# What about the children? Incorporating osteological, archaeological, and ethnographic data to understand Sadlermiut childhood

by

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A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

MASTER OF ARTS

Department of Anthropology

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FACULTY OF GRADUATE STUDIES

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## ABSTRACT

Skeletal remains have long been used by physical anthropologists in order to understand the health and lives of past peoples. The purpose of this research is to better understand the lives of the Sadlermiut children from Native Point Southampton Island, Nunavut. To do so, a three-fold methodology integrating archaeological and ethnographic evidence of children and childhood with an osteological analysis of growth and development is utilized. This is the first study to concentrate on the skeletal remains of those less than 18 years of age from the Sadlermiut archaeological sample. This research suggests a high prevalence of infant mortality among the Sadlermiut, the largest proportion of which were female. The growth of the Sadlermiut is comparable to that of the Eskimo and Aleut from Alaska, yet less than that of modern children of European descent, and other Aboriginal archaeological populations from North America.

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## DEDICATION

This work is dedicated to the memory of three very important women. My grandmother Molly French, who dreamed of being an archaeologist; my great-aunt Elsie French who inspired me to want to teach and who believed in my dream; and my great-aunt Marie French for listening as I expounded again and again about anthropology. Your love, encouragement and belief in me are a constant light.

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# CHAPTER 1: INTRODUCTION

The study of human skeletal remains is the oldest field in human biology, and it is the study of such remains from archaeological sites that provides researchers with a direct link to past peoples. When there is little or no literary or cultural evidence, research that analyzes human skeletal material offers the only avenue of investigation into the past (Brothwell 1968). Skeletal remains have long been used by physical anthropologists in order to understand the health and lives of past peoples, particularly when there is little or no other available information.

The purpose of this research is to better understand the lives of the Sadlermiut children. In order to do so a three-fold methodology integrating archaeological and ethnographic evidence of children and childhood with an osteological analysis of growth and development is utilized. By pairing all three of these avenues of research together it will be possible to link changes in growth and development with certain periods in the lives of these children, such as weaning and puberty. It will also be possible to identify periods of stress that these children may have experienced because of malnutrition and disease. Finally it will be possible to understand the growth experienced by the Sadlermiut in relationship to other archaeological populations, allowing for the interpretation of differences in growth that may be due to genetic and environmental differences and adaptations.

The inclusion of archaeological and ethnographic information allows for the determination of whether or not artifacts are included with the burials of subadults and their potential meaning. Burial goods can reflect a person's social status and role, and illuminate differences between males and females and between different age groups.

Social roles change a number of times throughout an individual's life. Being able to identify these changes skeletally and link them to specific social changes as outlined in the ethnographic record can increase the understanding of the Sadlermiut.

The last of the Sadlermiut at Native Point Southampton Island, Nunavut, perished in the winter of 1902-03 from an epidemic introduced by a Scottish whaling ship (Collins 1956c; Merbs 1983; Taylor 1959). Their place in Inuit history has always been of interest to archaeologists, yet the answer has remained elusive. Collins (1956b) believed them to be a remnant of the Dorset Palaeo-Eskimo. Others believed them to be related to the Thule, but having different material culture and behaviours due to their isolation on Southampton Island (McGhee 1978; Rowley 1994). Their mysterious existence and unknown population affinity has prompted numerous studies. Research on the Sadlermiut skeletal remains to date has included studies on bone density (Mazess 1966; Mazess and Jones 1972), osteoporosis (Thompson, et al. 1984), patterns of tooth loss (Merbs 1968), cancer (Cassidy 1977), dental and cranial metrics and morphology (Mayhall 1979; Popham and Bell 1951; Utermohle and Merbs 1979), ancient DNA (Hayes, et al. 2005), spinal column defects (Merbs 1962, 1974, 1996, 2002a, b, 2004) and activity related bone changes (Merbs 1983). In a number of these studies the osteological analyses incorporate ethnographic and archaeological information in order to add context to the osteological analyses, most notably the study by Merbs (1983) on activity related bone changes. Yet to date no study has been performed that concentrates on those individuals whom are less than 18 years of age. This project concentrates on these individuals specifically, making it unique.

Research concerning children and childhood in archaeological populations has gained recognition in the last ten years (Baxter 2005, 2006a, b; Derevenski 1994b; Kamp 2001b) with emphasis on gaining insight into the child's world (Lillehammer 1989), recognizing children as social actors capable of contributing to society and the identification of material culture belonging to children (Finlay 1997; Kamp 2001a; Milne 2005; Park 1998, 2006). Prior to this, children and childhood were rarely mentioned in anthropological research due to their perceived invisibility. This was attributed to the belief that children were passive and did not impact society and any evidence that could be linked to them archaeologically was not likely to survive (Baker, et al. 2005; Baxter 2005; Chamberlain 2000). Contrary to these beliefs, it has been illustrated that children can and do interact meaningfully with the world around them, and in doing so affect and change it. Evidence of such can be identified in the archaeological record.

In biological anthropology children are considered to be those between the ages of 3 and 7, and are grouped under the category of 'subadult', which refers to all individuals less than 18 years of age. In general and for the purpose in this study, the term subadult will refer to all individuals who are less than 18 years of age. Biological anthropologists are in a unique position in which to understand children and childhood in the past, as they work directly with the skeletal remains of these individuals. It is through the osteological analyses performed by biological anthropologists that makes it possible to assign ages to individuals, create age categories, identify weaning and puberty, two important biological, social and cultural stages.

# CHAPTER 2: LITERATURE REVIEW

Unlike anywhere else in the animal kingdom, modern human growth is characterized by an extended period of dependency (Bogin 1997). Furthermore, this coincides with the cessation of brain growth and a prolonged childhood, and continues until the beginning of puberty. It is unique to humans and may in fact be related to the development of language and culture (Bogin 1997; Hoppa and FitzGerald 1999; Humphrey 1998). Growth in childhood is the major contributing factor to variation in adults making the study of growth and development the only real tool available for understanding morphological variation and differences among and between groups (Hoppa and FitzGerald1999; Johnston 1969). It is therefore not surprising that physical anthropologists have studied growth worldwide over a wide range of time periods (Hoppa and FitzGerald 1999).

In the history of anthropological research, growth studies have played an important role for both palaeoanthropological and bioarchaeological studies. Palaeoanthropologists concentrate on dental development to understand the process of evolution and bioarchaeologists utilize the appendicular skeleton to understand past population health (Hoppa and FitzGerald 1999). Classic growth and development studies use sub-adult skeletal remains as a proxy with which to understand population health (Hoppa 2000), and analyze evidence of health and nutritional stress in order to better understand the weaning process and mortality patterns (Saunders, et al. 1993). Yet there is a need to move beyond this and to recognize the child as a social actor and to put the child at the centre of research. The incorporation of archaeological and ethnographic research can put the life of children in context and can facilitate the construction of hypotheses that aim to explore the experience of childhood in the past. In fact the approach to incorporate osteological, archeological and ethnographic information with which to understand children and childhood was put forth in 1989 by Lillehammer as a call to anthropologists to give past children a voice (Lillehammer 1989). By incorporating archaeological and ethnographic research into osteological analyses, physical anthropologists have a unique opportunity to better understand childhood in the past.

## GROWTH AND DEVELOPMENT

### The Process of Bone Growth

Growth refers to the "incremental changes in size and morphology that occur throughout the development of the individual" (Scheuer and Black 2000:4). It is the nature of bone growth that makes growth and development studies possibleha

Bone is a unique tissue due to its growth characteristics and the important role it plays in the overall size of an individual (Rallison 1986). The process of bone growth is a regular system of laying down bone. All skeletal elements begin as cartilage with a base of mesenchyme, the embryonic connective tissue precursor. Most bones, including those of the skull and face, develop through the process of endochondral ossification where bone is preceded by cartilage (Rallison 1986; Scheuer and Black 2000; White and Folkens 2005). The process of turning cartilage into bone begins at the centre of the bone shaft or diaphysis, in close proximity to the nutrient foramen responsible for nutritional transport to the developing cells. These primary ossification centres are formed when the cartilage cells begin to degrade and there is an increase in the deposition of hydroxyapatite, the mineral matrix of bone (Rallison 1986; Scheuer and Black 2000). After these cartilaginous cells have begun to degrade, osteoblasts, cells that build bone, begin to form a layer of bone on the mineralized cartilage (Scheuer and Black 2000). The bone continues to grow in length through the continuous degradation of cartilage and deposition of osteoblasts. The new bone undergoes reorganization through remodeling by osteoclasts; cells that remove and remodel bone, in order to maintain appropriate ratios of bone thickness (Scheuer and Black 2000). The creation of primary centres of ossification and the process of ossification begins in utero (Rallison 1986; Scheuer and Black 2000; White and Folkens 2005).

Secondary centres of ossification begin to form just before birth and start at the ends of the long bones or close to their final layout and are called epiphyses (Rallison 1986). The area between the primary and secondary areas of ossification is called the growth plate or epiphyseal plate and is an area of rapid growth and undergoes the greatest growth in length (Rallison 1986; Scheuer and Black 2000). As growth continues, and the deposition of bone exceeds the growth of the cartilaginous cells, the growth plate narrows and is completely replaced by bone so that the epiphysis is fused to the diaphysis, marking the end of longitudinal growth (Rallison 1986; Scheuer and Black 2000; White and Folkens 2005). The timing of such epiphyseal fusion is well documented and plays an important role in the age determination of subadults.

In addition to growth in length, the growth plate is also responsible for growth in width (Scheuer and Black 2000; White 2005). Bone cells, osteocytes, do not divide and replicate and due to the fact that the mineral matrix of bone is rigid, bone is unable to expand from within and can only grow by adding new layers (Scheuer and Black 2000;

White 2005). This is a balanced process of apposition of bone by the periosteum, a fine membrane that lies on the outside of bone which is responsible for the transportation of nutrients. The cambrium, the portion of the periosteum that lies closest to bone, is responsible for laying down new bone cells. As new layers are added, the bone is continually remodeled on the interior, through the canal so that the boney cortex is controlled and the correct proportions are maintained in the transverse plane (Rallison 1986; Scheuer and Black 2000; White 2005). Growth in length and width occur simultaneously so that there is a continuous process of cartilage being replaced by bone and the apposition and resorption of bone through the exterior and interior of the shaft.

Any injury to the growth plate, whether from developmental problems, inherited traits, disease or trauma, can result in a stimulation or inhibition of growth (Scheuer and Black 2000). The growth plate undergoes rapid growth during childhood and so is susceptible to stress. It is therefore the area from which evidence of growth faltering can be found. Due to its cartilaginous nature, the growth plate does not survive archaeologically. Rather physical anthropologists look for evidence of trauma or stress in the form of non-specific stress indicators such as Harris lines, lines of growth arrest visible through x-rays; reduced long bone length relative to the population; linear enamel hypoplasia, lines of halted growth visible in the enamel; and periosteal bone changes (Hoppa 2000; Humphrey 2000).

### Factors that Influence Growth

Growth is a complex process controlled by genetics and hormones, but influenced very strongly by environmental factors, such as nutrition, disease, infection, and socio-economic status (Eveleth and Tanner 1990; Frisancho 1980; Hoppa 1992; Johnston 1969; Rallison 1968; Scheuer and Black 2000; Silventoinen et al.1999). However, of all of these, nutrition is the one factor that plays the largest role in growth.

There are a number of environmental factors that affect growth, but all of them hinge on nutrition especially when paired with the prevalence of infection in childhood (Eveleth and Tanner 1990). King and Ulijaszek (1999) consider nutrition and infection to be the two most important environmental factors that affect growth. The interplay between nutrition and infection is a complex one and rarely can the two be separated (Lovejoy, et al. 1990). Anemia provides good example of this complex interaction. Although anemia results from a lack of iron, which can be due to diet, it is compounded by the presence of diarrheal infection and or parasitic infections that further restricts the amount of iron available to the system (Frisancho 1993). In fact, in most developing countries, diarrhea diseases of infants cause the greatest impact on growth potential (Eveleth and Tanner 1990). The effect of environment has been illustrated in twin studies where twins are raised in different environments and despite having the same growth potential reach different heights as adults (Eveleth and Tanner 1990; Rallison 1986; Scheuer and Black 2000).

Genetics play an important role in the attainment of adult body size, body shape and the pattern of growth (Rallison 1986; Eveleth and Tanner 1990; Scheuer and Black 2000). Those most closely related genetically experience the most similar patterns of growth with monozygotic twins experiencing the closest growth pattern, then families, and so on (Eveleth and Tanner 1990).

Growth is regulated by the human growth hormone secreted from the anterior pituitary gland (Rallison 1986:7). Sex hormones also play an important role in growth and account for differences observed between males and females in growth tempo, epiphyseal union, and the timing of the adolescent growth spurt (Rallison 1986:7). Epiphyseal union and therefore skeletal maturation occurs earlier in females than in males. This is due to the fact that estrogen favours bone maturation whereas testosterone stimulates the growth of cartilage, such that the bones of males will continue to lay down cartilage and grow in length after the bones of females have begun to fuse (Scheuer and Black 2000). This has also been attributed to genes that play a retarding role on the Y chromosome (Rallison 1986:7).

The effect that environment has on growth is most noticeable in developing countries where there exists a large gap between individuals of different social economic status (Silventoinen et al.1999). A child may undergo a number of growth disruptions and survive, but adaptations are made to ensure survival, which may result in a smaller overall body size. If an entire population endures the same insults a smaller overall body size results, thus making a population smaller as a whole (Eveleth and Tanner 1990; Frisancho et al. 1975). Consequently, environmental factors can ultimately affect genetics over a long period of time, as the body learns a process of adaptation.

