Paleopathology of the Santa Barbara Channel Area

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Paleopathological evidence indicates that many of the pathogens that afflict modern people were present in prehistoric California. Bone lesions of the kind we now associate with streptococcal or staphylococcal infections were fairly common in some California Indian populations. There is also evidence that gastrointestinal infections transmitted by drinking contaminated water were prevalent in some areas. Tuberculosis, coccidiodomycosis and treponematosis are three additional infectious diseases reported as possibly present in prehistoric California. Archaeological evidence shows that the prevalence of infectious diseases increased significantly during the prehistoric period. This decline in health was no doubt a result of the health problems people encountered when they began to aggregate in large villages. As the number and intensity of interactions among people grew, so did the opportunities for the maintenance and spread of infectious disease.

In the Santa Barbara Channel area, these changes in infectious disease were accompanied by a decrease in body size and an increase in the frequency of traumatic injuries. Paleopathological studies indicate people who lived in this area during periods of environmental instability suffered more infectious disease and nutritional stress than people who lived under more favorable conditions.

Figure 1: Distribution of cranial injuries in female (left) and Male (right) crania from the Santa Barbara Channel area.

Traumatic Injuries
Crania from the Northern Channel Islands off the Santa Barbara coast show a high frequency of well-healed depressed fractures in the outer table of the cranial vault (18.56% n = 598). Such injuries are rare among the mainland inhabitants (7.5% n = 146). This prevalence of traumatic injuries among the islanders may be a result of intense competition over resources in a geographically circumscribed environment. The frequency of cranial injuries increases significantly between the early and late prehistoric periods on the Channel Islands. This temporal variation appears to reflect changes in patterns of violence associated with population growth and environmental instability (Walker 1989).

Osteoarthritis
The severity of osteoarthritis in Santa Barbara Channel area changed markedly with the economic shift from hunting and gathering to intensive fishing and craft specialization that occurred in this area (Walker and Hollimon 1989). The joints of 967 burials from seven archaeological sites occupied between 3500 B.C. and the time of European contact were scored for osteoarthritis. These data show that the rate at which people developed osteoarthritis increased through time. This suggests that the adaptive shift toward more intensive exploitation of the marine environment resulted in an increase in the time people spent in strenuous physical activity. The increase in osteoarthritis affected males to a greater extent than in females. One interpretation of this is that the workload of men increased with the economic importance of fishing.

An analysis of the distribution of arthritic lesions in the knees suggests that some individuals engaged in strenuous activities that involved kneeling for prolonged periods of time. Activity-related arthritic changes in this population include porosity, lipping, and eburnation of the postero-superior surface of the femoral condyles and complimentary changes in the articular surfaces of the proximal tibias. These lesions are similar to those found in European ecclesiastical populations where kneeling in prayer for long periods was a common practice. Ethnographic evidence suggests similar lesions among Native Americans from the Santa Barbara Channel area are an osseous response to habitual digging stick use, a subsistence activity that was predominantly the domain of women.
Oral Health
Dental studies of Channel Island skeletal collections provide evidence of significant temporal changes in oral health. Carious lesions decrease significantly through time, as do sexual differences in caries rates. Tooth wear rates also decrease through time. These dental health changes appear to reflect shifts in diet and sexual division of labor associated with a subsistence shift from the exploitation of roots, tubers, and other cariogenic plant foods to the intensive exploitation of fish.

Evidence of Nutritional Deficiency
Cribra orbitalia, a form of porotic hyperostosis that often has been linked to iron-deficiency anemia, is as common among the fisher-people of the Santa Barbara Channel area, whose diet was rich in iron and essential amino acids, as it is among maize-dependent agriculturalists. Northern Channel Island crania have much more cribra orbitalia than those from the California mainland. The highest incidence is on San Miguel, a small geographically isolated island with a shortage of fresh water and terrestrial resources. The Indians who lived on Santa Cruz, the largest of the northern Channel Islands with the greatest diversity of terrestrial plants and animals, have less cribra orbitalia than those who lived on Santa Rosa or San Miguel Island. This shift towards more intensive marine resource use has been documented through isotopic studies. The ratios of $^{15}\text{N}$ to $^{14}\text{N}$ and $^{13}\text{C}$ to $^{12}\text{C}$ tend to be higher in marine than in terrestrial organisms. They consequently can be used to make inferences about the contribution of marine and terrestrial resources to prehistoric diets. Differences in $^{15}\text{N}/^{14}\text{N}$ and $^{13}\text{C}/^{12}\text{C}$ ratios of individuals from mainland sites dating from the early and late prehistoric periods show that the marine component of the diet increased substantially through time (Walker and Deniro 1986). Our isotopic studies also provide evidence of sex difference in diet with males consuming more marine resources during the early prehistoric period than females.
geographical distribution appears to be explained by island-mainland and interisland differences in water contamination, exposure to fish-borne parasites, and nutritional adequacy of the diet. Recent research suggests that these lesions are difficult to explain in terms of iron deficiency and may instead reflect megaloblastic anemia associated with vitamin B$_{12}$ and folic acid deficiencies.

**Treponemal Disease**

The earliest well-documented cases of treponemal disease in the western United States come from SBa-52, a village site on the mainland coast of the Santa Barbara Channel. The cranial lesions typical of modern venereal syphilis are uncommon among these people.

Skeletal remains from SBa-52 are especially informative because both macroscopic and microscopic evidence indicate that treponemal disease afflicted a large proportion of the population.

**Figure 2: Histological section of a tibia from Burial 5 at SBa-52 showing features associated with treponemal disease.**

In Figure 2, the first dark, diagonal band in the upper portion of the slide is a thin layer of calcite deposited on the surface of the bone. The underlying band is a laminated layer of subperiosteal new bone that formed on top of the original cortical surface, which is the triangular area formed by the lower left corner of the slide. The layer of subperiosteal new bone formation has *polster* (pillow-like structures) which are delimited invaginations formerly occupied by blood vessels that reach nearly to the level of the original cortical surface. Some of the diagonal striations, or *grentstreifen*, in the layer of subperiosteal new bone contain collagen and delimit the boundary between the original cortical surface and the newly formed bone. *Polster* and *grentstreifen* are diagnostic features of treponemal disease.

The hypothesis that a new European form of treponemal disease was introduced during the early historic period is supported by cranial lesions in two crania from the Skull Gulch site (SBa-2b) on Santa Rosa Island. In striking contrast to the treponemal disease syndrome seen in the Santa Barbara Channel area throughout the prehistoric period in sites such as SBa-52, these individuals exhibit the massive cranial vault and nasopalatine involvement that is pathognomonic of modern untreated venereal syphilis. Caries sicca affects most of the cranial vault of one individual and another shows extensive nasopalatine destruction.

**References**


