INTENSIFICATION, POPULATION AND SOCIAL CHANGE IN SOUTHEASTERN AUSTRALIA: THE SKELETAL EVIDENCE

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INTRODUCTION

> The pathology of a society reflects its general conditions and growth, and offers, therefore, valuable clues to an understanding of the total society.[1]

It is with such statements in mind that physical anthropologists have used the principles of palaeopathology to try to understand more about human disease, ecology, behaviour and demographic organisation in the past.[2] Statements can be made, not simply about the evolution and history of disease, but also concerning the morbidity, nutrition, adaptation, and health and social conditions of a particular population.

Cemetery populations from many parts of Europe have made invaluable contributions to our understanding of the health and disease of people inhabiting commercially settled towns in the past.[3] The mainstay for palaeopathological research has, however, been Amerindian populations.[4] These people, representing hunter-gatherer, semi-sedentary and farming people, have provided a model on which palaeoepidemiology has been largely constructed. Australia too provides a most suitable place for the investigation and reconstruction of health and stress in past hunter-gatherer people, but until now this opportunity has been almost totally ignored.[5] Aboriginal people have inhabited the Australian continent for at least 40,000 years occupying a diverse range of temperate, tropical and arid environments. With the benefit of palaeopathological methodology we are now in a position to determine the broad pathological, demographic, cultural and adaptive characteristics of Aboriginal groups inhabiting each environmental niche. Because there is such diverse environmental variation within the Australian continent, it is reasonable to assume possible variations in patterns of precontact stress and disease.

Previously, insights into past societies have nearly always been achieved through archaeological investigation, but by studying skeletal rather than cultural remains it is possible to make substantial additions to this knowledge. This is especially so in regard to the evaluation of environmental pressures exerted on individuals living a hunter-

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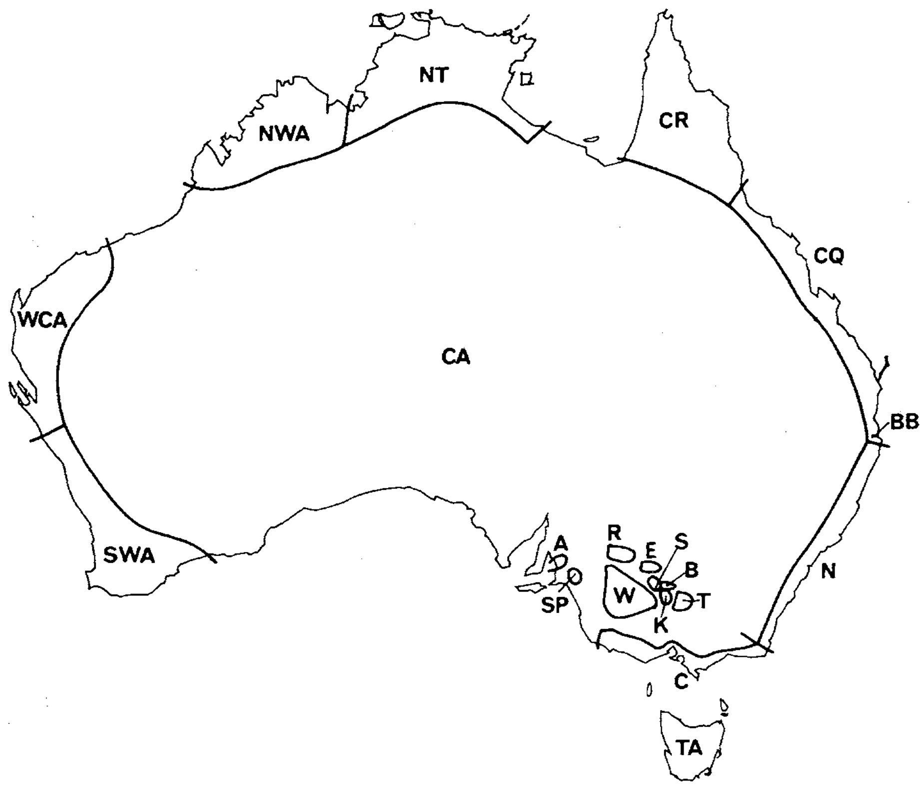
1 Ackerknecht 1953: 120.

2 Buikstra and Cook 1980; Ubelaker 1982.

3 Moller-Christensen 1978; Wells 1967.

4 Cook 1979; Huss-Ahsmore et al. 1982; Mensforth et al. 1978; El-Najjar 1976 and 1978.

5 Sandison 1980; Prokopec 1979; Webb 1981.



Map 1. Sample locations used in this study (see also Table 1).