In cases of childhood illness, even mild illnesses, or episodes of malnutrition, growth slows or halts. Despite this, the child typically recovers and, with adequate nutrition, can experience a period of catch-up growth after which they return to a normal growth curve. This period of catch-up actually requires more energy than normal growth. If children do not receive the adequate nutrition after overcoming a sickness, they will be stunted, as they were unable to attain their optimal height despite genetic influences (Eveleth and Tanner 1990; Rallison 1986).

The effect that malnutrition and illness has on the growth of a child depends on the intensity and duration of the insult and the age of the occurrence. Children are most at risk from the negative affects of malnutrition and illness between birth and five years of age (Eveleth and Tanner 1990). Yet good health and nutrition during pregnancy is imperative, as it plays an important role in establishing an individual's ability to reach their growth potential (Strauss and Dietz 1997). In-utero nutrition, maternal nutrition and birth weight have important implications with respect to growth after birth and any growth deficits that occur in-utero persist into early childhood (Ruowei et al. 1998). Growth retardation that occurs in-utero is followed by an intense period of catch-up growth that lasts up to eight months after birth. Despite this period of catch-up growth the child will never be able to attain his/her genetic growth potential. Therefore nutrition in-utero and that up to the age of five years, will have lasting effects on the growth potential of a child, despite his/her genetic growth potential.

At six months of age, the effects of malnutrition and illness cause a decrease in the weights of infants. This is linked to the decline in lactation, which commonly coincides with weaning and the substitution of low protein, high carbohydrate foods (Eveleth and Tanner 1990). By the time a child is two years old, any deficit in growth that will be evident in adulthood has already been accumulated. Growth can be negatively affected by insults during adolescence but the greatest effect on final height is caused during the early childhood years. The bones of the legs grow the fastest in early childhood, when the child is most susceptible to the negative effects of nutrition and illness, making them the skeletal elements most greatly affected by such stressors (Scuilli 1994). This makes the long bones of the lower limbs excellent indicators of stress or growth disruption.

**The Role of Growth in Understanding Past Peoples**

The growth rate of a child reflects his/her health and nutritional status better than any other index (Johnston 1969). In fact the average weights and heights of a nation's children can accurately reflect the public's health and nutritional status (Eveleth and Tanner 1990; Silventoinen et al.1999). It is through the study of the growth and development of children and adolescents that patterns of growth are identified and potential variation evaluated, making possible the reconstruction of health changes and nutritional status of past populations (Hoppa 1992).

Growth and development can be approached through the use of both longitudinal and cross-sectional studies (Eveleth and Tanner 1990). Longitudinal studies follow the growth of living children through time, that is, they use the same individuals throughout the research project, measuring long bone length at different ages for each individual in the study. Yet due to their very nature, growth and development studies that are performed on skeletal remains are cross-sectional, that is, it is only possible to look at each individual at one stage in their life, the stage at which they died. Cross-sectional studies are limiting as they do not allow for the representation of growth within an individual or the true representation of growth within a population as they are compiled of results from snap shots of growth that occurred at specific ages.

The first studies of growth and development were based on living children in order to track and understand the process of growth. The longitudinal research of Maresh (1943) on x-rays of the six long bones of living children pioneered the study of growth and development. This research established a base for understanding the process of long bone growth and its relationship to age. All children in this study represent the white upper middle class and are free of nutritional issues or chronic disease, making them a healthy group with which to compare other populations.

In a study of living children aged 11-17 who had suffered a period of protein-malnutrition in their first three years of life, Briers and colleagues (1975) note that the only growth parameter that was negatively affected was height. This deficit in height is linked to the chronic nature of the malnutrition not to an acute case or the timing of the malnutrition. The fact that height is the only variable that undergoes lasting negative effects is further evidence that long bone growth in length is a sensitive indicator of nutritional stress.

In a study of living children from the Aleutians and Alaska, Garn and Moorrees (1951) noted that patterns of tooth eruption began earlier among them than compared to children in populations of white or African descent. In all cases, the teeth of children from white populations erupted later than all other comparative samples. They also found that based on growth patterns, body build was established early in childhood despite the fact that projected stature may have been taller than that of their parents (Garn and Moorrees 1951).

The growth and development studies performed on living children prompted physical anthropologists to incorporate similar techniques in the study of archaeological populations. The study of growth and development of past populations provides information as to the timing and degree of growth interruptions, differential growth and evidence of differential health between populations across time and/or space (King and Ulijaszek 1999; Saunders et al. 1993). It also allows for the determination of different skeletal proportions between populations (Johnston 1968; Y'Edynak 9176), and the analyses of long bone growth is a useful tool with which to understand stress in the form of nutritional deficits due to its susceptibility to insults from environmental factors (Hoppa and FitzGerald 1999).

Skeletal maturity (i.e. bone age), and dental maturity are measures that are widely used to determine the rate of maturation, which is independent of childhood or adult body size (Eveleth and Tanner 1990). Each measure reaches the same final point in all normal persons – all bones will grow and fuse and all teeth will erupt - unlike measures of height and weight, where there is considerable variability. It is this property a shared final outcome that makes these useful scales of maturation, as bone age and tooth age are definable and useful (Eveleth and Tanner 1990).

Growth in early childhood becomes standardized reaching a "near-linear increase" until the growth spurt in adolescence (Saunders et al. 1993). Because growth in childhood is a regular process (Rallison 1986) and linear in nature, any deviation from its path as a result of malnutrition or disease can be identified (Saunders, et al. 1993). Direct evidence of malnutrition or disease stress may not be visible on the skeletal remains as lesions or lines of arrest, rather delayed growth or a reduction in bone length may be the only indicator.

Palaeodemographic data are a good way in which to understand stress experienced by a population. The mortality pattern illustrated by palaeodemographic research is a method by which to gauge the ability of a population to deal with stress (Lovejoy, et al. 1990). Neonatal mortality is linked to the physiological weakness of infants, and is intrinsically linked to the health of the mother during pregnancy. Thus it is a sensitive indicator of maternal health, which in turn makes it a sensitive indicator of overall population health (Hoppa and FitzGerald 1999). Postneonatal mortality is more strongly linked to environmental factors such as nutrition which is linked to breastfeeding. Breast-fed babies are more likely to survive the first year of life than those who are not breast-fed and infant mortality tends to increase after weaning and the introduction of new foods (Saunders et al. 1995). If weaning is a critical period and linked to an increased mortality, it goes to follow that those who survived the weaning process probably underwent a period of nutritional and/or disease stress, which can be identified through the examination of their growth. The growth experienced before the age of three years is a sensitive indicator of nutritional and disease stress experienced by the population under study. While palaeodemographic data and mortality profiles can tell a great deal about the stress experienced by a population and its ability to cope with such stress, the patterns and rates of growth reflected in long bone length, within that population also assist in understanding the nature and timing of the stresses experienced.

**Previous Research**

Johnston's (1962) study of the growth of the long bones of infants and young children of Indian Knoll is a major reference for researchers studying growth and development today. The Indian Knoll site dates to the pre-agriculture, pre-pottery Eastern Archaic period approximately 5000 years ago. Johnston (1962) had two objectives in presenting his data: (1) to look at the growth of the long bones associated with increasing age; and, (2) the mean values at each age for each bone (Johnston 1962). In addition, Johnston (1961) studied the timing of epiphyseal union in order to understand the rate of growth experience by the subadults of Indian Knoll. He found that the timing of epiphyseal union did not differ significantly from that of other groups. Whether or not this is due to the close timing between dental calcification and epiphyseal union or the population matured at the same rate as the European children is still to be determined. Differences in growth rate between populations that start at the same baseline, diverge as one population is exposed to a more stressful environment. This affects that population's ability to reach their genetic growth potential (Johnston 1962).

With respect to growth and development studies in Canada, Saunders and Melbye (1990) set a precedent for utilizing the skeletal remains of children for the determination of the occurrence of chronic stress. In their studies of two Ontario ossuaries they encountered a paucity of children less than 6months of age; this was a reflection of sample bias. On the other hand, they found a large number of children between the ages of 2 and 5, which they linked to weaning and feeding practices through enthnohistoric accounts (Saunders and Melbye 1990).

Goodman and colleagues (1984) were able to link growth faltering in children between the ages of 2 and 5 to nutritional stress caused by the introduction of a low protein maize diet during weaning. Lovejoy and colleagues (1990) noted growth faltering in children up to 3 years old in a Late Woodland population. Based on previous archaeological studies they believed the diet to have been adequate and so nutrition was not likely the cause of the altered growth pattern. Upon closer examination of the long bones numerous subperiosteal bone changes indicative of a boney reaction to infection were discovered. They were therefore able to conclude that within this population, the reduction in growth was caused by high levels of infection (Lovejoy, et al. 1990).

Cook (1979) performed an extensive analysis of subadult skeletal remains from Middle and Late Woodland sites in order to better understand the affect of and the timing and transition to agriculture on health. Using demography, growth arrest and retardation, and direct skeletal evidence of nutritional changes, she was able to illustrate changes in health associated with subsistence changes and human adaptation to such changes (Cook 1979)

Saunders and colleagues (1993) performed a growth and development analysis on the subadult skeletal remains from a 19th century cemetery in Belleville, Ontario. They created skeletal growth profiles (SGP's) by plotting diaphyseal lengths by chronological age as determined by tooth formation. They compared these SGP's to modern standards and to archaeological and contemporaneous samples. By doing so they were able to illustrate how the growth of children in 19th century Belleville differed from or was similar to other populations. Such differences and/or similarities can then be explained by nutritional and health status that varies between groups geographically and temporally. For example, they noted that the Belleville children had longer long bone lengths than the two archaeological populations, but that any differences were negligible by the age of two. The St. Thomas children were found to have similar SGP's to those of the modern comparative sample except for those children under the age of two years. These children had slightly shorter long bone lengths than their modern counterparts. This may be associated with stressors linked to poor maternal health during pregnancy (Saunders et al. 1993).

Merchant and Ubelaker (1977) compared long bone lengths of the Arikara to those of Indian Knoll (Johnston 1962), and the femoral growth curves to Late Woodland, Eskimo and modern whites, using dental standards of Moorrees and co-workers (Moorrees, et al. 1963a, b). They found that long bone growth was slowest in the Eskimo sample, followed by the Arikara and Woodland and fastest in the white children (Merchant and Ubelaker 1977). Eskimos had a slower growth rate as well as a shorter final height than the modern white population. This could be attributed to the more rigorous environment and hereditary shortness of the Arikara, Woodland and Eskimo peoples (Merchant and Ubelaker 1977). They also found that the dental formation standards of Moorrees and colleagues (1963ab) which are based on a white sample, over-aged the individuals in the Eskimo, Arikara and Woodland samples and therefore likely underestimated the growth of these non-white populations (Merchant and Ubelaker 1977).

Eskimo and Aleut adults are of medium to short stature with broad and long upper bodies, short legs (especially the lower leg) and short forearms (Y'Edynak 1976). Upon performing a growth and development analysis of Eskimo and Aleutian children from the 1700's Y'Edynak (1976) was able to conclude that these proportions are in fact created and present in childhood. This suggests that adult proportions are determined in early childhood and are enhanced in adolescence with the adolescent growth spurt.

Through research on archaeological subadult skeletal remains and comparative analysis, it is possible to understand not only biological issues but also social ones (Humphrey 2000). Subadult skeletal remains and the analysis of growth and development can help address issues such as the type and degree of environmental stress a population endured at a particular time or differential stress experienced within a population. This can be interpreted in terms of changes in socio-political and socio-economic circumstances, changes in subsistence strategy, changes in population density and the presence of warfare and political instability (Humphrey 2000).

## Interpretation of Growth and Development

The ability to understand past population health and demography by utilizing these kinds of osteological analyses is limited due to various methodological differences between studies. The growth data of Maresh (1943) is commonly used as a comparison for the growth of archaeological populations, yet the method in which the data was collected is different. Maresh (1943) collected data by the longitudinal analysis of radiographs from living children, whereas all archaeological material is based on the direct analysis of skeletal remains, which can have implications as to how the measurements of long bone length were conducted. In addition, the children included in the Maresh (1943) data were all modern healthy white children who grew up in an environment drastically different from that of an archaeological population. Despite this, the growth data from Maresh (1943) provides a comparison with which it is possible to illustrate the drastic differences sometimes visible between past and modern populations. Furthermore, the dental development data of Moorrees and colleagues (1963a, b) which is the data most frequently used by physical anthropologists to age skeletal remains of subadults, is based on modern white children. Ages determined using this comparative data may not accurately age archaeological populations, particularly populations of a different ancestry, as dental development and timing of eruption varies with respect to the ancestral heritage of a population.

Concern has been expressed that the study of human skeletal remains cannot reflect the risk of illness that members of past populations may have experienced (Wood, et al. 1992). Wood and colleagues (1992) argue that data from osteological analyses is biased. This is because physical anthropologists use a skeletal sample that only includes individuals who died, as that is the only way individuals become part of the study sample. These samples do not include all those who may have been at risk of disease or death, only those who actually died. In addition, they argue that there are risks to developing diseases that are undetectable, such that the physical anthropologists cannot then possibly refer to the population as a whole. Rather, the physical anthropologist can only ever work with a sub-sample of a population, one that may have been more at risk that the rest of the population, but which not possible to quantify.

In response to this issue, Saunders and Hoppa (1993) illustrate that for non-specific stress indicators or for evidence of disease to be physically left on bone, the individual had to have survived that period of stress and lived long enough for growth to resume. This suggests that that particular incident was not the cause of death, which, in turn, means that the particular events under study did not likely impact mortality. Lovejoy and co-workers (1990) point out that infant and child death is most likely a result of acute infection, rather than a chronic disease process. Therefore the growth of these individuals is a good representation of population growth as it was not effected by nutritional or disease stress, and so is the same growth pattern experienced by those who survived into adulthood.

