 20th century (Chartkoff 1993). Similarly, in 1986 four chipping stations in the high Sierra Nevada near Sonora Pass, at over 3000 meters elevation, were visited. Surface artifact types suggested again an occupation up to or near the end of the prehistoric era, with no Historic Period component. These observations, though few, led to an initial suggestion that major population reductions or abandonment at middle and high elevations had occurred coincident with the 19th century. Similar patterns in the same area were shown in test programs by Goldberg and Moratto (1983), and Napton and Greathouse (1976), among others.

Other studies reported in the literature show somewhat similar patterns. For example, Mundy (1988:159-168) has summarized nearly forty testing and excavation projects in Yosemite, Sequoia and King's Canyon National Parks. Combined data from obsidian hydration and sourcing, radiocarbon determinations and coastal shell artifacts show populations and area usages peaking before A.D. 1700 with only modest populations surviving into the Gold Rush period. Ethnohistoric sites are largely confined to Yosemite Valley and do not show overlapping of obsidian and shell imports with historic goods (also see Hull 1988). Moratto, Tordoff and Shoup (1988) report similar patterns in summarizing the results of the massive New Melones Reservoir project in the Central Sierra Nevada foothills to the northwest of Yosemite. They note that occupations at New Melones extended through the Late Period into the Historic Period, thus spanning the era from before the onset of coastal colonization to the period after major Euro-American occupation had emerged during the Gold Rush between 1848 and 1860.

A variety of relevant information came from the New Melones excavations. For example, the largest and richest shell bead collection at New Melones came from the site of Tuo-S444/449, a lower foothills village. This site yielded more than 200 shell beads from the coast, most dating from the Late Period, and nearly 30 glass trade beads from the Protohistoric era. Sporadic contacts between coastal communities and European ships provided a means for trade beads to enter the indigenous system prior to the onset of missionization after 1769. This site provides some evidence for continuity of interaction between coast and Sierra Nevada during that span.

On the other hand, the authors caution against simplistic assessments of the bead patterns. They note, for example, that in this part of the state, shell artifacts are found overwhelmingly in ceremonial and mortuary contexts which are not reflected in their sample. Two relevant sites, Winslow Cave and Pinnicle Point Cave, yielded more than 4300 and 11,000 shell artifacts respectively (Moratto et al. 1988: 328). The significance of the sample from Tuo-S444/449, then, is greatly diminished by this disparity.

The New Melones project excavations (which did not include Winslow Cave or Pinnicle Point Cave) yielded more than 6000 glass trade beads from 18 Protohistoric/Historic occupation sites (Moratto et al. 1988: 335). Of the 43 Late Period sites reported in the study, however, only ten of them also included historic glass trade beads. Not only are there less than one-quarter as many Protohistoric/Historic era settlements in the area as there are Late Period settlements, the Protohistoric/Historic sites generally are smaller than their prehistoric counterparts.

The region of the New Melones Reservoir lies within the traditional territory of the Miwok culture. Although the foothill area around the present-day reservoir continued to be occupied by Miwok people throughout the Historic era, and Colonial-era glass trade beads have been found at several sites in the area, glass trade beads were not contemporary with shell from the coast or with obsidian imports. Both the number and the size of historical sites were markedly smaller than prehistoric sites in the foothills around New Melones. When both the decline of numbers of sites and the decline of site sizes coincident with the Protohistoric/Historic era are taken into consideration, the data strongly suggest that local populations declined and that magnitudes of interactions between the foothills and the coast declined at the same time.

Obsidian studies in the northern Sierra Nevada have been reviewed by Markley and Day (1992). Their summary indicates that, prehistorically, especially in the Late Period, populations in the region participated in several interaction spheres which changed over time. Some of these exchange systems extended between the northern Sierra Nevada and the coast, although others did not. The studies cited do not provide specific evidence, however, as to whether these interaction spheres, even those that did not involve the coast, continued to operate during the colonial period.

Hanson (1993) describes excavations at GAL-718, on the Stanislaus River, which was occupied

from approximately A.D. 450 into the 19th century. The prehistoric components show the occurrence of a major base camp which participated in regional exchange systems involving both obsidian from east of the Sierra Nevada and shell from the coast. A remnant, much smaller, ethnohistoric community is recorded for the 19th century. In the historic period, the community seems to have dropped out of its indigenous, long-range exchange relationships.