TABLE 1. Location and Area Codes

Locations:		Locations (cont.)	
T	– Tocumwal, Echuca and Deniliquin	TA	– Tasmania
K	– Kow Swamp (modern)	CQ	– Coastal Queensland
B	– Baratta	CR	– Cape York and Cairns
S	– Swan Hill	BB	– Broadbeach collection
E	– Euston	QB	– Coastal Queensland and Broadbeach
R	– Rufus River	P	– Pleistocene sample (includes Kow Swamp collection, Cohuna and Coobool Crossing series)
M	– Precise location unknown but from the Murray River		
SP	– Swanport		
A	– Adelaide	Areas:	
C	– Coastal Victoria	CM	– Central Murray (K,B,S,E)
W	– West central Victoria (Wimmera)	MUY	– Murray Valley (T,CM. R, M)
N	– Coastal New South Wales	R	– Rufus River
CA	– Central Australia	SC	– South coast (SP, A, C)
WA	– Western Australia	DES	– Desert area (CA, NWA, WCA)
NT	– Northern Territory (tropical)	TRO	– Tropics (NT, CR)
AT	– Northern Territory (including arid area)	CTL	– Eastern coast (QB, N, SWA)

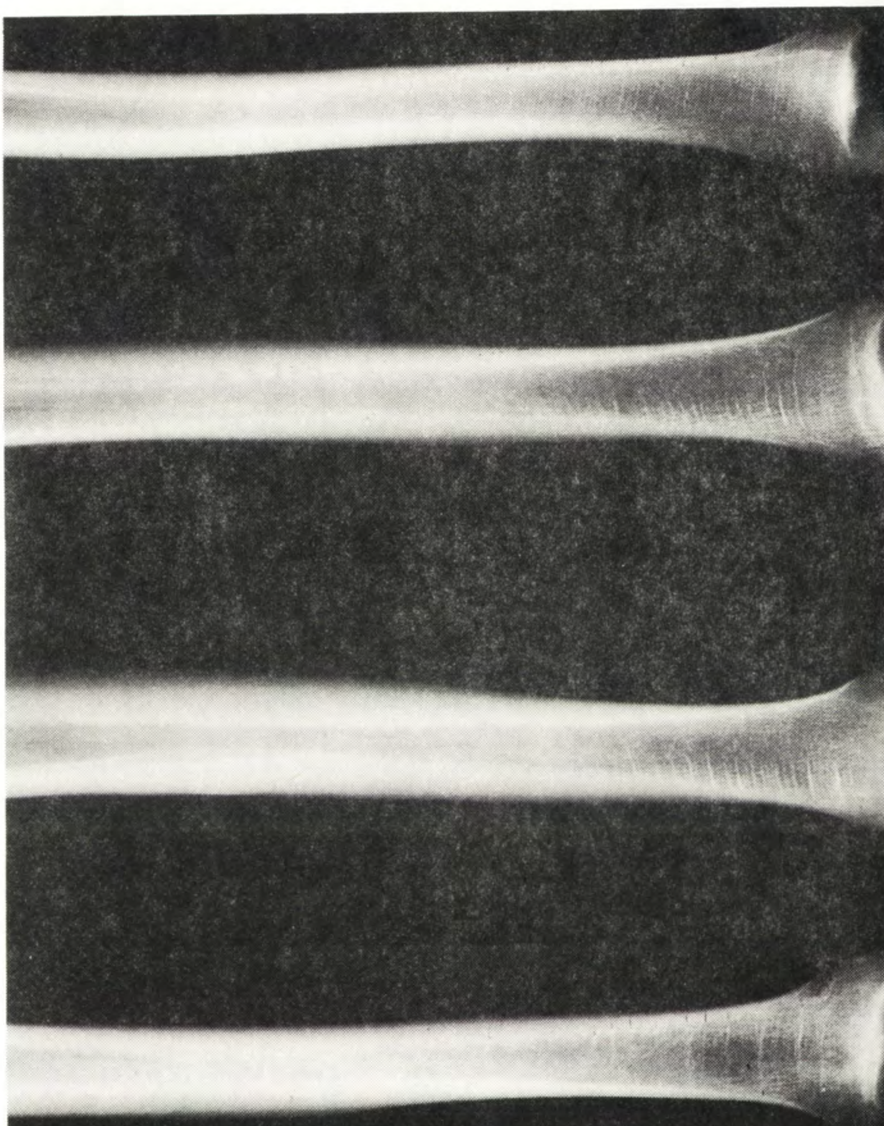


Figure 1. The 'step-ladder' effect of Harris lines in distal tibiae.

gatherer lifestyle. Such biological studies also add further dimensions to the investigation of prehistory. It is, after all, people, not their tools and chattels, that suffer the vagaries of the environment in which they live, and these vagaries are often reflected in the form of diagnosable traits within the skeleton.

In this paper I have asked three basic questions: (1) are there differences in health and stress patterns between Aboriginal groups inhabiting different ecological zones? (2) can the answers to these questions tell us more about Aboriginal society and lifeways? and (3) does the health status of Australian hunter-gatherers differ from similar people around the world?

Stress Indicators

I have surveyed Aboriginal skeletal material in various collections around Australia in order to derive some general patterns of precontact Aboriginal health and disease. Nine major pathologies were recorded which can be divided into two main groups: stress indicators and general pathologies (Table 1). In this paper I will be discussing the former only.

Two of the three stress markers discussed here occur during the time of skeletal growth, the third can appear at any time: they accumulate when the individual experiences bad nutritional and physiological states. These indicators can be divided into two categories: those that represent acute or transitional stress, such as systemic disease and malnutrition (Harris Lines and Dental Hypoplasia) and those showing chronic or long term stress such as anaemia (*Cribra Orbitalia*).

