Averbuch males have significantly greater frequencies of osteoarthritis for the shoulder and hip, but not the knee. This pattern is suggestive of change in workload and activity with the adoption of agriculture.

Unlike males, agriculturalist females from the lower Illinois River valley have a higher prevalence of vertebral osteoarthritis than forager females from the same region (Pickering, 1984). These differences are especially pronounced in cervical vertebrae, which may be related to an increase in mechanical demand in this region of the skeleton with the shift to agriculture (Pickering, 1984).

Fahlström (1981) identified an unusually high prevalence and severity of shoulder osteoarthritis in adult males in the Medieval skeletal series from Westerhus, Sweden. Historical analysis of this population suggests that the high frequency in males reflects work and activity practices that are exclusive to men, including parrying in sword fighting, spear throwing, timber cutting, and other activities associated with repetitive, heavy loading of the shoulder joint (Fahlström, 1981).

Some analyses reveal no appreciable differences between males and females. For example, males and females in the Dickson Mounds, Illinois series show no differences in prevalence of appendicular osteoarthritis (Goodman, Lallo et al., 1984; Lallo, 1973). The similarity between sexes infers that mechanical loading of most articular joints in this setting was broadly the same in adults regardless of sex, in contrast to most other prehistoric Eastern Woodlands populations (compare with Bridges, 1992). Similarly, documentation of prevalence of osteoarthritis in two series of African American adults from nineteenth- and twentieth-century Washington, DC shows no appreciable differences between adult males and females, suggesting that labor demands were similar for men and women in this setting (Watkins, 2012).

Two clear trends emerge when examining sex differences (Bridges, 1992). First, where there are statistically significant differences between males and females, males nearly universally show a higher prevalence of osteoarthritis than females. Second, when looking at specific regions of the New World, maize agriculturalists tend to display more sexual dimorphism in degenerative pathology than foragers. This suggests a difference in behavior leading to degeneration of articular joints in agriculturalists but not in earlier foragers. The change in pattern of sexual dimorphism suggests that there was a fundamental shift in the division of labor once agriculture was adopted (Bridges, 1992).

5.3.3 Age variation

The documentation of age-at-onset of osteoarthritis should provide an indication of when individuals enter the work force. In the late prehistoric Ledders series from the lower Illinois River valley, elbow and wrist osteoarthritis commences earlier in females than in males, which may indicate that women were subjected to the mechanical demands of adulthood earlier than men (Pickering, 1984). Eskimos have the earliest age-at-onset in comparison with Southwestern (Pecos Pueblo) agriculturalists and urbanized American Whites and Blacks (Jurmain, 1977a). These differences reflect the relatively greater mechanical demands on the Eskimos in comparison with other human populations.

Interpretation of intra- and inter-population differences in osteoarthritis prevalence must consider age structure as it is such an important predisposing factor. For example, females have a greater prevalence of osteoarthritis than males in all but three of 16 joints in a series of human

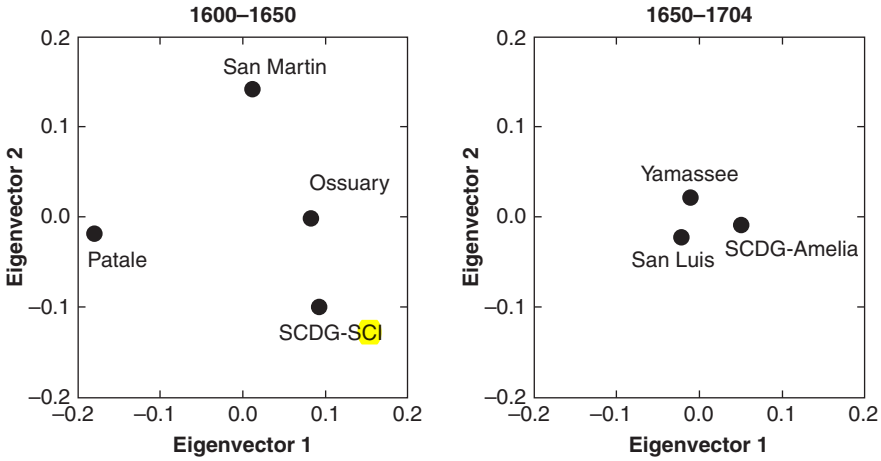

Figure 9.9 Eigenvector plots for early mission (left) and late mission (right) populations in La Florida indicate a reduction in genetic diversity among local groups over time. (From Stojanowski, 2009; reproduced with permission of authors and University Press of Florida.)