Reflecting the historic side of the region's archaeology, several investigators have tracked the occurrence of European trade beads in protohistoric and early historic indigenous settlements. Motz, Ritter and Rock (1986), for example, have outlined the introduction of glass trade beads into coastal California settlements by the Spanish and Russians in the late 18th and early 19th centuries. Arkush (1990) documents the occurrence of trade beads in the eastern Sierra Nevada and western Great Basin, noting that "glass beads either partially or completely replaced aboriginally produced beads of shell and stone during protohistoric times (1990: 30)." The quantitative data on trade bead occurrence also show that the quantities of trade beads were minuscule compared to the quantities of shell beads available prehistorically (1990: 32). These data suggest both that late prehistoric exchange systems did not survive into historic times to any extent, and also that the level of economic activity reflected in the bead replacement indicates a marked decline took place.

SOME PERSPECTIVES ON EXCHANGE AND CARRYING CAPACITY

The involvement of many California communities in elaborate exchange relationships has implications of several sorts for the nature of the social systems involved. Some analysts have recognized evidence indicating the occurrence of socially complex systems in both prehistoric and ethnohistoric California (see Bean and Blackburn 1976; Bean and King 1974, for example).

These implications are coming to be better understood in both empirical and theoretical terms. For example, and as noted earlier, Jeanne Arnold's continuing analysis of prehistoric craft production and exchange systems involving the late prehistoric Chumash of Santa Cruz Island has provided strong evidence for the occurrence of sociopolitical systems at the level of chiefdoms (see Arnold 1992; Arnold and Munns 1994, for example). However one wants to define the views of the Kroeberian school as to how complex pre-Contact California sociopolitical organizations became, no claims were made by them for systems as stratified as chiefdoms.

The emergence of social stratification among communities heavily involved in exchange relationships is expectable in several ways. When communities are economically self-sufficient, households operate largely as autonomous units and expend calories of work proportional to the acquisition of calories through subsistence activities. As Sahlins and others have long noted (Sahlins 1968, for example), hunter-gatherers are now known to have been able to provide for household needs with as little as 60-80 work-days of labor per year, leaving most of the potential work time either devoted to non-subsistence work or to non-work activities.

The strategies for the organization of work are key to understanding the growth of complexity in cultural systems. In prehistoric California, one of the important long-term trends was the development of collective work strategies of resource acquisition. They included the collection of seasonal surpluses and the use and management of storage facilities to shift resource surpluses over time (Chartkoff and Chartkoff 1984: 227-234). These strategies enhanced subsistence productivity without cutting significantly into the non-subsistence component of the work year.

At the same time the model of collective work strategies was applicable in other arenas of the economy. A major example concerns the participation of communities across a region in a network of exchange relationships. Participation in exchange required communities and their households to maintain subsistence levels for self-needs but also to invest parts of

the remaining work-year in activities directed at exchange. Although specific aspects of exchange were the consequences of individual acts, the system required both collective labor and managerial oversight. The evolution of exchange thus required the evolution of organizational complexity within communities.

At the same time, exchange is a reciprocal activity, meaning that to acquire one must give relatively proportionately. To give, one must generate surpluses beyond subsistence needs. These surpluses must, first of all, involve materials to give in the broadest sense. These materials may be raw materials, finished products, services, or some combination of them. When exchange takes place within a community, these materials are circulated within the community. When exchanges occur between communities, the transfers take place both between communities and within each community. Since many raw materials must be acquired from distant sources, even a good deal of within-community exchange ultimately involves between-community exchange as well.

Participation in exchange requires collection of surpluses of resources beyond household-level consumption needs. It also requires development of at least craft semi- specialization so that exchangeable goods and services can be generated beyond household and home-community levels of consumption. Exchange, which is an economic activity, therefore also is a social activity. It can be expected that the practice of exchange of goods often involved social gatherings. Such events in turn suggest accumulations of food surpluses made specifically to support those events.

Management activities may also be implied. The organization of this work on behalf of the community, the planning of exchange activities, the organization of sessions, the conducting of inter-community negotiations of some form, the receipt of acquired commodities and the redistribution of acquisitions all call on managerial activities beyond the level of those used in community activities at the level of complete self-sufficiency.

Whether such management should be seen as beneficial, exploitative or a combination of both is not significant here. Its value for adaptive achievement is important, though. The emergence of full-time specialization need not be implied, at least at first, because the time and labor needed can be taken from the portions of the available work-year not already devoted to household-level subsistence. But the development of degrees of semi-specialization, with differences in levels of collective responsibility, promotes social differentiation beyond what is expectable in self-sufficient (and therefore economically isolated) communities.

If participation in exchange promotes the emergence and accentuation of social differentiation, it also has implications for population carrying capacity. As physicists have noted since Einstein's time, time, matter and energy are theoretically interchangeable and can be understood as alternate forms of the same thing. At a more grounded level, participation in exchange means that the energy/material productivity of a community must rise both totally and per capita to generate the means and commodities to exchange. It also means that the total productivity of the community (equivalent to the Gross Domestic Product or GDP concept used in modern national economics) includes a fraction that involves flow between communities, a fraction not present in self-sufficient communities. This fraction of the GDP not only creates greater wealth levels per capita and per household, it also raises carrying capacity for the community as a whole.