Harris Lines

Harris lines (Figure 1) have no single cause but systemic disease such as measles, whooping cough, influenza and chicken pox, trauma (such as appendictomy and immunisation), and malnutrition have been cited as causal agents.[6] These lines are networks of trabecular bone spanning the medullary cavity of the long bones. They are formed by a two-part process. The first part reduces the thickness of the epiphyseal cartilage plate beneath which osteoblasts form a layer of bone. The individual's recovery from the stress episode initiates bone laydown on the inferior surface of this plate, thickening it and producing the thin line of bone visible under X-ray examination. A semi-permanent record of acute, transitory metabolic insults is more, therefore, left behind. In the adult these lines can be seen in a position along the shaft of the bone approximating the age at which disturbance occurred. By dividing the distal end of the tibia into three growth stages, or age groups, a longitudinal study can then be made of Aboriginal childhood stress. This type of study can reveal: the age at which children were most vulnerable to stress; the persistence of stress; comparisons between the susceptibility of males and females, and the general expression of disease and stress in temporally and spatially disparate people.[7] It should be noted that only those tibia with associated crania can be sexed.

6 Steinbock 1976; Garn et al. 1968.

7 McHenry 1967; Clarke 1980.

Dental Hypoplasia

Dental hypoplasia (Figure 2) in some ways is similar to Harris lines. Some stresses disturb tooth enamel laydown, resulting in a thinner than normal band of enamel on the tooth.[8] This distinctive band, however, is unlike Harris lines in that a certain degree of severity can be inferred from the type of hypoplasia present. I have distinguished two degrees of severity: lines and grooves, and pitting. For this particular exercise, however, except where otherwise stated, these have been combined to form a single frequency. Unlike Harris lines, only the presence or absence of hypoplasia has been recorded, not the number of times it has occurred on a given tooth.

By surveying the permanent canine tooth, the enamel of which is formed between four months and six to seven years, it is possible to pinpoint stresses occurring during the first six years of life. Similarly, by looking at the third molar, which develops between six and seven years and fourteen years, a second age group can be monitored for stress events.[9] By surveying adults, in which both of these teeth have erupted, I have been able to look back at the individuals's first fourteen years of life. Sex identification is possible only in adults, but indirectly this has enabled me to make comparisons between male and female children.

Cribra Orbitalia

Cribra Orbitalia (Figure 3) is the pitting of the orbital plate of the frontal bone caused by chronic iron deficiency anaemia.[10] Three basic types of lesion represent mild, intermediate and severe forms of the condition.[11] Here I have combined the three to form only the categories of present or absent. Five age groups can be monitored: 0-5 years, 6-11 years, 12-20 years, young adults (21-35 years) and old adults (>35 years).

POPULATIONS

Over 1,000 individuals were X-rayed for Harris lines and about 2,000 surveyed for dental hypoplasia and cribra orbitalia. These have been divided into populations according to ecological, cultural and demographic parameters. For the purposes of this paper, however, I have merged various groups so that only six basic populations are represented (Map 1). Of these only the south coast (SC), central Murray (CM) and east coast (CTL) will be contrasted with brief mention of other populations when necessary.[12]

8 Sarnat and Schour 1941 and 1942.

9 Wells 1967.

10 Cockburn 1977; Hengen 1970; Angel 1967; Cybulski 1977; Webb 1982.

11 Nathan and Hass 1966.

12 The seven populations discussed here are denoted thus: central Murray (CM), Murray River (MUY), Rufus River (R), south coast (SC), Desert (DES), Tropics (TRO), east coast(CTL). (see Map 1 and Table 1).

Figure 2. Dental hypoplasia indicated by the indented lines in the enamel of the incisor and canine teeth.

Figure 3. The porous morthology of Cribra Orbitalia, an anaemia related condition affecting the orbtal plate of the frontal bone.

STRESS EVIDENCED IN SOUTH EASTERN AUSTRALIAN ABORIGINAL POPULATIONS

I have used an Index of Morbidity to compare populations for Harris lines. This index is formed by dividing the total number of lines in a given population by the number of individuals (or tibia) X-rayed. This will be referred to as 'index'.[13] Two major features are immediately evident. The Murray people and, in particular, those of the central Murray show greater incidence of Harris lines than any other populations examined except those of the south coast which display an inordinately high index. Figure 4 shows the percentage of individuals in each area without Harris lines. It is notable that only 21.5 per cent of the Murray people escape this form of stress, compared with 54.4 per cent at Rufus River and over 55 per cent of the eastern coastal group. It seems likely that the 45 per cent of people affected in the eastern coastal population might either represent individuals from a particularly disadvantaged group (females?) or, a group living at a particularly stressful time. The latter is possible because there is a lack of adequate time reference for this skeletal sample. But with over 80 per cent of individuals from the south coast having Harris lines, stress for them seems to be omnipresent, temporally and throughout the population.