## THE ARCHAEOLOGY OF CHILDHOOD

### Understanding the Concept of Childhood

Childhood is a stage unique only to the human life cycle. Bogin (1997) defines childhood as "the period following infancy, when the youngster is weaned from nursing but still depends on older people for feeding and protection" (Bogin 1997:64). Chamberlain (2000) provides a more general definition: "the period of physical and social development from birth to maturity." (Chamberlain 2000:207).

Cultures worldwide recognize a time in the life of an individual which can be called "childhood" (Bogin 1997). This extensive period of "post-weaning juvenility" has been used as a model for understanding resource sharing, sexual division of labour and tool use and these features have been linked to the excess cost of dealing with this extended period of dependency (Bird and Bird 2000). The concept of childhood has been linked to changes in the construction of the family and its recognition in Europe between the 15$^{th}$ and 17$^{th}$ centuries (Lillehammer 1989). During the 18$^{th}$ and 19$^{th}$ century, with changes in education, reforms and ultimately attitudes towards children, the period of childhood was changed from a 'short' one to a 'long' one, paralleled with the child's new and central place within the family (Lillehammer 1989).

The idea of childhood has played a significant role in the understanding of human evolution. The development of childhood is considered the result of the introduction of a new life stage into the primate pattern of growth and development (Bogin 1997). Humans undergo five stages in the course of their growth from birth to reproductive maturity – infancy, childhood, juvenility, adolescence and adulthood. All other primates and social mammals go through these stages with the exception of childhood and adolescence. Each of these stages, particularly those related to the rate of growth, feeding practices and reproductive behaviour can be defined through biological and behavioural characteristics. The stage of childhood "fills the gap" as it were, between being dependent on the mother for feeding and feeding independence (Bogin 1997). The juvenile stage of development characterized by independent feeding practices prior to sexual maturity, can be found in most social mammals (Bogin 1997). Children typically reach this juvenile stage at around age seven, making the childhood stage of life between the ages of three and seven. Most social mammals, as they move from infancy to juvenility, are in possession of their permanent teeth. Yet in humans, children's permanent dentition does not begin to erupt until the age of 6 starting with the first molars. This makes them dependent on older individuals to assist them in feeding or food procuring practices, since their deciduous dentition is less robust and they have energy demands that exceed their ability to attain food (Bogin 1997). This period of extended dependency allows sufficient time for the development of the larger human brain and allows for developmental plasticity; the ability of the individual to adapt as necessary to environmental circumstances and cognitively to learning processes and knowledge (Bogin 1997). Moreover, this period also affords individuals the time to acquire specific skill sets, patterns of socialization, personality development, and an understanding of the complex social roles and behaviours individuals require to become an active participants within in their society (Bogin 1997; Baxter 2005; Derevinski 2001; Kamp 2001b).

In palaeodemographic research the period of development from birth to maturity is broken down into age categories. Infant refers to those between birth and up to one year of age, young child refers to those between one and three, child refers to those between three and seven, juvenile for those between seven and twelve, and adolescent refers to those between 12 and 18. In some cases, the infant is broken further to neonate (birth to one month old) and post-neonate (one month to 12months old). The specific age designations for each category can vary between researchers and countries. For the purposes of this research the definition of childhood as that provided by Chamberlain (2000) is the one which will be used. Such that when the term childhood is used in discussion, it refers to the entire range of birth to maturity. Specific age categories used to understand the demographic makeup of this sample will be those listed above.

Studies of children have long been a part of developmental psychology and sociology and have allowed for the understanding of how individuals develop within societies and how culture is passed on from generation to generation (Chamberlain 1997). The presence of children in such studies and the recognition that much can be learned from including children in research is in part responsible for prompting anthropologists to included children. Given that the fields of psychology and sociology have benefited from the inclusion of children and child specific research, the inclusion of a similar field of research in anthropology has great potential.

Lillehammer (1989) suggests that any model created to understand childhood in the past should acknowledge that changes in the dynamic of family, and by association, the adult world, will affect the world of the child. The structure of the family affects a child's living conditions and ultimately their experience of childhood. The number of children in a family can play a role in economic success, family power, and status (Kamp 2001). In addition, age can be an important variable in social organization and rites of passage can play a role in social values and social change (Kamp 2001).

Lillehammer (1989) suggests that childhood is a social rather than a biological category. The position that children hold in society and the study of them as a social category has "rarely been explored." Age has been treated as a variable, not as a principal, that helps in the organization of society (Derevenski 1994). Children play a role in their own development by interacting with the world around them, mastering skills and acquiring knowledge (Derevenski 1994). Children produce their own futures and reproduce cultural knowledge, making them active social agents. By recognizing the role children play in society, research on them can provide us with a better understanding of how cultural dynamics within a specific social group change over time (Derevenski 1994).

Classic archaeological studies that do include children are those where items can be directly linked to children, such as burial goods. Harke (1989) found that knife blade length was correlated with the age and sex of the individual with which they are buried. No knives with blades greater than 106mm were found associated with juvenile burials. Rather, longer blades were associated with adult male status. For juvenile burials, there was no difference in blade length between males and females, but differences were found in the frequency of deposition, with males having a greater number of knives. Harke (1989) does not go beyond this to suggest how these knives; their blade length and inclusion in juvenile burials could have implications for the children themselves and their roles as social actors within their group.

## The Invisibility of Children

In the field of archaeology, children and childhood have been considered invisible (Derevenski 1994). This is linked to the belief that physical evidence, skeletal and/or archaeological, of children does not survive. It is more likely though that it is the cultural ideas of the archaeologist that do not allow for the identification of children and their material culture.

Baker (1997) suggests that children are invisible in anthropological research due to the male centric view of anthropology in the past. It is only with the advent of a feminist anthropology that children are recognized as they may have been defined as feminine, or at least of sharing the qualities associated with being female, making them invisible alongside women. In the western world, children exist as weak, subordinate, parts of the domestic realm, small and illogical and therefore did not find their way into broader anthropological research (Baker 1997). By including children in archaeological research it is possible to better represent the complexity of past societies (Baker 1997).

The western world's view of children marginalizes any economic or social role they may play and views them as being apolitical. The concept of 'child' and 'childhood', can only be understood in relationship to the western world's notion of 'adult' and 'maturity' (Derevenski 1994a, 1997, 2000; Finlay 1997). If in our own culture children interact on a daily basis with the things around them, whether with eating utensils or toys, it goes to show that children had the same or similar interactions in the past. It is always the adults who have the socio-political power and control within a society, and therefore the control over the production of material culture (Derevenski 1997). Yet in a number of societies, children and their contribution to economy play a large and important role. A reasonable conclusion then is that children also made important contributions to past societies (Derevenski 1997).

As mentioned in the previous section, the prolonged period of dependence upon an adult is the pervasive concept of childhood. It is this ideology that has led archaeologists to see children as "passive, inert automatons" (Derevenski 2000). The western notion of childhood puts considerable emphasis on chronological age. Children in the archaeological record are defined as a developmental age group linked to a chronological age and so are only seen according to physical anthropological ideas of a physiological state of being rather than a social category (Derevenski 2000). In non-western societies it is stages of maturation that play an important role which take account of biological age, but also the personality, skill and individual traits of the child (Kamp 2001). In western views of children as passive makes it difficult for the archaeologist to move beyond this ideal and recognize the child as an interactive and important individual within a society.

Children and their material culture are utilized as a way in which to understand the adult world, and objects associated with them are only understood in relation to adults (Derevenski 2000). This is a structuralist view that sees relationships as dualisms (a basic tenet of structuralism) or binary opposites, adult, child; male, female (Scott 1997).

The age at which children undertake their roles and responsibilities that prepare them for adulthood varies from culture to culture. The behaviour expected for children also varies. There is a tendency across multiple cultures including the west, to expect a high degree of responsibility and ability in performing tasks from children beginning at age 5-7 (Rogoff, et al. 1975). Considerable research has been conducted regarding the roles and responsibilities of children in egalitarian societies, how these change as the child ages, and how they vary with respect to sex. This type of information is important as it can assist in the understanding of archaeological societies (Rogoff, et al. 1975).

**Preservation, Recovery and Representation of Child Skeletal Remains**

The lack of child representation in anthropological research is also linked to the concept that the skeletal remains of children do not survive archaeologically. But there are a number of reasons as to why and where the skeletal remains of children are found. The lack of representation of subadult skeletal remains can be partially explained by the fact that the inclusion of infants or children in a cemetery varies. Rega (1997) found that inclusion in a cemetery at Mokrin was at least partially dependent on the age-at-death of the individual, because infants younger than one year were absent. The lack of those less than one year old in the cemetery could indicate the fact that the infant is not considered a member of the society and so does not accord the same treatment as older individuals. Therefore an age of one year could indicate a change in the role of the infant, as it is afforded the same treatment as other individuals (Rega 1997).

In addition to cultural practices that affect the inclusion of children in cemeteries, the skeletal remains of children are impacted by problems of differential preservation since their bones contain a lower mineral content in bones compared to those of mature adults, and their skeletal remains are smaller and may be overlooked during excavation especially if they are buried with other adult remains. Furthermore, the graves of children may be overlooked because they are smaller and shallower and may be more prone to damage or loss because of natural processes or human activities (e.g. ploughing, construction) (Chamberlain 2000).

**Recognition of the Material Culture of Children**

The ability to recognize the presence of children and/or their behaviour in the archaeological record has been questioned. Children tend to have a distorting impact on material culture (Hammond and Hammond 1981); therefore, they affect the distribution of artifacts. Hammond and Hammond (1981) caution that researchers need to take into consideration the affect that a child, by playing, will have on the deposition of artifacts. Yet, they do not acknowledge that children can have intentional effects or other ways of influencing the archaeological record.

Small items are commonly associated with children and may be toys, yet they may have a more complex significance, such as the ritualistic association of amulets. There is no way in which to relate the size of an object to its use by a child, whether for education or recreation (Finlay 1997). The crude and poorly made are always associated with children as they are seen as part of the learning process (Finlay 1997). If the range and skill of children in non-western countries is taken into consideration, the equation of age and lack of skill can be quickly called into question (Finlay 1997).

## Finding Children in the Archaeological Record

By acknowledging that children may have played a role in economy and the division of labour, allows for their recognition as social actors (Derevenski 1994). In a large number of non-Western societies, children did and do make up a significant portion of the workforce (Scott 1997). Lillehammer (1989) suggests that one must have a good understanding of the adult world being investigated in the past before one can look for the child's world. Yet the concentration should be placed directly on the discovery of children. The material record must be addressed in ways that account for age and age distinctions (Lillehammer 1989).

Lillehammer (1989) cautions that items that children may have played with may have in fact also functioned in the adult world. She suggests that miniature tools and weapons could have been made in order to train the child.

## Studies in the Archaeology of Childhood

The increase in research in the last ten years, that includes children and their identification in archaeological assemblages, has been an important change in the field of anthropology as it opens an avenue of investigation into understanding past societies otherwise unexplored. The roles that children play in society vary from culture to culture, as does the age at which children begin these roles. Being able to recognize such social changes through the analysis of archaeological material allows for a broader understanding of the complexities of past societies and differences among and between peoples.

Learning is how children gain the knowledge and skills that ensure the continuation of a craft within a community (Crown 2001). The production of lithics, ceramics and weaving are some of the skills that may be learned at a young age (Kamp 2001a). How children participate in the production of these crafts can assist in the understanding of how knowledge is passed down, how technology and knowledge are accessed and the order in which a complex skill is learned (Crown 2001).

Due to their ability to survive in the archaeological record, and their ability to illustrate individual technology, knapped lithics have a unique ability to inform researchers about past mental abilities (Stout 2002). "Skill acquisition is a process of learning how to act in order to solve a problem rather than one of acquiring some rigid motor formula" (Stout 2002:694). Among the Langda on Indonesia, apprenticeship used to begin around the age of 12 and 13 (Stout 2002). Stout (2002) was able to identify characteristics of adze production that could be linked to the skill of the stone worker, therefore making it possible to identify those who were apprentices and those who were not – which suggests the ability to identify younger individuals or children – or their efforts in the past.

The variation found in lithic assemblages has been linked to the level of expertise of the knapper (Shelley 1990). In an experiment that collected the material of new and learning flintknappers and comparing the cores and flakes to those of experienced knappers, Shelley (1990) was able to identify those that belonged to each group. As pointed out by Shelley (1990), no one is "born" an expert knapper. It is a skill that is learned, beginning in childhood. Differences in the motor skills of individuals affect the ability of the knapper to remove flakes and the completion of the final product. Given that the development of fine motor skills is related to age, material knapped by young individuals can be differentiated from that knapped by older individuals (Stout 2002).

The availability of raw material for knapping can affect the presence of novice flintknapping. The expert knapper may salvage the attempts of the novice in order to preserve the stone. This paired with the expert assisting the novice could blur the boundaries between the novice and expert (Milne 2005). The presence of novice knapping is restricted by the age of the individual, social organization, raw material availability, and location (Milne 2005; Stout 2002).

Kamp (2001a) found that children among the Sinagua started learning how to make ceramics at a young age, and made animal figures and small dishes for use as playthings. Through the presence of fingerprint ridge breadth measurements she found that children were in fact producing full-sized and usable ceramics at a young age. Finger print ridge breadth increases in size with growth, allowing for the identification of children of different ages (Kamp 2001a). Kamp (2001a) suggests that based on this evidence, children learn about clay and how to work with it and develop the motor skills necessary by making things for themselves, notably playthings. There exists an intermediate stage of ceramic production where novices produce small vessels before they move onto full-sized vessels. These smaller pots are not as well made as larger pots, suggesting that they were made by less skilled and, therefore, younger potters. The ability of children to make full-sized and usable pots suggests that they were able to contribute to the economy at an early age (Kamp 2001a).