single population. However, in the later mission period of the later seventeenth century, a population bottleneck and increased broad-scale gene flow among once-distinct populations resulted in reduced genetic diversity in the larger, aggregated mission community (Figure 9.9). Although the patterns of genetic diversity presented in these analyses are not a surprise in consideration of the context of population aggregation and movement during the mission period, they nonetheless reveal the powerful analytical depth of biodistance analysis for developing a more informed understanding of biological variation and social change in this setting.

9.3.2 Linking the dead to the living

The call for identification of biological and cultural links between living native groups and potential archaeological ancestors as a result of new laws on the repatriation of Native American remains in the United States has created additional incentive for biodistance analysis. Biodistance provides a powerful means of linking present and past populations in North America or other regions where repatriation of human remains is a point of discussion. On the other hand, it is difficult to identify relationships between living and ancient groups owing to the remarkable level of population movement and decline of native societies after initial contact by Europeans.

Alaska is a highly visible focal point of repatriation discussions, in large part due to the presence of vibrant Native communities living in the region today. In order to identify links between living and past groups, a substantive amount of dental data has been analyzed from both contexts on Kodiak Island. Prehistoric and living populations have been studied by biological anthropologists seeking information about ancestral and descendant relationships (Scott, 1994). Scott (1994) analyzed dental morphological variables from prehistoric archaeological dentitions from the Uyak site, which includes a population succession from the

10.5 New solutions to interpreting age-at-death profiles in archaeological skeletal series: it is really mostly about fertility not mortality

In the short run, bioarchaeologists were shocked by Bocquet-Appel and Masset's "farewell to paleodemography" (1982). Some authorities expressed indignation and extreme doubt that age estimations and mortality profiles are influenced by the age structure of the reference sample. After all, do not all humans age and/or senesce at the same rate and in the same manner? Van Gerven and Armelagos (1983) reassessed Bocquet-Appel and Masset's assertion that the Nubian series was biased by the Korean War dead sample that McKern and Stewart (1957) had used to develop their age estimation method. In order to address the conclusion drawn by Bocquet-Appel and Masset, Van Gerven and Armelagos compared age-at-death of well-preserved Nubian skeletal remains from Wadi Halfa (n=201) and Kulubnarti (n=162) using Todd's (1920) and Brooks's (1955) methods of age estimation for the pubic symphysis. Using the Kolmogorov–Smirnov two-sample test for cumulative frequencies and applied to cumulative mortality curves, they documented a strong, highly significant *difference* between the three series, suggesting that the age profiles of archaeological series are not influenced by the reference sample. Based on their analysis, the study presents findings to suggest that at least part of the record of paleodemographic research warrants further attention. Similarly, others made the case that Bocquet-Appel and Masset's (1982) criticisms were extreme and premature. That is, use of multiple age indicators, selective use of age estimation methods with known accuracy, use of population-specific age estimation methods, development of methods for aging older individuals, and standardization of age estimation methods, a direction for research supporting the continued importance of paleodemography would be provided (Buikstra & Konigsberg, 1985; Lovejoy et al., 1985). Arguably, while the death of paleodemography was announced prematurely by Bocquet-Appel and Masset, fundamental elements of age structure analysis were in need of attention (Hoppa & Vaupel, 2002; Konigsberg & Frankenberg, 1992, 1994, 2002).