Who, then, is being affected by this type of stress? The 0-5 year old group suffers fairly equally in all populations with the exception of the south coast people (Figure 5). Within the central Murray people stress continues at the same rate into the 6-10 year age group; it vastly increases on the south coast but significantly drops in other populations after the 0-5 year old period. The age group including those older than 11 years experiences the lowest amounts of stress in any population at any time during childhood with the eastern coastal people enjoying substantial decreases at both the 6-10 year and >11 year stages. The two outstanding populations are the central Murray and south coast. Ages 6-10 in the latter group seem to be the most vulnerable, but a trend is evident here. All age groups in the south coast population are experiencing stress rates somewhat greater than the same age group in any other population.

For dental hypoplasia in the 0-7 age category there are highly significant differences between people in the central Murray (CM) and Rufus River (R) ($p = < 0.001$) and significant differences between the central Murray and the Desert (DES) ($p = < 0.01$) (Figure 6). All other populations have similar amounts of hypoplastic incidence with males generally having greater frequencies than females.

The older age group (7-14 years) shows a substantial drop in dental hypoplasia for both sexes in all populations except females at Rufus River. A highly significant amount of stress remains, however, in the central Murray region, 25 per cent, as opposed to the rest of Australia which has a combined frequency of nine per cent ($p = < 0.001$). Such non-alleviation of stress is reminiscent of the pattern observed for Harris lines, whereby lines are formed throughout sub-adulthood. There is no significant difference of dental hypoplasia between males and females in either age group in any population. Further, the south coast region does not stand out for this stress in-

[13] The index of morbidity as developed by Calvin Wells is arrived as thus:

$$\frac{\text{number of lines}}{\text{number of bones}} = \text{I of M}$$

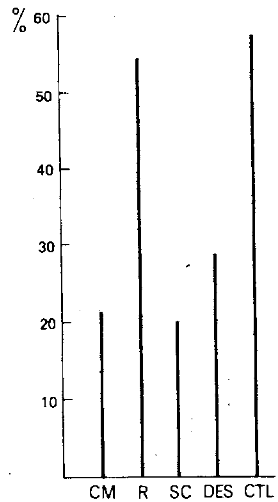


Figure 4. Frequency of individuals without Harris lines.

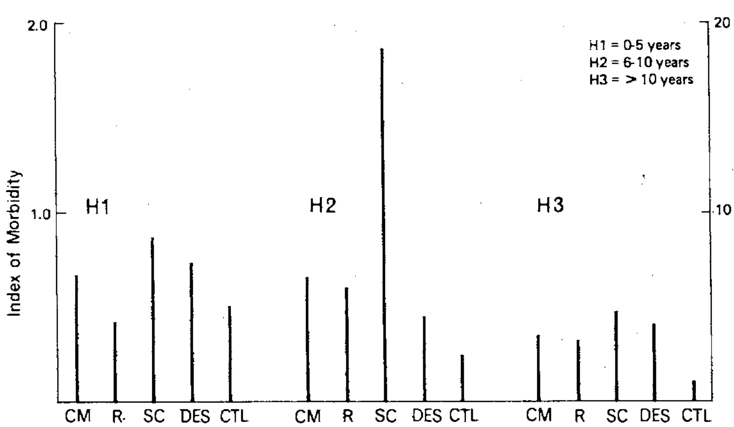


Figure 5. Harris line distribution in three age grades, by Area.

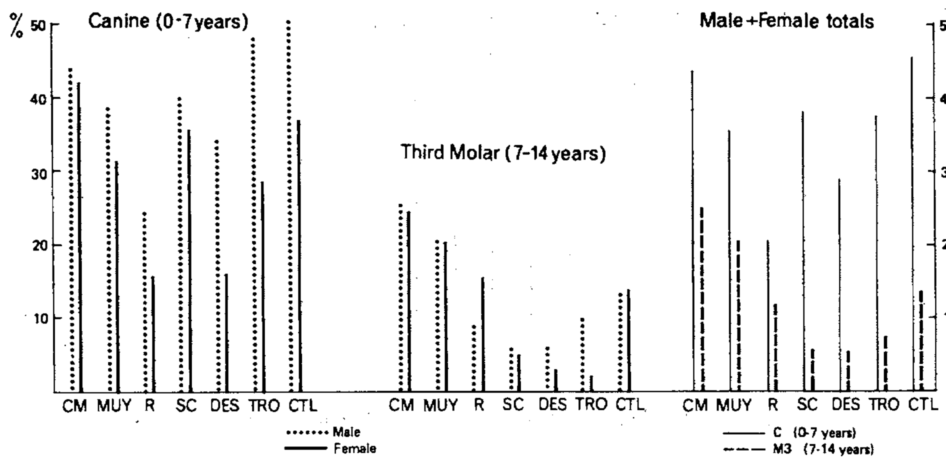


Figure 6. Individuals with dental hypoplasia, by Area.

dicator as it did for Harris lines. The implications of these frequencies will be discussed later.