Some errors in ceramic production and design may be age-related. The ability for children to plan and execute designs on ceramics is related to development, therefore design can be used as a way to identify products made by children (Crown 2001). If the concept of symmetry is not understood until a child is around 4 or 5 years old, then only asymmetrical designs may be expected before this age (Kamp 2001a). The identification of ceramics that were made by children can assist in understanding the role of children within the society and their expected contributions.

Bird and Bird (2000) found that Meriam children participated in foraging for shellfish with efficiency relative to their size and strength. Differences between the adults and children in foraging may therefore be linked to the differences in physiological constraints rather than having different goals (Bird and Bird 2000).

Lillehammer (1989) suggests that aspects of both learning and fun are reflected in toys, and that as a result, they make an excellent medium with which to find the 'child's world. Toys are made for children and represent attempts by adults to enforce certain behaviours based on gender, age, socio-economic class and ideas of beauty (Wilkie 2000). In the 19$^{th}$ and 20$^{th}$ century toys represent a medium of communication between adults and children and between children and other children. Children's use of space – presence of toys in specific areas of a site - can tell a great deal about what children were doing and to what extent they were influenced by adults at the time. The ways in which toys were used and discarded can tell a great deal about how children communicated with adults through the toys (Wilkie 2000). Yet to concentrate on toys as the only material that may have played a role in the lives of children encourages a specific and a culturally biased view of the roles children played (Derevenski 1994).

The ability to recognize the presence of children in the archaeological record is illustrated in the research of Park (1998, 2006). By combining archaeological material (lithics) with ethnographic accounts of the Inuit, he was able to identify items that could have been utilized by the children in games and hunting practice.

It is important to recognize that not all things small are toys since they could be items of ritual significance, such as those used by shamans (Park 1998). However, small things of ritual significance can in fact belong to children. There are numerous accounts in ethnographic literature that children wore amulets in order to ensure survival, safety and prosperity (Jenness 1922b; Rasmussen 1931b, 1932b), therefore small items with ritual significance can belong to children separate from an association with a shaman.

Finally, evidence of children as social mediators for adults can be found for example, in Wilkie's (2000) study of two plantation sites in Louisiana. Silvia Freeman was an African-American who worked as a cook in one of the plantation houses. Segregated from the African-American community yet alone in a white dominated world, there is evidence that Silvia relied on her five children, through their attendance at the church school, to create ties to the wider African-American community. Friendships that children enjoy are not separate from the social world of adults, but are entwined, as children can meet new friends through the friends of their parents and vice versa. In this way children should be acknowledged as individual social actors who are capable of creating "extended social networks through friendships." (Wilkie 2000:107).

These studies illustrate that children do interact meaningfully with the world around them and ultimately change it and that it is possible to identify the child and childhood in the archaeological record. Although it has taken anthropology a while to get to the point of including children in research, these studies support the fact that children are not passive, but are active individuals who can and do shape the world around them in unique ways. Children play a role in how societies function and contribute to society, by including children in the analysis of past peoples the entire society is included in interpretation.

### The Role of Biological Anthropologists

Biological anthropologists are in a unique position to understand children and childhood in the past because they work directly with the skeletal remains of children and are able to identify periods of change such as weaning and puberty through analysis of these skeletal remains (Perry 2006). The health, malnutrition and diseases experienced by children in the past is vital in understanding what their lives were like, and it is through osteological analyses that such questions can be answered (Lillehammer 1989). Moreover, the analysis of children's skeletal remains enables researchers to establish age categories, which when combined with archaeological and ethnographic data can allow for the skeletal/dental age to be linked with social categories (Kamp 2001b). Physical anthropology needs to move beyond simple osteological analyses to include a methodology in which the child is made a focus of the research, and what the consequences of ill health and malnutrition may have had on the life of the child itself (Kamp 2001b).

## THE SADLERMIUT

### Archaeological Context of the Sadlermiut

The place of the Sadlermiut in Inuit history has always been a topic of interest and yet a conclusive answer has remained elusive. Collins (1956a, c) postulated that they were the last remnant of the Dorset who occupied the Canadian Arctic from 800BC to 1000AD. The Dorset culture is derived from the Pre-Dorset; part of the larger culture configuration the Arctic Small Tool Tradition (ASTt) and can be found across the Canadian Arctic from Victoria Island to Ellesmere Island to Greenland and Newfoundland (Maxwell 1984, 1985; McGhee 1978; Park 1993). The Dorset developed a unique way of life specific to the arctic, with a reliance on small marine mammals and large land mammals. They are not considered to have been as technologically developed as later Inuit groups as they lacked dogsleds and bows and arrows, and the ability to hunt whales. On the other hand they had snow knives and built snow houses and survived in an extremely harsh environment until about 1000AD when evidence of their existence ceases to be found archaeologically (Maxwell 1984, 1985; McGhee 1978). The disappearance of the Dorset may be linked to a warming period that affected sea-ice conditions and animal distribution, potentially leading to starvation and population decline (Maxwell 1985). It may also be linked to the population movement of the ancestors to the modern Inuit, the Thule from Alaska around 1000AD (Maxwell 1985; McGhee 1978, 1984). The Thule developed in Northern Alaska and the Bering Strait with earliest evidence at 900AD and moved east until 1300AD at which point they occupied all the eastern arctic that had previously been occupied by the Dorset (Park 1993). The development of the Thule culture is linked to hunting large baleen whales as they had the technology for open sea hunting (e.g. kayaks, skin floats, large harpoons) (McGhee 1978). Their expansion across Canada has been linked to the route of these whales, but there is nothing to suggest that they would have had better hunting in the east than in the west, raising the question as to the reason for their migration out of Alaska.

Rather McGhee (1984) suggests that they moved east in order to gain access to iron. Iron has been found at Dorset sites and through trade the Thule may have been prompted to move east for better access. The material culture of the Thule replaced that of the Dorset, which then remained relatively unchanged until European contact. This is reflected archaeologically by the disappearance of the Dorset culture and the systematic spread of the Thule across the arctic (McGhee 1978).

Some believe that the Thule came into contact with the Dorset and the Dorset adapted to their technology. Others suggest that the Thule went through Canada unopposed. Still others believe that ultimately the Thule were the same as the Dorset but their different technology was due to a combination Dorset technology and borrowed technology from Birknick (Hayes, et al. 2005).

According to Inuit mythology the Dorset are referred to as the Tunit and were encountered by their ancestors (the Thule) when they came to the Canadian arctic. They are thought to have been a large and gentle people who were great seal hunters, with whom the Inuit lived for a number of years until they drove the Tunit out after a quarrel. There are numerous Inuit mythologies, yet the stories of the Tunit differ in the quality of their detail and the specific locations of occupation. This suggests that these two peoples did in fact overlap in area and timing of occupation (McGhee 1978). This idea is supported by carbon dates that suggest the Dorset and Thule overlapped for 1000 years. On closer examination and controlling for contamination, problematic source material and geographic discontinuity, Park (1993) suggests that the Dorset were in fact extinct prior to the arrival of the Thule. Population replacement verses cultural mingling is hard to detect in the archaeological record and is made more difficult by the fact that Thule sites are built on top of Dorset sites due to a limited number of areas in which to establish a home (Hayes, et al. 2005). It is therefore not possible to say conclusively whether or not the Dorset and Thule lived in the Canadian Arctic at the same time.

Collins (1956a, c) supported his theory that the Sadlermiut were related to the Dorset by the presence of Dorset artifacts on Walrus Island and at the Sadlermiut site of Native Point, the largest Sadlermiut site on Southampton Island. In addition, a Dorset site was found in close proximity to Native Point (Collins 1956b). Based on similarities in recovered lithics, Collins (1956b) believes that Sadlermiut artifacts evolved from the Dorset.

The Inuit in the Hudson Bay area claimed that the Sadlermiut spoke a strange dialect and utilized chipped stone technology rather than ground stone slate tools– two elements used to link them to Dorset rather than Thule culture (McGhee 1978). On the other hand their stone houses and other artifacts are based firmly in the Thule tradition, suggesting that they were in fact Inuit (McGhee 1978). Based on a comparison of material cultures, hunting practices and ethnographic accounts, the Sadlermiut are most closely affiliated with known Inuit groups (Rowley 1994). Rowley (1994) goes on to suggest that they were in fact of Thule ancestry but due to their isolation and the particular environment of Southampton Island they developed a technology and culture much different from the Inuit of the mainland.

Based on metric and discrete trait analysis of dentition, the Sadlermiut are the same as Kamarvik and Silumiut (Mayhall 1979). Furthermore, craniometric analysis groups the Sadlermiut with those of the Inuit from Northeast Greenland, Baffin Island

and the Naujan, Kamarvik and Silumiut Thule on the West coast of Hudson's Bay (Utermohle and Merbs 1979).

In order to better understand the peopling of the Canadian arctic, Hayes and colleagues (2005) utilized mtDNA for the analysis of genetic affinities between the Dorset, Thule and Sadlermiut. Through the use of ancient DNA analyses it is possible to determine the direct genetic affinities of a people and such analyses offer the most direct test of replacement versus continuity (Hayes, et al. 2005). All 15 samples of Thule mtDNA were haplogroup A. Of the three samples of Dorset mtDNA, one was haplogroup A, one D and one undetermined. Of the 13 Sadlermiut mtDNA, six were haplogroup A and seven haplogroup D. This means that the Dorset were fixed for haplogroup D, the Thule fixed for A and the Sadlermiut equally fixed for both A and D. The complete difference in haplogroup between the Dorset and Thule suggests a genetic replacement in addition to a cultural replacement across Canada 1000 years ago. Furthermore, the fact that the Sadlermiut share haplogroups with both the Dorset and the Thule suggest they were influenced by Dorset genes (Hayes, et al. 2005). This lends support to the idea that the Dorset and the Thule interacted for a number of years and could also explain why other Inuit peoples referred to the Sadlermiut as Tunit -the old people – they were different and likely older than the others from the mainland due to their Dorset ancestry.

**The Native Point Site (KkHh-1)**

Southampton Island is difficult to access yet the easiest area to land by boat is near Native Point on the southeast portion of the island. The western area of the island is separated from the mainland by Roes Welcome Sound, an area difficult to cross. Most of the island is covered in limestone, making travel by foot or dogsled from the west to Native Point difficult. The richest resources on Southampton Island are found at Native Point, making travel across the island unnecessary (Rowley 1994).

In the first season of archaeological excavation, Collins (1956b) found around 90 semi-subterranean houses covering 30 acres at Native Point; this represents the largest site of its kind in the arctic. The interiors of the houses were sunken and filled with the stones from the walls and roofs while others comprised simple pits sunk into the ground. A large number of seal, caribou and walrus bones and hundreds of stone cairns and meat caches were found and excavations yielded numerous artifacts (Collins 1956c; Taylor 1959). In addition there were more than 100 human burials at Native Point, with the bodies of some in stone vaults, and others on the surface surrounded by stones. Kayak rests are found at Sadlermiut sites (Lyon 1825) and Comer collected kayak lances (Boas 1901) good evidence for kayak use. In addition the Sadlermiut were considered excellent bowhead whale hunters both from the ice (Comer 1910) and from kayaks (Mathiassen 1927).

**Contact with the Sadlermiut**

The geographical isolation of the Sadlermiut resulted in later European contact than other Canadian Inuit peoples across the Arctic. This suggests that the Sadlermiut retained their way of life for 100 years longer than other Inuit people (Merbs 1983).The first written account of contact between Europeans and the Sadlermiut took place between the ship the *Griper* and Caption Lyon in 1824 (Lyon 1825). Associated with this first contact is a sketch of a Sadlermiut man paddling out to meet the ship on a raft of seal skin floats. The man's hair was tied up in a top knot at the front of his head, a unique style not recorded for any other Inuit group. Contact also occurred with a whaling vessel known as the *Abbie Bradford* in September of 1878 (Ferguson 1938). An Eskimo who traveled on board, was not aware that anyone actually lived on the island and neither he nor Ferguson could understand the language of the people. Ferguson (1938) noted that they had snow knives made out of walrus tusks, needles made out of ivory, and arrowheads made out of flint, but no tools made of iron. They wore bearskin shoes and their clothing was neat, clean and made of seal or deerskin, and trimmed with Arctic fox.

Captain George Comer, a whaling captain, had contact with the Sadlermiut from 1896 until their demise in 1903 (Comer 1910). A great deal of information comes from this contact as he collected a large number of artifacts on behalf of Franz Boas (Boas 1888, 1901). Comer reported that in 1896 there were about 70 Sadlermiut at Native Point (Comer 1910) and in 1898 there were only 58 remaining (Boas 1901). This points to a population decline in a short period of time, which suggests the population may have been under stress for a while prior to their demise in the winter of 1902-1903.

There is only one incidence of recorded contact between the Sadlermiut and the Inuit of the mainland of the west coast of Hudson Bay (Rowley 1994). The Aivilingmiut told Comer (1910) of this visit that occurred before 1800. Five Sadlermiut men met five Nuvukmiut men and entered into friendly combat. The strength of the Sadlermiut made them stand out in this story, as they were noted to be able throw the other men over their shoulders.

The Sadlermiut participated in the trade route that ran along the south coast of Baffin Island, but when the British whalers set up whaling stations along the southeast coast of Baffin Island in 1823 this trade network was disrupted. Inuit peoples began to group around the areas the whalers occupied (Rowley 1994). In the 1870's the isolation of the Sadlermiut increased with the addition of a whaling station on the south coast of Baffin Island as it attracted the Sikosuilarmiut from Foxe Peninsula. Any trade between them and the Sadlermiut became increasingly unlikely (Rowley 1994). With the establishment of the whaling station at Cape Low on Southampton Island in 1899 the social isolation of the Sadlermiut continued (Rowley 1994). The Aivilingmiut had been working for the Scottish whalers for years and were well equipped to do so with access to iron, wooden boats and guns. According to Rowley (1994:379) by 1902 the Sadlermiut were very isolated, even ignored by other Inuit on Southampton Island and became "strangers in their own land".