Regardless of the tone of comments, either for or against abandoning paleodemography altogether, Bocquet-Appel and Masset (1982) set into motion a debate about the relative value of paleodemography and the need for new methods for reconstructing and interpreting ancient age structures in past societies. Their work served as a call for developing methods that would address shortcomings in age estimation methods as well as elucidating how death assemblages influence reconstructions of demographic composition. It made clear that age profiles derived from censuses of living populations and death assemblages are simply not the same, with the latter subject to biases and circumstances not present in the living. Censuses of living populations are based on known ages, whereas censuses of dead individuals from a collection are based on estimates fraught with problems, owing to use of methods, which for the most part, assume uniformity across age groups and across human populations in aging and skeletal indicators of age. Moreover, it is simply untenable to continue attempting to fit age structures of archaeological skeletal series into patterns that may or may not be predicted by model life tables developed from entirely different environmental, social, and economic circumstances. Basically, while the life table has analytical merits for predicting length of life in living populations, it has limited usefulness in paleodemographic investigation (Hoppa, 2002).

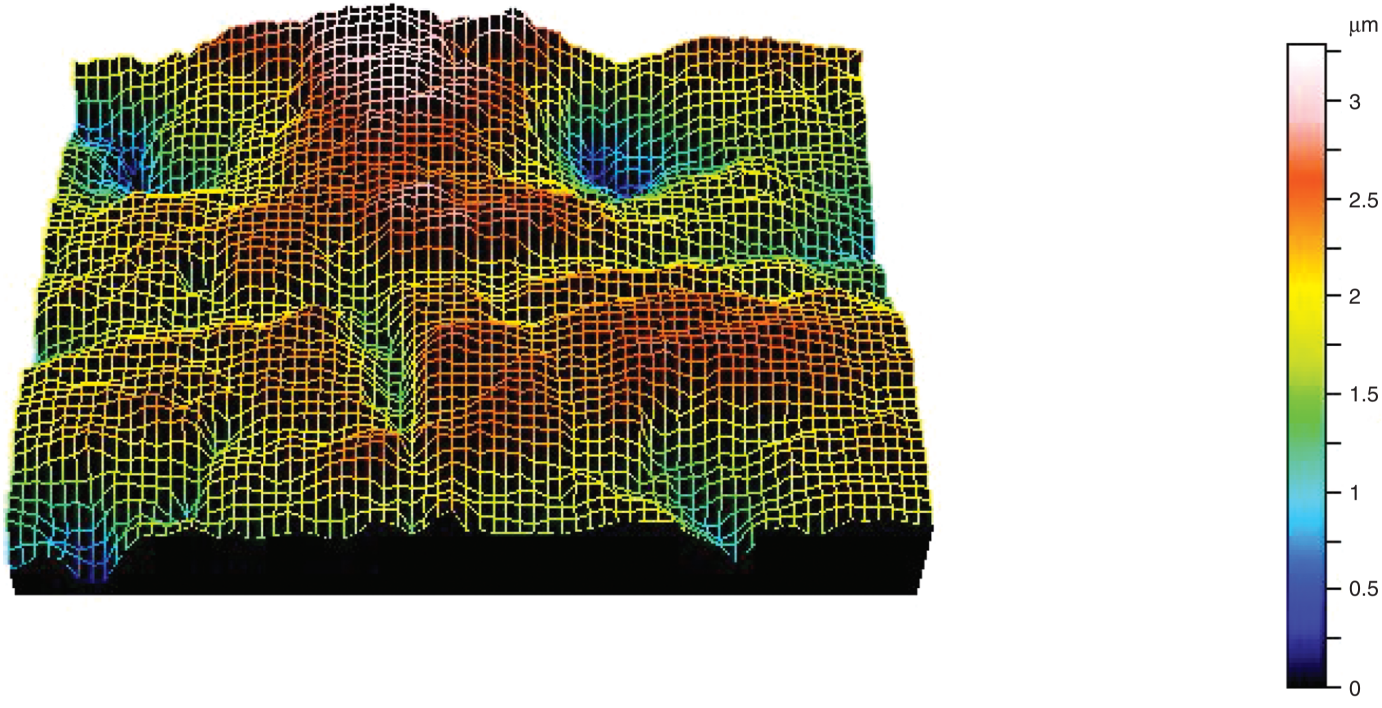

Figure 7.12b Confocal microscope 3D image (× 100) of same location on same tooth. (Image courtesy of Melissa Zolnierz and Christopher Schmidt.)