The survey of Cribra Orbitalia (iron deficiency anaemia) has produced results similar to those already seen for the other two stress markers. The frequency of all juveniles affected in the central Murray (CM) population is 59.3 per cent, significantly different ($p = < 0.001$) from the 42.6 per cent for the combined juveniles from all other groups (Figure 7). Figure 8 show the sequential progression of anaemia in sub-adults and two adult age groups from the south coast, central Murray and east coast populations. This highlights the sub-adults of the central Murray which have very high rates of anaemia that drop to around 33 per cent in adults. It should be noted, however, that 73 per cent of children under 11 years in the central Murray collection show this condition, while for the south and east coast populations it is seen in only 38-9 per cent and 40.9 per cent respectively. There is, then, an obvious difference between the central Murray and coastal people as regards this form of stress.

Generally, those populations having high rates of sub-adult anaemia have also high numbers of adults with this condition. Secondly, significantly higher incidences of anaemia occur in adult males and females from the central Murray region than in any other area. Finally, there are always more females than males affected in all populations in this study but this seems to be the general trend world wide.

DISCUSSION

To give some idea of the occurrence of Harris lines in Aborigines, I have compared the results here with two other morbidity indices. That for a Saxon population from Burgh Castle in England sits at the 2.6 level: these people were part of a substantial population, living in squalid and cramped conditions with open cess pits and a lot of infectious disease to cope with.[14] In contrast, a Bronze Age group from Dorset, enjoying a healthier lifestyle with better nutrition, much less infectious disease, and smaller numbers of people has an index of 0.8. Although a direct comparison of these people with Aboriginal groups cannot be made, the figures illustrate that changes in the frequency of Harris lines are tied directly to the social and pathological ecology of the individuals having them.[15] Such a comparison also highlights the fact that Aboriginal people do display a high variability of this stress related trait.

Because we are talking about Aboriginal society we are able to eliminate automatically almost all of the causes of Harris lines cited above. Also, by looking at their pattern of placement and interval within the bone and combining this with other pathological data we can throw more light on causational differences between populations.

When we look at the rates of non-specific infection in the areas under discussion it is possible to find out more about the health of the people and what may be causing Harris lines. The south coast region has one of the lowest frequencies for non-specific infection; the highest frequency is seen in the central Murray. The small size of available samples from the tropics (TRO) necessitated my omitting this area from discussion.

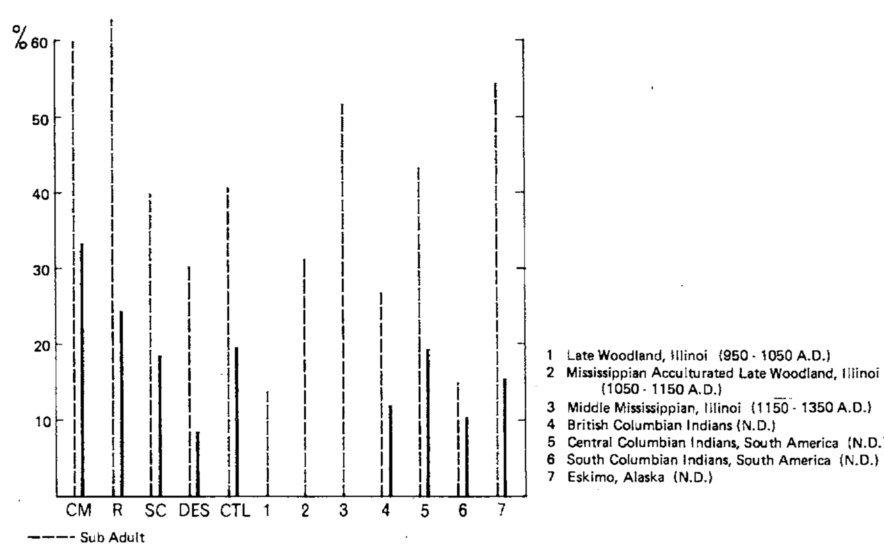


Figure 7. Comparison of cribra orbitalia frequencies in Australian Aborigines and some groups of American Indians.

[14] Moller-Christensen 1978.

[15] McHenry 1967.

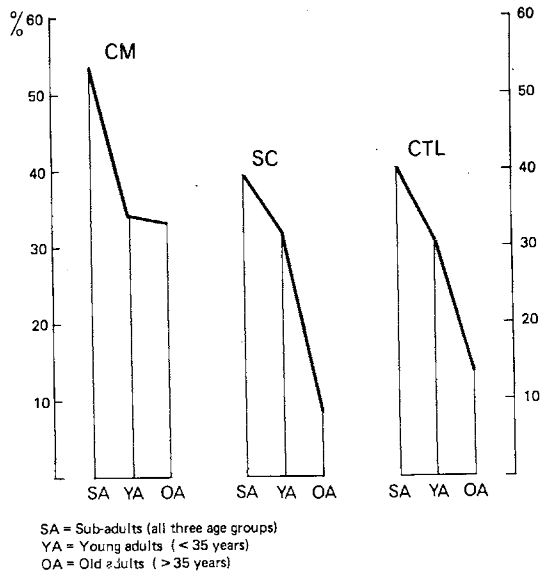


Figure 8. Decrease in incidence of cribra orbitalia (anaemia) with age.

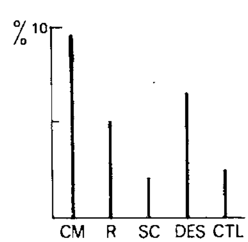


Figure 9. Non-specific infection of the six major long bones, by area.