The Sadlermiut became extinct in the winter of 1902-03 when a community member who had been visiting the whaling station at Cape Low brought an epidemic to their village at Native Point. The Scottish whaling ship the *Active* had a sick crewmember on board when they got to Southampton Island and Inuit became sick at every port that the *Active* visited that year. The village at Native Point was hit so hard by the epidemic that upon discovery people were found dead in the street and in their houses (Mathiassen 1927). The only Sadlermiut who survived were a woman and four children who had previously been adopted by the Aivilik. The last known Sadlermiut Etienne Kingak, one of these four children, died in 1948 at Igloolik Mission (Taylor 1959).

# CHAPTER 3: MATERIALS AND METHODS

## MATERIALS

This research examines the subadult skeletal remains of the Sadlermiut from Native Point (KkHh-1), Southampton Island, Nunavut, curated at the Canadian Museum of Civilization (CMC) in Gatineau, Quebec. These remains were excavated in the 1950's as part of three different archaeological projects (Collins 1956a; Merbs 1983; Taylor 1959). Henry B. Collins of the Smithsonian Institution conducted excavations at Native Point for two field seasons 1954-55 (Collins 1956a, b, 1957). W. E. Taylor of the National Museum of Canada (now part of the CMC) returned to Native Point in the summer of 1956 to concentrate on the Sadlermiut site at Native Point (Taylor 1959). William S. Laughlin of the University of Connecticut, and Charles F. Merbs returned to the site in 1959 to continue excavating (Merbs 1983) and in fact were responsible for recovering the greatest number of human skeletal remains.

Although there is little information to narrow the timing of their occupation, it is believed that the Sadlermiut occupied Native Point for 500 years (Merbs 1983). In 1986 Comer (1910) numbered the Sadlermiut at 70 and in 1902 there were only 56 individuals remaining, it is therefore likely that the skeletal collection represents an extended occupation from the early 1400's to 1903. Thus the skeletal collection includes individuals who died before European contact and those who died in the early period after contact (Merbs 1983).

The entire Sadlermiut skeletal collection includes 778 individual catalogue numbers of which 115 refer to individuals less than the age of 18 as determined by the CMC (Table 1). All analyses in this study focus on these 115 individuals. Overall preservation was good, although varying from individual to individual. Damage was found to occur most frequently to the cortical bone at the shaft ends restricting the ability to take measurements of such elements.

*Table 1 CMC Age Categories*

| | |
|---|---|
| Infant (birth – 3years) | 68 |
| Child (3 – 12 years) | 24 |
| Juvenile (13-18 years) | 23 |
| Total | 115 |

## METHODS

For each individual a general skeletal inventory was conducted, with particular attention paid to recording the presence and degree of completeness of the elements necessary for conducting this research. The skeletal inventory and dental recording forms used by the Canadian Museum of Civilization were utlized for this research. Additionally, a spreadsheet for measurements and a recording notebook were also utilized. Photographs were allowed and thus were taken to document anomalies and all dentition for future reference.

Measurements were taken for both the left and right sides of all elements, dependent upon the degree of completeness. For long bones, every effort was made to ensure that the maximum length of all elements was taken. Measurements were taken if approximately 30% of the metaphyseal surface was intact at both proximal and distal ends. The area that retained this boney surface was important because in order to take maximum length the *most proximal* and *most distal* areas needed to be intact. Maximum length and width measurements were taken of diaphyses, with no fused epiphyses. If an element had one or more epiphyses fused, maximum length and width measurements were still conducted because growth still occurs even if an epiphysis is fused and only ends when both ends are fused. Taking the length of long bones with one or more epiphyses fused still gives an indication of growth in length and can help in determining timing of fusion relative to this population.

Measurements of cranial elements were taken when the element was at least 75% complete or if any damage to the element did not affect the ability of the researcher to accurately take the measurement. If the area that was missing or damaged was not directly involved in the measurement, the measurement was considered valid. See Appendix A for a complete list of measurements.

In order to create skeletal growth profiles, the lengths of long bones were plotted with respect to determined dental age at death. This was performed using the program SPSS 15. This program was also used for statistical analyses.

### Age Determination

It is possible to determine the age at death of subadult skeletal remains by dental development and tooth eruption, by epiphyseal fusion, and by long bone length. Of all of these, dental age is the best indicator of chronological age, as it occurs independent of skeletal maturation and is least influenced by environmental factors (nutrition and/or disease) (Buikstra and Ubelaker 1994) .

#### *Dental Age*

Dental age was recorded based on the presence of teeth and their calcification and/or eruption score (Trodden 1982). Calcification scores could only be recorded if the tooth was loose or visible in the crypt to the extent that the formation of dentin and enamel could be determined. Where possible every tooth was scored separately. Despite the fact that Trodden (1982) only provides age data for permanent teeth the scoring system was also used to score the development of deciduous teeth, allowing for the determination of age for these deciduous teeth based on the age and tooth formation data of Moorress, Fanning and Hunt (1963a). Permanent teeth were also assigned ages based on the age data of Moorrees, Fanning and Hunt (1963b) for both upper and lower permanent canines, premolars and molars. In some cases, teeth were scored as the average between two stages (i.e. Score 4/5 as 4.5) because this was a better representation of their stage of development. Teeth that were erupted and in occlusion (Stage IV) were recorded but no stage assigned as Trodden (1982) does not in fact offer any age data for teeth at this stage.

Scores for each tooth were then matched to their corresponding mean ages for males and females and combined standards for Inuit children. Trodden (1982) offers mean ages for both Inuit and Indian children but due to the ancestry of the sample under study the only ages used were those for Inuit children. Both male and female mean ages were utilized in order to identify the magnitude of difference that may occur between ages based on whether the individual is considered male or female. The combined mean ages (those created by Trodden) were also used to allow for a non-sex specific age determination. Each score for each tooth in an individual was assigned an age, which were then averaged to arrive at a single age for the individual based on all teeth. Therefore each individual has a mean age for female, male and combined categories. In addition another age combination referred to as M's Combo Age, was created by averaging the female and male age determinations to arrive at a combined age based on both the female and male standards. For an example of how this was conducted see Table 2.

*Table 2  Example of age determination using dental stages*

| Cat # | Tooth | Score | Female Mean | Male Mean | Combined M&F Mean | M's Combo Age |
|---|---|---|---|---|---|---|
| 301 | $I^2$ | 10/11 | 10.86 | 11.92 | 11.54 | **9.55** |
| | $I_1$ | 10 | 7.25 | 8.83 | 8.01 | |
| | ${}_1I$ | 10 | 7.54 | 8.83 | 8.01 | |
| | $PM_1$ | 9 | 10.82 | 10.34 | 10.57 | |
| MEAN | | | **9.12** | **9.98** | **9.53** | |

M's Combo Age = all means under Female Mean (36.47) + all means under Male Mean (39.92)/ 8 = 9.55

This was undertaken to see if a difference existed between Trodden's (1982) mean age of males and females combined and one that averaged the means of males and females once the ages were assigned. In this case there was a slight difference. As can be seen from the above table the Combined Means for Males and Females as based on Trodden's combined means falls directly between the male and female means as does M's combo age. Therefore in the creation of a final age it was the mean of the female and male age determinations that was used rather than the combination mean. Also to note in this table, the mean age assigned for the combined score of 10/11 is an average of the mean age for score 10 and score 11.

The standards for age determination based on deciduous tooth formation of Moorrees, Fanning and Hunt (1963a) for the canines and first and second molars were utilized. The presence of deciduous teeth and their calcification scores have the opportunity to provide a great deal of information with regards to age, therefore justifying the use of a second set of age standards even within a single individual. In addition

Moorrees, Fanning and Hunt (1963b) standards were used to determine the age of the permanent teeth in the same manner as that of Trodden (1982) so that the magnitude of difference could be observed.

Although teeth were scored based on Trodden (1982) these scores were easily converted into the scores used by Moorrees, Fanning and Hunt (1963b) (Table 3).

*Table 3 Tooth development stages/scores*

| **Trodden 1982 Permanent Teeth** | | | **Moorreess et al.** |
|---|---|---|---|
| No corresponding score | | $C_i$ | Initial Cusp Formation |
| Initial calcification and coalescence of cusps | 2 | $C_{co}$ | Coalescence of cusps |
| Complete coalescence of the cusps. The crown is 1/4 complete with little depth in the centre of the crown. | 3 | $C_{oc}$ | Cusp outline complete |
| The crown is 1/2 complete. The centre crown has depth, but no dentin formation. | 4 | $Cr_{1/2}$ | Crown 1/2 complete |
| The crown is 3/4 complete. A layer of dentin is visible. The pulp chamber diverges in a wide arc. Prominent enamel extension are evident. | 5 | $Cr_{3/4}$ | Crown 3/4 complete |
| Crown completed. Termination of the enamel at the cemento-enamel junction is visible. The pulp chamber is converging. | 6 | $Cr_c$ | Crown Complete |
| no corresponding score | | $R_i$ | Initial root formation |
| no corresponding score | | $Cl_i$ | Initial cleft formation |
| Root calcification is 1/4 complete. The root length is less than the crown height. Interradicular cleft formation may be evident in molars. | 7 | $R_{1/4}$ | Root length 1/4 |
| Root calcification is 1/2 complete. The root length is more than equal to the crown height. Interradicular cleft formation is usually evident in molars. | 8 | $R_{1/2}$ | Root Length 1/2 |
| The root calcification is 3/4 complete. The root length is greater than the crown height. The root apex is widely divergent. | 9 | $R_{3/4}$ | Root length 3/4 |
| Root length is complete with the apex convergent. Initiation of apical closure. | 10 | $R_c$ | Root length complete |
| no corresponding score | | $A_{1/2}$ | Apex 1/2 closed |
| Termination of root calcification with apical closure complete/almost complete. | 11 | $A_c$ | Apical closure complete |

Age was determined following the same method as that used for the standards provided by Trodden (1982). An age was assigned for each tooth score and then averaged within an individual to arrive at a single age. This was done for both males and females. For individuals that had scores that were between two i.e. $Cr_{3/4}$ /$Cr_c$ the average of the two ages was determined.

For each individual, the age as determined by Trodden's (1982) standards for permanent teeth, and the age determined by the data of Moorrees and colleagues (1963a,b) for deciduous and permanent teeth were averaged to arrive at a single final age.

There were a number of individuals who had teeth present in situ in the jaw, making it impossible to assign a development stage without a radiograph. There were also some individuals who had teeth that could not be aged based on either set of age data (Moorrees, et al. 1963a, b) due to which teeth were present or the data available for that particular tooth at its particular development stage. In such cases, age was assigned based on the dental development/eruption chart of Ubelaker (1978).

### *Skeletal Age*

The determination of age through the analysis of long bone length and comparing these lengths to expected length at specific ages, provides an additional method by which to determine the age of this population. This is beneficial when there are no teeth present. Skeletal age was determined for all ulnae, radii, femora, tibiae, and fibulae based on maximum length and the ilia based on maximum width, using the standards in Ubelaker (1978).

**Sex Assessment**

While there exist a number of reliable and accurate metric and morphological techniques to determine the sex of adult skeletal remains, there are no techniques for estimating the sex of subadult skeletal remains with the same degree of accuracy (De Vito and Saunders 1990; Loth and Henneberg 2001; Schutkowski 1993). This is due to the fact that sex differences found in the skeleton are minimal prior to puberty, making the determination of sex for individuals whom have yet to reach puberty difficult (Hunt and Gleiser 1955; Loth and Henneberg 2001). Methods that have produced the most reliable results are those that rely on the identification of morphological traits (Sutter 2003). Sex differences have been identified in the pelvis of infants and very young children (Boucher 1957; Schutkowski 1993). Mandibular protrusion and sciatic notch depth has been found to provide good results for neonates and infants (those under one year of age). For children aged two to five years sciatic notch angle, sciatic notch depth, arch criteria and iliac crest curvature provide the most accurate determinations. For children aged six to 15 years, sciatic notch angle, sciatic notch depth, the arch criteria and mandibular arcade shape provide the best degree of accuracy (Sutter 2003).

Despite the difficulties associated with determining the sex of subadult skeletal remains, it is just as important as adult sex determination for archaeological and historic interpretations, particularly for those that involve sex ratios (Schutkowski 1993; Thieme and Schull 1957). The current sex ratio for subadults used in archaeological contexts and palaeodemography is 1:1 (Mittler and Sheridan 1992). This ratio assumes an even distribution of male and female children, which would not reflect any differences in distribution that may be sex dependent. Subadult sex determination is necessary for the accurate reconstruction of palaeodemographic patterns of survivorship and mortality in childhood and differences that may be sex dependent such as nutritional and disease stress and growth and development (Mittler and Sheridan 1992).

The variables as listed in Table 4 were those used in this study to assess sex. These variables were selected based on their reliability for individuals of different ages.

*Table 4 Sex Estimation*

| **Element** | **Characteristics/Traits** | **Reference** |
|---|---|---|
| Pelvis | Sciatic notch depth, breadth and angle | (Holcomb and Konigsberg 1995; Schutkowski 1993) |
| | Elevation of the auricular surface | (Holcomb and Konigsberg 1995; Schutkowski 1993; Weaver 1980) |
| | Iliac crest curvature | (Schutkowski 1993) |
| | Arch criteria | (Schutkowski 1993) |
| Mandible | Symphyseal shape | (Loth and Henneberg 2001) |
| | Mandibular protrusion | (Schutkowski 1993) |
| | Mandibular arcade shape | (Schutkowski 1993) |
| | Gonial eversion | (Loth and Henneberg 1996) |

**Archaeological Material**

Access was granted to the archaeological catalogue for Native Point (KkHh-1). In the general database provided by the CMC regarding brief inventory, location, excavation year etc. there was a comments section regarding associated burial goods for a number of subadults. The catalogue of artifacts was cross-referenced with the information from the general information database and the presence of artifacts was then linked to specific individuals.