This should be true not only in principle, but in practical terms as well. Participation in exchange involves collection, redistribution and use of additional food surpluses, meaning that more calories enter the community system and are circulated there. If individuals only consume relatively fixed numbers of calories per annum, a sustained rise in calorie production and consumption implies that carrying capacity is increased both in principle and literally.

To extend the principle, systems which participate in inter-societal exchange networks must generate increased productivity to do so. Increased production has several dimensions in

addition to increasing carrying capacity. If exports are generally balanced by imports, resources are generated to support some level of social and occupational differentiation and some degree of non-subsistence specialization of labor, whether in manufacturing, resource acquisition, product distribution, or service provision such as management. The extent to which these changes occur should be generally proportional to the fraction of GDP involved in exchange. To the extent that these differentiations and specializations result from the emergence of this increased fraction of GDP, their continuation is dependent on the continuation of those interactions and flow levels.

CONSEQUENCES OF COLONIZATION

Given this perspective, it is possible to return to the question of what the consequences were to populations outside the colonial zone of the onset of colonization in California by Spain. If the archaeological evidence for the Late, or Pacific, Period is correct, for at least the five centuries prior to the onset of colonization the peoples of California's interior valleys and Sierra Nevada were bound up in regional exchange systems with coastal peoples. Spanish colonization, undertaken between A.D. 1769 and 1822, absorbed the California coast from San Diego to the San Francisco Bay, and essentially all the indigenous societies therein. Coastal peoples were overcome by a concordance of factors, the most important of which included military conquest, debilitation from diseases, religious proselytization, and a desire for refuge from internecine conflict. Much of their initially-surviving population was reorganized and relocated into missions. Among its many other important effects, missionization broke down the networks of regional exchange in which these peoples had previously participated.

This breakdown, among other things, can be seen to have diminished the GDP's of the peoples inland who also participated in those networks. Inland peoples lost their exchange partners along with most markets for their own exchange product and the sources of replacement inputs from their partner-societies. Not only were flow rates reduced or eliminated between communities, but elements instrumental to the functioning of the system also were lost, such as sources of the shell money used in their money system and raw materials from the coast used in their own craft production.

With a serious and irreversible reduction in GDP, inland communities would have faced permanent declines in carrying capacity, with consequent or concomitant implications for population sizes, densities and degrees of sedentism. Also affected would have been the degrees of social differentiation and occupational specialization previously attained. All these factors should have diminished among inland peoples because of the breakdown of their exchange relationships with coastal societies.

This interpretation is not offered as a rejection of the significance of disease, another population-decimating agent that resulted from Euro-American intrusion into Native California life. The significance of the impact of disease on Native California populations has been emphasized by Cook (1976), Erlandson and Bartoy (1995), Preston (1996) and others. Diamond (1999) has offered a particularly impressive overview of the dynamics of disease and its impact on non-Eurasian populations.

Rather, it remains unclear just what the trajectory of disease was across Native California. European disease may have had the relatively sudden and overwhelmingly devastating impact seen to the east on Mississippian populations, or to the south in Mexico. Alternatively, due to the relatively small size of many communities and the dispersal of populations in a number of parts of California's interior, the spread of European diseases may have taken place less suddenly. Native Californian exposure to European diseases may have begun as early as the 1530s, much earlier than the onset of colonization, as a result of the spread of diseases north from Mexico, the movement of Spanish expeditions northward starting in the late 1530s, and the periodic landing of ships at various places along the coast starting as early as the

1540s. It therefore is possible that the impact of disease did not have the sudden, late emergence that colonization of the coast did between 1769 and 1822 (Chartkoff and Chartkoff 1 984: 277-278).

Of perhaps more importance from the perspective of scientific confirmation, the impact of disease prior to colonization has been very difficult to determine. Because of timing, no written records of pre-colonial epidemics were made, a point that applies especially to inland populations. In addition, many types of relevant epidemic diseases, such as smallpox and measles, do not leave clear skeletal traces, so empirical confirmation of diseases as cause of death is not yet reliable. At the same time, California does not have a clear archaeological pattern of massive rises in mortality, large-scale village abandonments or other plausible associations with disease along the coast between 1540 and 1769. Such evidence should be clear and abundant in order to argue that disease had a major impact on breaking down indigenous populations, economies and social systems prior to the onset of Spanish colonization. So far, it is not.