The pattern of lines in the tibia of people from the south coast shows an equally spaced, 'step ladder' pattern. It points to their regular production in a manner rather reminiscent of an annual, or even biannual, stress period (Figure 1). This leads me to suggest that regular, seasonal episodes of nutritional stress rather than an annual disease were more likely to have been experienced by Aboriginal people showing this regularity of line formation. Harris lines can be traced from birth, throughout the growing life of the particular bone. To account for the high rate of lines in the 6-10 year age group we must look at physiological, nutritional and social factors. Most of the nutritional needs of the 0-5 year age group are met for the first two or even four years of life by full or partial breast feeding. This buffers infants from any nutritional stresses experienced by the wider community. Members of the over 11 year old age group most likely fend for themselves and, in some cases, are attaining an age at which they are traditionally accepted as members of the adult group and benefiting from all the nutritional and social advantages this brings. The 6-10 year age group, however, will, as the major body of children, be the survivors of the 0-5 year old group, carrying with them the effects of stress from two or three post-weaning years. Also they are the group in which the growth spurt begins at around seven to 10 years putting physiological demands on the body. This, in turn, renders children vulnerable to dietary changes and environmental insults.[16] They as well as adult females, may be subjected also to certain food taboos, and still have a great reliance on adults for their dietary needs.[17] Nevertheless, regular episodes of famine seem to occur on the south coast throughout life; this is demonstrated by the higher amounts of Harris lines on an age for age comparison with sub-adults from other areas.

In people from the central Murray area line patterning is not quite the same as it is for those from the south coast. The regular spacing of lines, although seen, is not the same nor, of course, is their frequency although the central Murray is second highest for this trait. The non-regularity in occurrence and spacing of lines is thought to represent a different aetiology for their occurrence in this area from that of the south coast. When we look at the amount of non-specific infection in the seven populations it is possible to find out more about the health of the people and the background to possible causes of the frequencies of Harris lines. In Figure 9 we can see the different frequencies of non-specific infection and observe that the highest rates occur in the Murray (the Tropics can be ignored because of sample size). This amount of non-specific infection suggests that there are some significant differences between the Murray people and those of the south coast. High levels of infection are to be found in groups of American Indians inhabiting the Georgia coast.[18] These people, however, were maize farmers and subject to the health changes settled community living brings. The frequency of non-specific disease in the pre-agricultural phase of the Georgia community was 1.7 per cent which is comparable to that found in the Aboriginal group from the south coast. What are we seeing, then, in the Aboriginal groups from the River Murray? I will return to this later.

16 Black et al. 1938; Harrison 1977.

17 Elkin 1979; Dawson 1881; Spencer and Gillen 1969.

18 Larsen 1982.

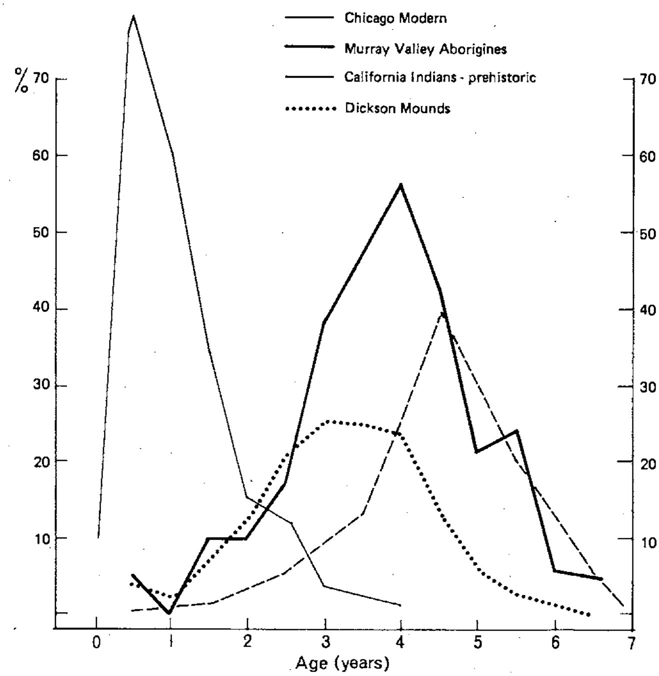


Figure 10. Distribution of dental hypoplasia during the first five years of life. (After Goodman and Armelagos 1980 cited in Huss-Ashmore 1982, and Green 1982).