# CHAPTER 4: RESULTS

## Number of Individuals

In the CMC database there were 115 individual case numbers, but after review of these remains only 113 individual case numbers are included in this research. One individual was removed because he/she was in fact a much older adult. The other individual was removed due to an inconsistency between dental age and skeletal growth such that it was likely there were two individuals represented by these remains, but the issue could not be resolved. Therefore 113 individual case numbers make up the sample used for this research. Based on the metric data collected and presence of the right ilia there are 61 distinct individuals. In a number of cases an ilium was present and yet no measurements were taken because of poor preservation, therefore it is possible that there are more than 61 individuals but there are certainly no less than 61. In addition when the Canadian Museum of Civilization's database is taken into consideration with respect to catalogue number and burial number it is possible that there are up to 102 distinct individuals.

## Age Distribution

Of the individuals present it was possible to assign a dental age to 60 children, illustrated in Table 5.

*Table 5 N per age category based on dental age*

| Dental Age Range (years) | N | % of total N |
|---|---|---|
| 0-1 | 29 | 48.3 |
| 1-3 | 5 | 8.3 |
| 3-7 | 4 | 6.7 |
| 7-12 | 13 | 21.7 |
| 12-18 | 6 | 10.0 |
| >18 | 3 | 5.0 |
| Total N | 60 | 100.00 |

More individuals are assigned an age if aged based on diaphyseal length (Table 6). Due to the fact that dental age is more reliable and a more accurate representation of chronological age, it is the age determination method utilized in all analyses and comparisons in this study. It is useful to note however, that when aged by diaphyseal length, the number of infants increases the most, and makes up almost three-quarters of the entire number of individuals who could be aged using this method.

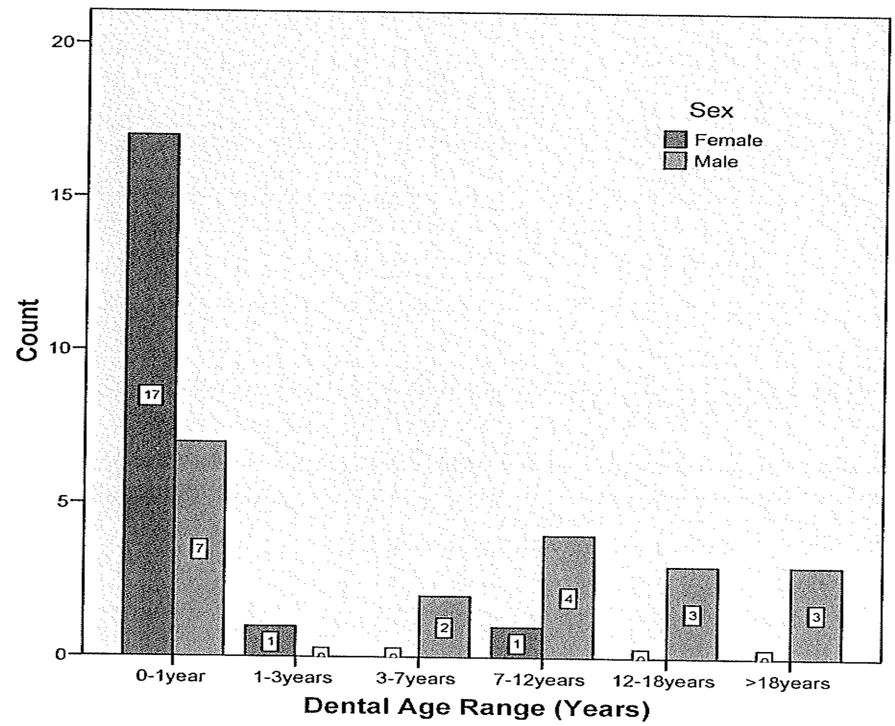
*Table 6 N per age category based on diaphyseal length*

| Skeletal Age Range (years) | N | % of total N |
|---|---|---|
| 0-1 | 56 | 73.68 |
| 1-3 | 1 | 1.32 |
| 3-7 | 11 | 14.47 |
| 7-12 | 8 | 10.53 |
| 12-18 | 0 | 0.00 |
| Total | 76 | 100.00 |

**Sex Distribution**

When the dental age categories are split by sex there are more females in the 0-1 year age category, while a greater proportion of the older individuals are male (see Fig.1).

*Fig 1     Age Category by Sex Based on Dental Age*




Although the number of females and males within the sample is equal (19 females and 19 males) the distribution of $^{2}$=14.967; df=5, p=.011). The standard residuals do not identify a specific cell in which the distribution can be linked. Therefore the difference in distribution is across the entire population and dental age ranges (Table 6).

*Table 7 Cross-Tabulation and Standard Residuals*

**Dental Age Range (Years) * Sex Crosstabulation**

| | | | Sex | | Total |
|---|---|---|---|---|---|
| | | | Female | Male | |
| Dental Age Range (Years) | 0-1year | Count | 17 | 7 | 24 |
| | | Std. Residual | 1.4 | -1.4 | |
| | 1-3years | Count | 1 | 0 | 1 |
| | | Std. Residual | .7 | -.7 | |
| | 3-7years | Count | 0 | 2 | 2 |
| | | Std. Residual | -1.0 | 1.0 | |
| | 7-12years | Count | 1 | 4 | 5 |
| | | Std. Residual | -.9 | .9 | |
| | 12-18years | Count | 0 | 3 | 3 |
| | | Std. Residual | -1.2 | 1.2 | |
| | >18years | Count | 0 | 3 | 3 |
| | | Std. Residual | -1.2 | 1.2 | |
| Total | | Count | 19 | 19 | 38 |

**Skeletal Growth Profiles**

The following graphs illustrate bone length by dental age in years (skeletal growth profiles). The largest portion of the population under study is less than 1 year old, accounting for the pooling of individuals in this age category throughout the profiles. In addition, those that are distributed at the higher (older and longer) side of the graph are most often male. The left and right clavicle, scapula, humerus, ulna, radius, ilium, femur, tibia and fibula are represented and where applicable are identified with respect to epiphyseal fusion (Fig. 6-17 pgs 56-61). In a number of cases individuals are marked by their unique catalogue number so they can be singled out for more detailed discussion.