Probably the best documented epidemic caused by White contact with Native Californians was the one in 1832-33 that spread from the north into the Sacramento River Valley (Cook 1976: 12). That epidemic may have caused the deaths of up to 90% of the village populations along the Sacramento River. The tragic epidemic, though, it must be noted, occurred more than a half century after the start of Hispanic colonization along the Pacific Coast, and did not spread from the area of Spanish contact inland, but rather in the opposite direction. This pattern makes it harder to argue that the onset of colonization launched a sudden and devastating episode of epidemic diseases. The importance of disease prior to or at the onset of colonization thus can be speculated upon theoretically, but may be difficult to document in very much detail.

From a slightly different perspective, however, a relationship between disease susceptibility and decline of carrying capacity can also be considered. A major factor in making a population susceptible to a new disease can be previous genetic isolation from the pathogen. At the same time, however, malnutrition also can be a major factor in making a disease have a more virulent impact on a population. The disease factor and the exchange breakdown factor thus may have been causally linked as co-variables. They may have been able to stimulate each other's extent by being in a symbiotic relationship under deviation-amplifying circumstances (Phillips 1990: 9-14; Staski and Marks 1991: 659-661).

The colonial system which the Spaniards introduced starting in 1769 can also be understood from other perspectives as contributing to this negative impact. Wallerstein's World Systems model, for example, helps to illustrate this view (1974; 1979; 1980; 1982). Although the literal application of world-systems models to archaeology has been appropriately criticized (see Chase-Dunn and Hall 1991; Kohl 1987, for example), the model suggests some enlightening metaphors (see Schortman and Urban 1987, for example). Chase-Dunn has applied a modified world-systems approach to the comparatively tiny interaction sphere of the Wintu, as one case (1992).

The system that existed prior to colonization involved more-or-less balanced reciprocity through exchange, as it is seen here. All participants generated surpluses above subsistence needs in order to participate in regional exchange, and all participants gained part of their GDP from inputs acquired through exchange. The system as a whole can be described as the sum of both the cumulative production of each society internally and the cumulative flow rates and volumes between all participating societies.

Colonization ended the intersocietal flows, thus diminishing GDP for all participants. It also imposed a new core-periphery relationship into the region. With Spain functioning as a core nation, in Wallerstein's terms, it reduced the new colonial populations back down toward subsistence levels, and then extracted outputs from them to shift to the new core nation (and

to some extent to Mexico as well, by comparison a semiperipheral society). This shift from reciprocal to non-reciprocal modes of interchange would have reduced carrying capacity for the colonized coastal populations below maintenance even more than for the inland populations.

If this argument has any validity, it has several implications. It is not currently known how accurate the implications are, but they serve as directions for future research. Cook's estimates of population are an example. Cook's mission-era censuses, reliant as they are on earlier Historical-era data from Kroeber and elsewhere, reflect, I believe, reductions in size of populations and complexity of sociopolitical systems from levels they had reached during the Late period of prehistory. These reductions were already underway in the Sierra Nevada before historic documentation began, I would argue, because of the consequences of the onset of coastal colonization during the late 18th century.

If carrying capacity was affected by exchange systems, and if exchange systems broke down inland because of the loss of exchange partners with the intermediate Central Valley populations, the level of sociopolitical complexity among peoples farther inland may well have been a good deal greater than was recorded ethnohistorically. This pattern would correlate with Arnold's discoveries about the Island Chumash and their prehistoric chiefdoms (Arnold 1992). Cook's figures for the year 1800 may seriously underrepresent population levels in 1700 or earlier. The 19,500 Eastern Miwok reported by Levy (1978: 399-400) from Cook's data, for example, may well have numbered 25,000- 30,000 or even more a century earlier.

CONCLUSIONS

This paper has argued that the historical impact of colonization on California' s indigenous societies may have been more extensive than often has been appreciated. Recent archaeological data suggest the occurrence of larger populations and more-complex patterns of sociopolitical organizations than have been reported ethnographically. It is argued that these larger and more-complex systems had evolved at least in part because of the development of regional systems of exchange. Conquest and colonization of one key part of the exchange system in the 18th century, it is felt, may have produced devolutionary simplifications elsewhere, as a result of loss of Gross Domestic Product (GDP) and consequent decline in carrying capacity.

This reconstruction, though preliminary at this point, is supported by several theoretical perspectives. It also agrees better with current understandings of archaeological data than do previous assumptions that California societies were still reaching their peak of size and complexity when the onset of the Historic era cut them short. It is felt that when a larger number of detailed regional studies, such as the New Melones project, has been such a case can be supported more substantially (see Moratto, Tordoffand Shoup 1988, for example). More systematic analysis is clearly needed, however, and it is hoped that this paper will help to stimulate such research.

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