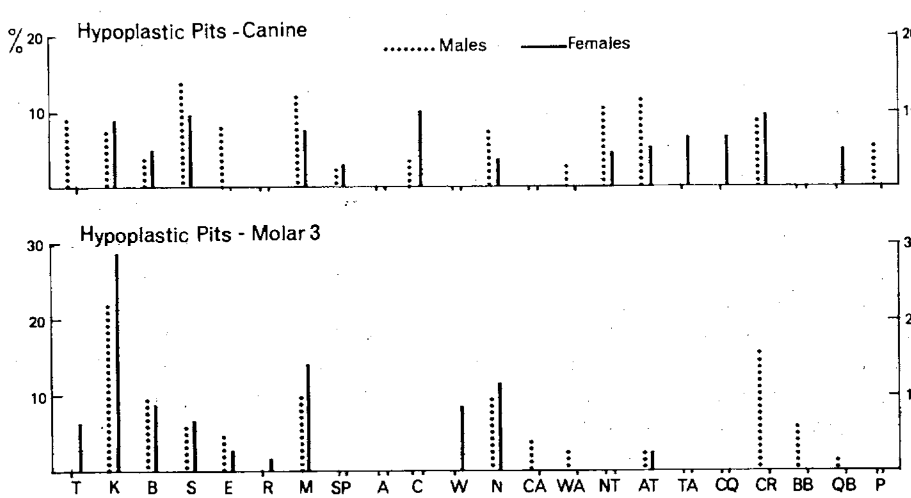


Figure 11. Frequencies of hypoplastic pit defects, by location.

On a microscopic level dental hypoplasia can show how many stress events have taken place during the time of enamel formation. The macroscopic level of investigation used in this study allows us to see one event only.[19] Therefore, exact correlation between Harris lines and dental hypoplasia cannot be expected, for undoubtedly each has its own triggering mechanism which changes with the individual's response to a particular stress. It has been argued elsewhere that events causing Harris lines do not necessarily initiate corresponding bouts of dental hypoplasia and when they do the latter often lags the former by up to six months.[20] Moreover, resorption of Harris lines due to endocrinal, mechanical and ageing processes will further confuse any attempt to correlate these two stress markers to any degree even on a microscopic level. The resorption with age process also provides an underestimation factor in the assessment of numbers of Harris lines. The true frequencies of Harris lines, therefore, will be greater in the living than those presented in this study.

The occurrence of hypoplastic events across a large portion of the youngest age group in both hunter-gatherer and historic societies has the effect of reducing the percentage of individuals affected at any one time. In contemporary society the contraction and concentration of hypoplastic events pushes the peak of children affected very high. These patterns follow the norms in the various societies for time of weaning. It seems, therefore, highly likely that dental hypoplasia in the 0-5 year age group is a product of this stressful time. Further, the position, height and spread of the susceptibles curves for hunter-gatherers in Figure 10 reflects more protracted weaning at a greater age in those societies. Green shows that dental hypoplasia in a prehistoric Aboriginal 0-5 year age group peaks between 3 and 4.5 years with a highest frequency of around 50 per cent (Figure 10).[21] In my survey Aboriginal children in the young age group vary from as little as 16 per cent in Desert females to 50 per cent in eastern coastal males, with the central Murray at around the 44 per cent mark. The peak age for pypoplastic events demonstrated by Green fits that of other groups from around the world. However the frequencies arrived at in his study and this survey are as high or even higher than those recorded for hunter-gatherer and settled groups elsewhere.

Although in the 7-14 year age group the Murray River people undergo a 50 per cent reduction in the amount of hypoplastic stress, this does not compare to the vast stress alleviation that takes place elsewhere for this age group. If we look at the type of hypoplasia occurring in this age group in the central Murray it can be seen that although substantial amounts of lines and grooves are forming, pits are forming also. These are most common in the Kow Swamp, Loddon and Kerang areas (K) (Figure 11). Therefore, although the central Murray maintains the greatest hypoplastic stress with respect to other areas, certain small localised groups within this larger area emerge as particularly subject to stressful events (Table 1).

The overall predisposition of males to higher frequencies of hypoplasia than females may be a reflection of the trend for males to be more susceptible to metabolic insults

19 Rose 1977.

20 Clarke 1980 and 1982; McHenry et al.

21 Green 1982.

during the formative years. This phenomenon is seen throughout the world.[22]

Anaemia can be caused by genetic, metabolic, pathological and nutritional factors.[23] No genetically induced blood diseases such as sickle cell anaemia or thalassemia have ever been detected in Aboriginal people; therefore, this cause can be eliminated.[24] Menstruation, lactation and breast feeding immediately predispose females to greater iron losses than males and this is the likely explanation for greater frequencies of cribra orbitalia in females, not only in Australian Aboriginal populations but also in other groups around the world.

Pathological and nutritional factors such as weanling diarrhoea, parasite infestation, the introduction of adult food and a lack of dietary iron often work synergistically, thus making it hard to evaluate the contribution of each to the aetiology of anaemia.[25] For small children, especially those at time of weaning, any or all of these processes can have dire effects on their general health and leave some individuals with generally weak constitutions.[26] Protracted weaning without suitable weaning foods can result in dietary insufficiency and weanling diarrhoea, and this is exacerbated by parasite infestation.[27] Helminth infestation prevents the body using ingested iron by causing nutritional malabsorption, even if those so infected enjoy a well-balanced diet. Further, iron loss can result from internal haemorrhaging through parasite related damage to the intestinal wall. The diarrhoea and sickness that nearly always accompanies such infestation exacerbates any existing enteropathy, dietary setback or infection. The Murray Valley provides a natural environment for the support of various species of intestinal parasites such as *Strongyloides stercoralis, Ascaris lumbricoides, Trichuris trichuris* and *Enterobius vermicularis* all of which can produce the above symptoms to varying extents.[28] It seems likely, then, that high amounts of parasite infestation would have been experienced by the Aboriginal people of this area.[29]