*Fig.2 Left Clavicle Length by Dental Age (years)*

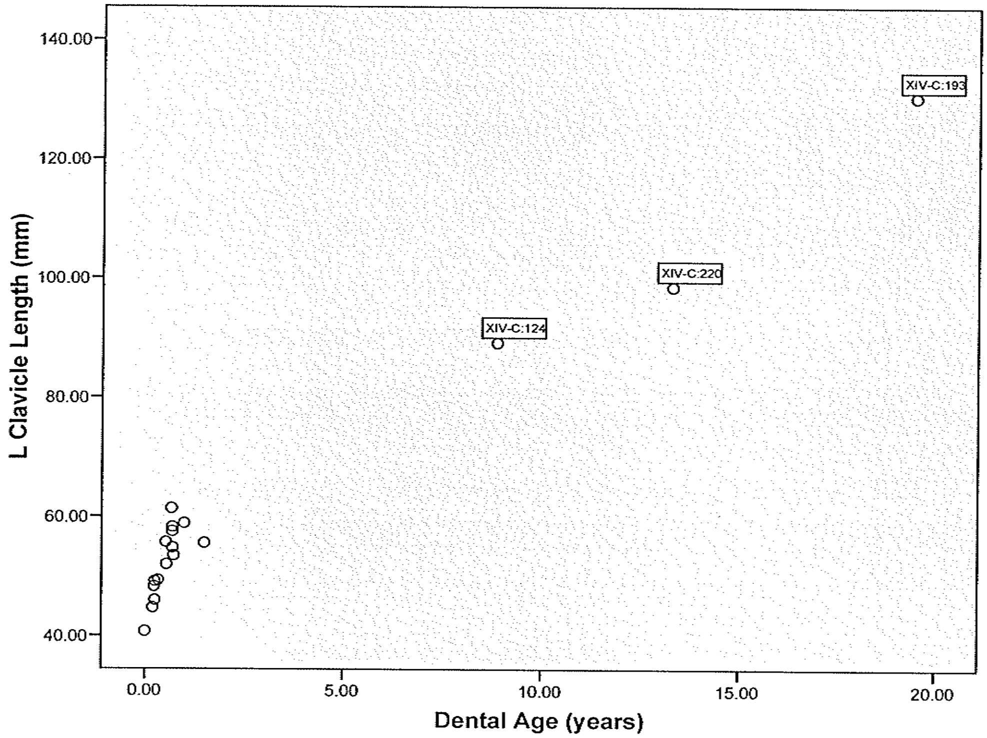



*Fig.3 Right Clavicle Length by Dental Age (years)*

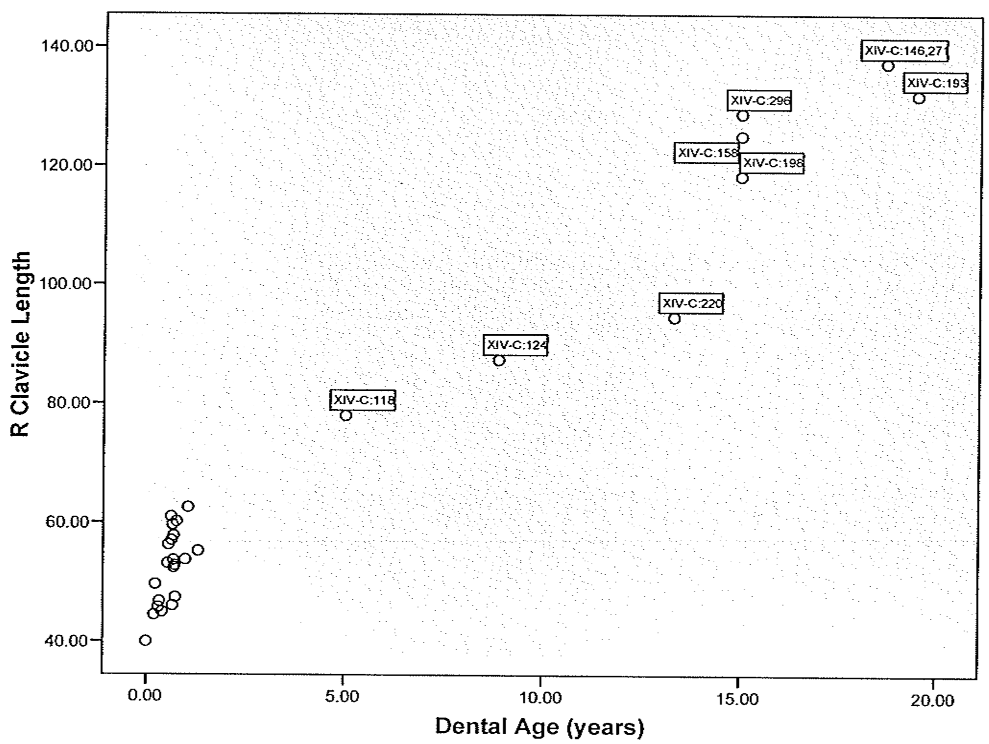


*Fig. 4  Left Scapula Length by Dental Age (years)*

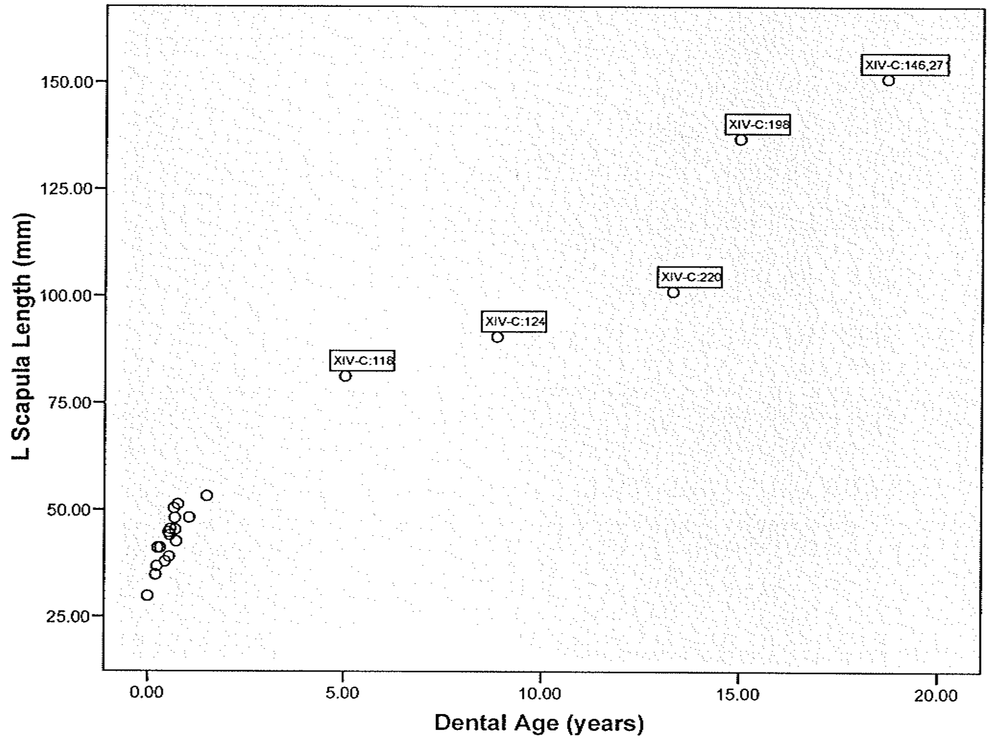



*Fig. 5  Right Scapula Length by Dental Age (years)*

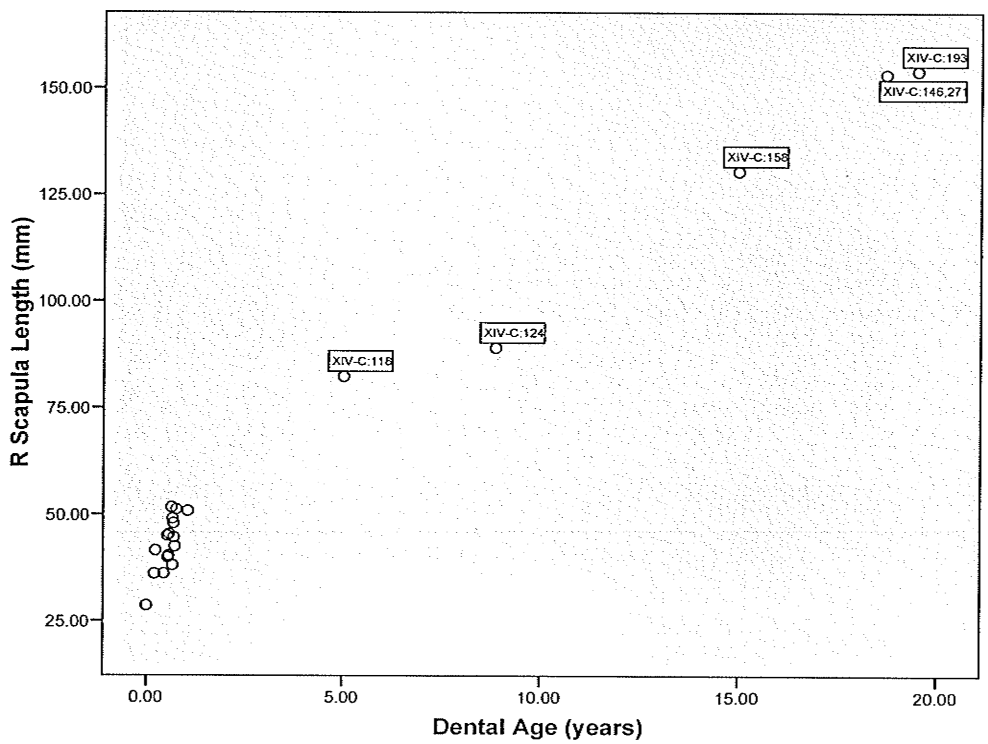


*Fig. 6 Left Humerus Length by Dental Age (years)*

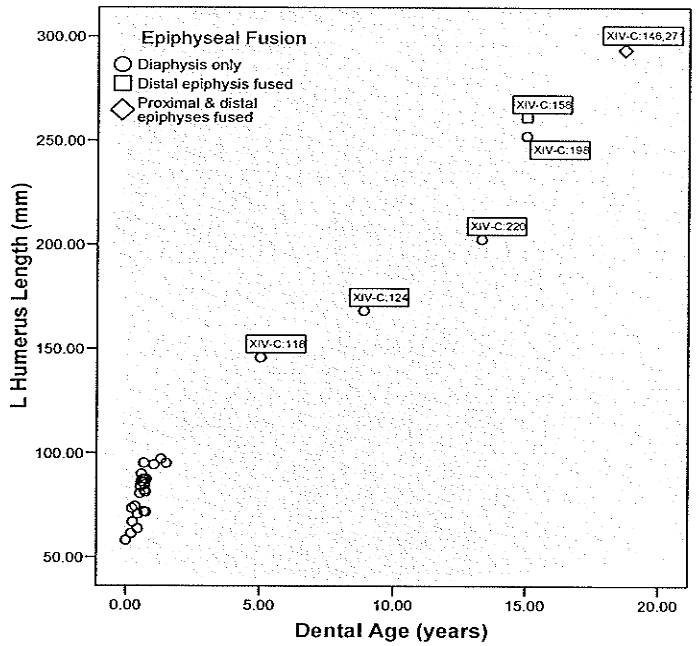



*Fig. 7 Right Humerus by Dental Age (years)*

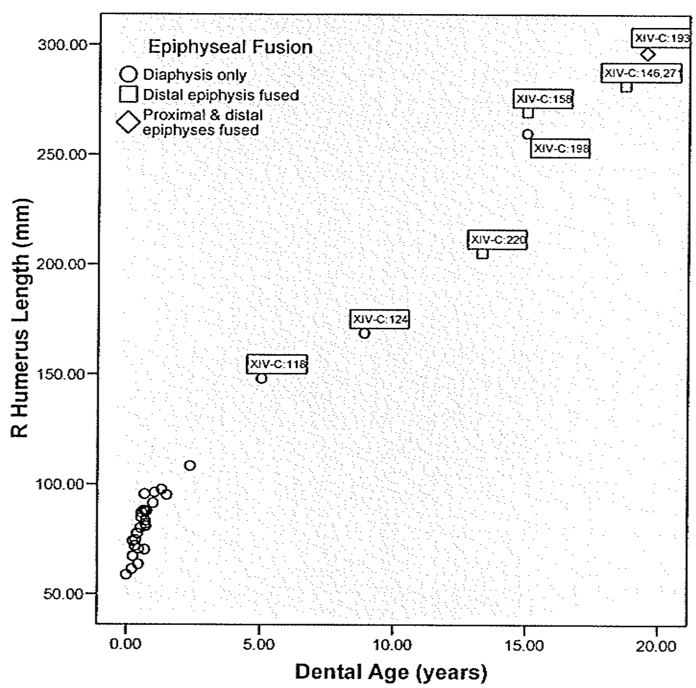


*Fig. 8 Left Ulna Length by Dental Age (years)*

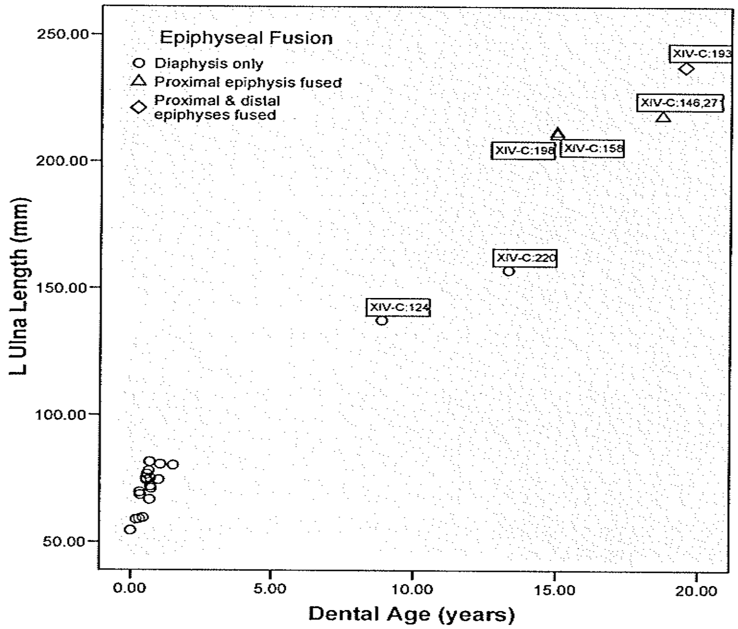



*Fig. 9 Right Ulna Length by Dental Age (years)*

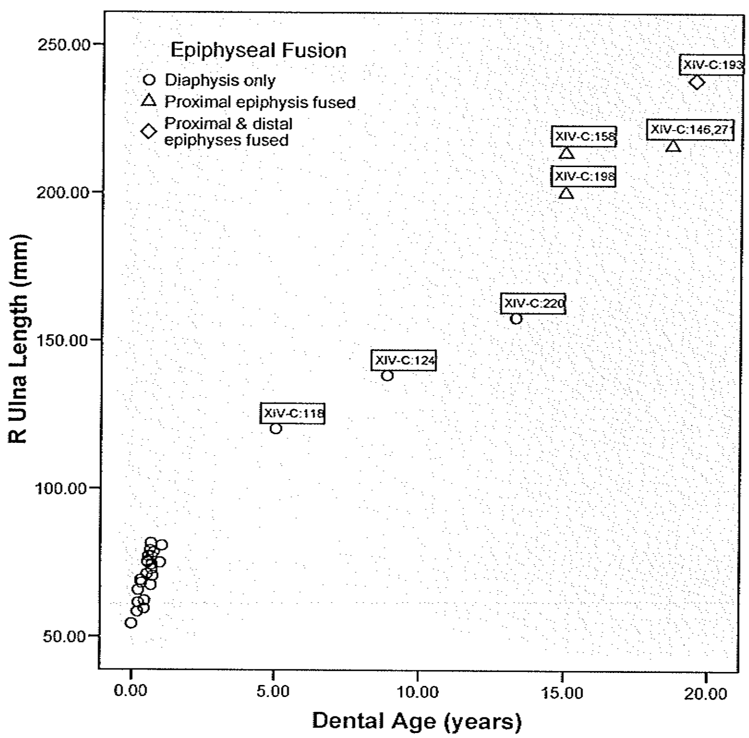


*Fig. 10 Left Radius Length by Dental Age (years)*

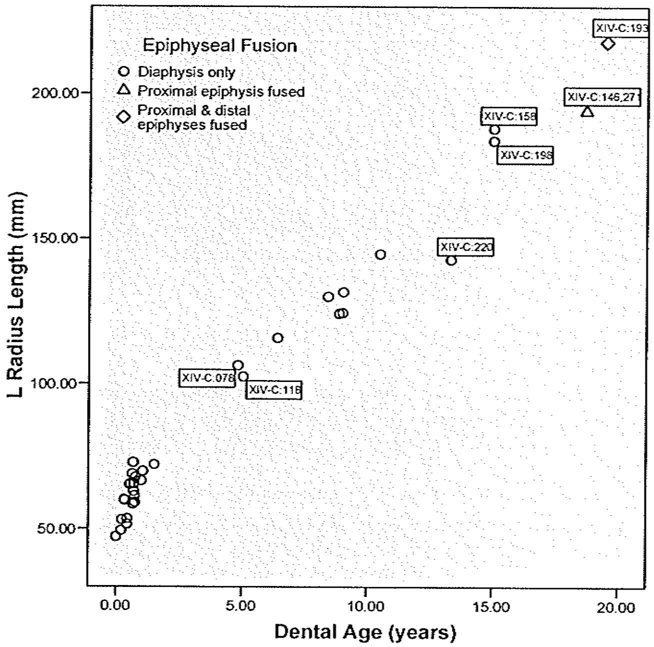



*Fig. 11 Right Radius Length by Dental Age (years)*

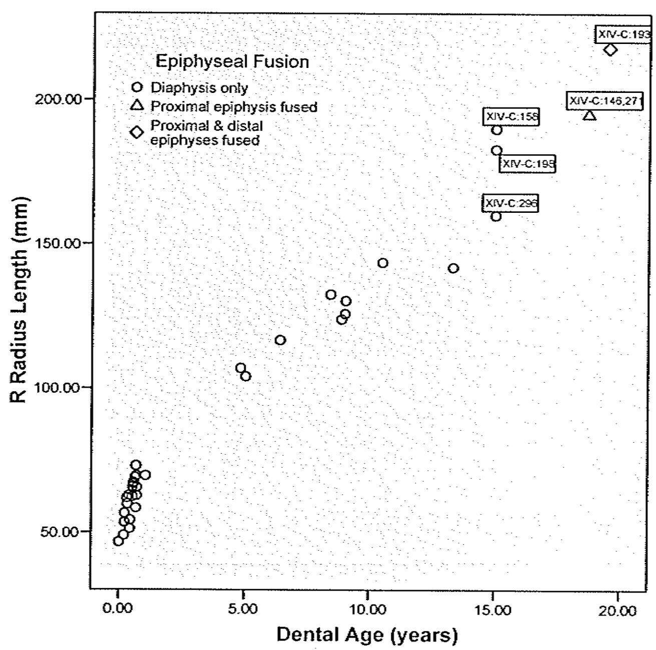


*Fig. 12 Left Femur Length by Dental Age (years)*

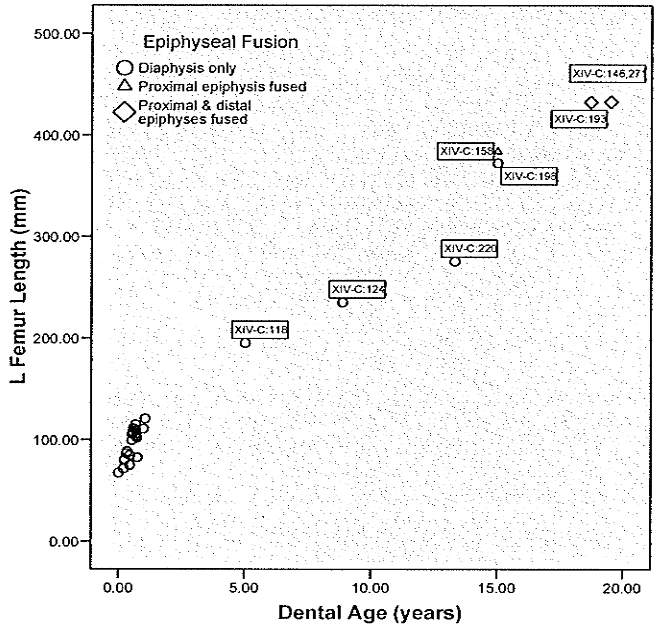



*Fig. 13 Right Femur Length by Dental Age (years)*

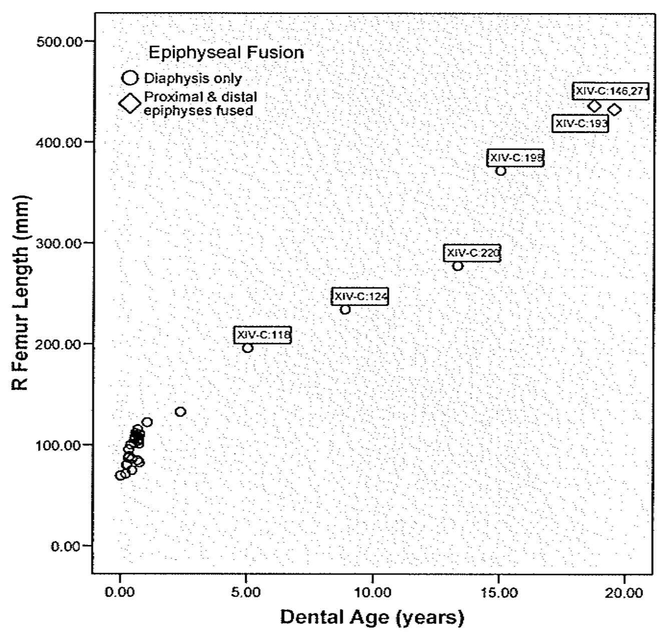


*Fig. 14 Left Tibia Length by Dental Age (years)*