It is clear from the frequencies of cribra orbitalia that anaemia is prevalent among Aboriginal juveniles from all parts of Australia. However the greatest amounts are found in children's remains from the Murray River region. The results of this survey show that the vast majority of these children was being subjected to stresses similar to those mentioned above. This trend was maintained into adulthood with the Central Murray showing frequencies of 29.7 per cent and 40.3 per cent for males and females

22 Goodman et al. 1980.

23 Robbins and Cotran 1979; Krupp and Chatton 1980.

24 Kirk 1981; Horsfall et al. 1953 and 1956.

25 Robbins and Cotran 1979; Krupp and Chatton 1980.

26 Moodie 1973.

27 Annette Hamilton (1981) discusses extensively the social, phychological, behavioural and nutritional effects of weaning on Anbarra children. Although this group is somewhat removed both temporally and spatially from the area under discussion here, it is thought that a similar situation at weaning time would be applicable to most Aboriginal groups, Australia wide.

28 Sweet 1924; Johnston and Cleland 1937.

29 For a fuller discussion of the possibilities of helminth infestation and its consequences in a tribal context see Webb 1982. For an extensive review of parasitic disease in contemporary Aboriginal society see Moodie 1973: 127-142.

respectively. The frequency of Cribra Orbitalia, as that for dental hypoplasia, diminishes somewhat in adults but not to the same extent as it does in other parts of Australia. This non-amelioration highlights the fact that anaemia is an ongoing phenomenon conditioned not just by the general susceptibility of the young but by aspects of this particular society which affect all its members.

Comparing the frequency of cribra orbitalia in the Murray people with that for other populations from around the world we can see the group is subjected to larger amounts of this type of stress than is usual for hunter-gatherer communities. The frequencies rank with some of the highest amounts anywhere. In fact, frequencies of cribra orbitalia comparable to those of the Murray are rarely, if ever, found in hunter-gatherer groups and resemble those in people who have taken up a more sedentary lifestyle. This is illustrated clearly in Figure 7. In three groups of Indian remains representing hunter-gatherers (Late Woodland), transitional hunter-gatherer/agriculturalists (Mississippian Acculturated Late Woodland) and agriculturalists (Middle Mississippian) there is a steady increase in the frequency of anaemia both in juveniles and adults. Increases in anaemia have, therefore, been seen to coincide with increasing sedentism.[30] The clustering of people into large groups and extended family situations; a general increase in population, and the lowering of sanitary standards are all features of increasing sedentism. From the above data it seems that the human ecology of the Murray shows similar characteristics, providing a catalyst for the growth and maintenance of large helminth populations. Moreover, even in an area providing a rich biomass the existence of large numbers of people could produce such intense exploitation that nutritional inadequacy might arise with comparatively small fluctuations in seasonal abundances and river levels. This would compound any pathological circumstances similar to those outlined above.

CONCLUDING REMARKS

The extraordinarily large amounts of regularly spaced Harris lines seen in the south coast people suggest seasonal stress in the form of feast and famine. The situation, however, has not affected the general health of these people as shown by low frequencies of dental hypoplasia, cribra orbitalia and non-specific infection. Although such palaeopathological data do not show up all the possible reactions that an individual might have to intermittent famine, it seems likely that some physiological adaptation to this situation could have taken place, equipping these people with a means of coping with such events. This could be supported by the general good health of the population in this region.

The data from the Murray Valley, on the other hand, provide us with a very different picture. Here we can see greater evidence of stress than for any other population except that shown by Harris lines in the south coast group. The highest amounts of any stress discussed in this paper are found in the central Murray, and this population stands out as having greater frequencies of stress-related skeletal markers than any

[30] Lallo et al. 1977.

other Aboriginal group anywhere in Australia. The patterns and frequencies of stress and disease found in the central Murray indicate a lifestyle distinctively different from that of many other Aboriginal groups. This distinctiveness does not match well with our expectations of small numbers of hunter-gatherers roaming widely and enjoying a continuing abundance of food. Instead, it is more reminiscent of the evidence provided from large numbers of sedentary, or at least semi-sedentary, people living in close proximity to one another and sharing plentiful, but heavily exploited, food resources which, when less abundant, causes serious hardship for the whole population already under some stress.

This conclusion may differ substantially from previously held beliefs about pre-contact Aboriginal demography. Recent research published by Butlin, however, has postulated that some rethinking about the palaeodemography of the Murray and south eastern Australia might be appropriate.[31] The findings of this survey strongly suggest that Aboriginal society in the central Murray was not only sedentary but must have been far higher in numbers than anything previously suggested or associated with this part of the Murray River. How far this population density extended is not known at this time. The evidence for coastal New South Wales must also, to some degree, be taken to indicate a similar situation.

My results were formulated concurrently but separately from those of Butlin, and even though they may be incongruous to our present understanding of precontact Australian Aboriginal population composition further human biological and interdisciplinary research is needed to bring together a fuller understanding of the lifestyle of the Aboriginal people inhabiting the Murray Valley and South Eastern Australia.

31 Butlin 1983.

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