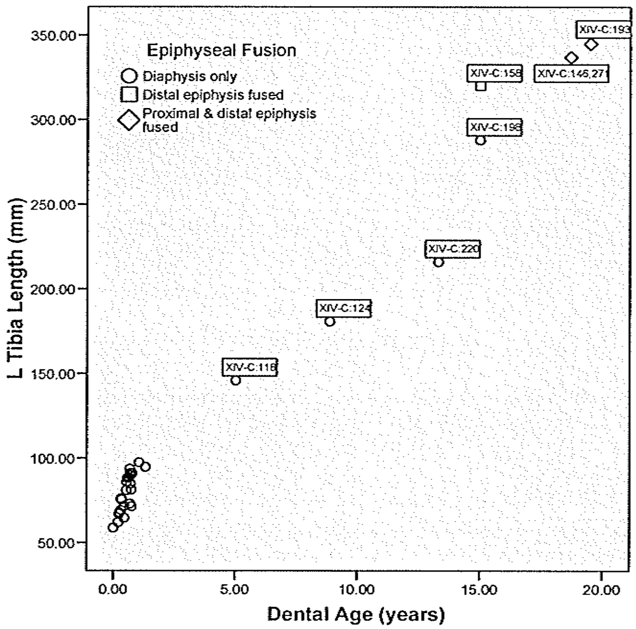



*Fig. 15 Right Tibia Length by Dental Age (years)*

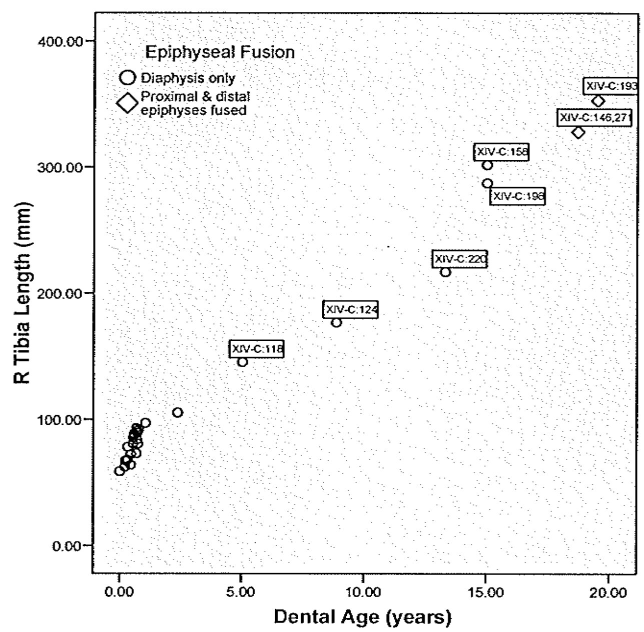


*Fig. 16 Left Fibula by Dental Age (years)*

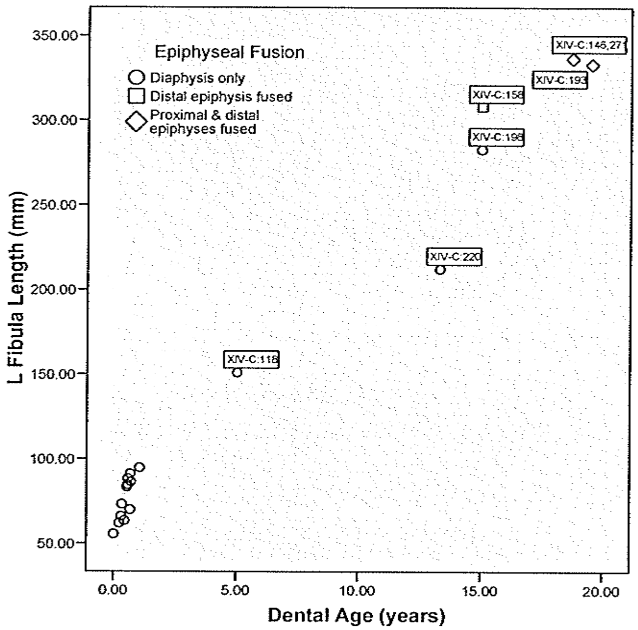



*Fig. 17 Right Fibula Length by Dental Age (years)*

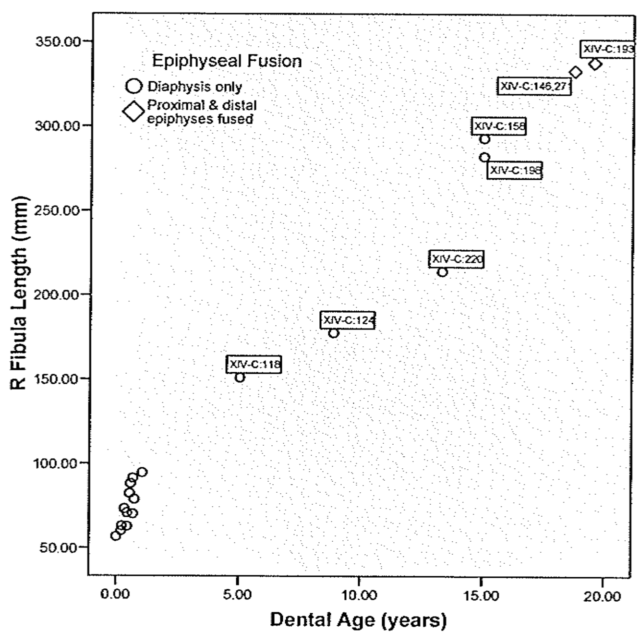


*Fig. 18 Left Ilium Length by Dental Age (years)*

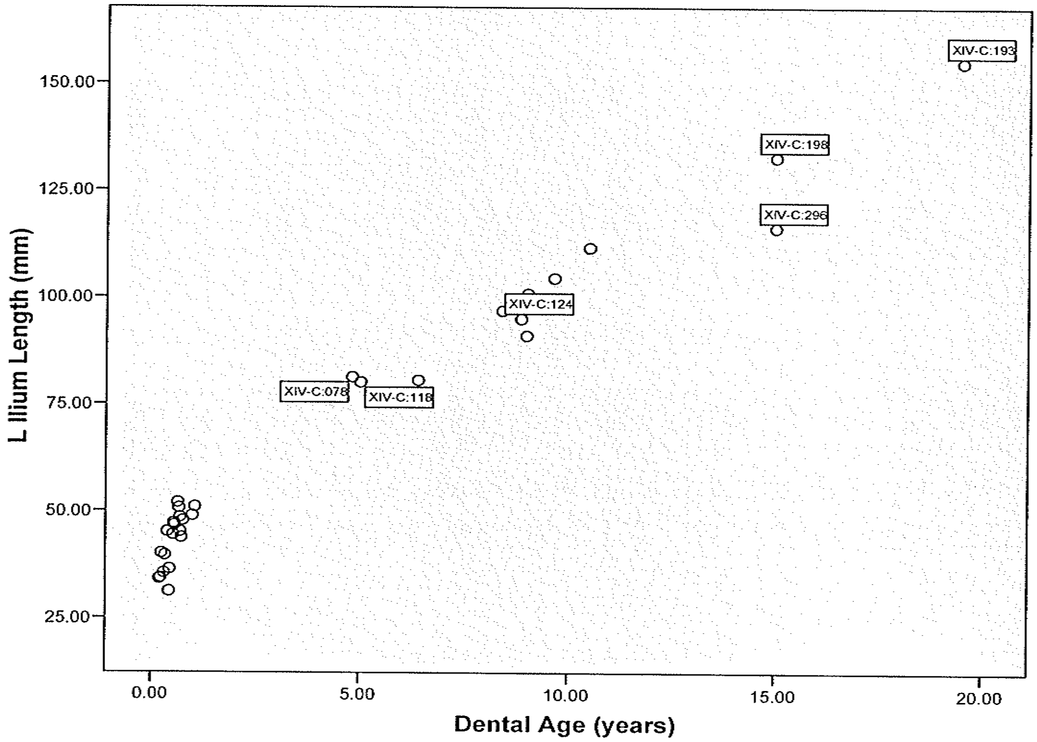
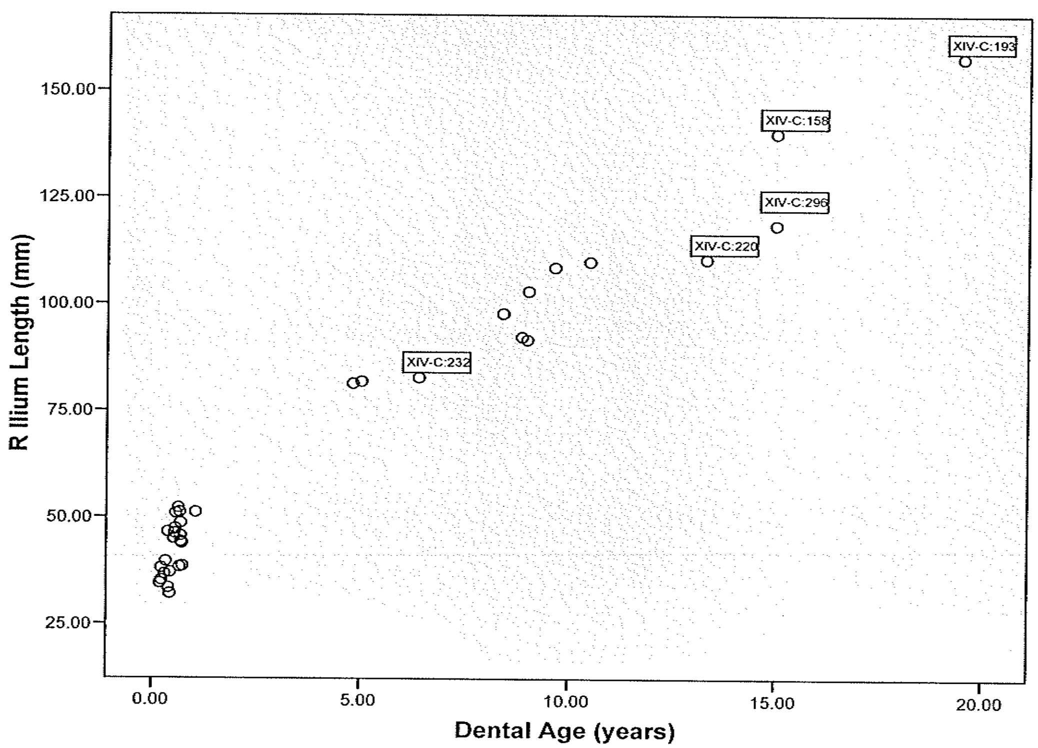



*Fig. 19 Right Ilium Length by Dental Age (years)*



## Bone Length and Tooth Development Stages

Long bone length was plotted with respect to individual tooth development stage while upper and lower teeth are plotted on the same graphs to illustrate any differential growth between maxillary and mandibular tooth development stage. Some points are marked by age to show variation in the actual age that occurs at that development stage.

*Fig. 20 Mean Humerus Length (mm) by Tooth Development: Upper and Lower Deciduous Canines – Marked by Age*

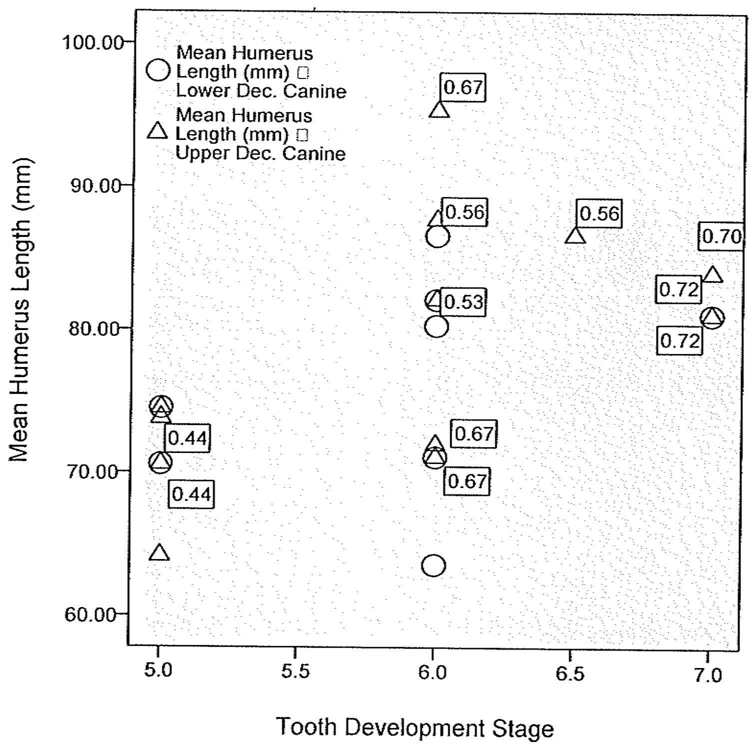


*Fig. 21 Mean Ilium Length (mm) by Tooth Development: Upper and Lower Deciduous Canines – Marked by Age*

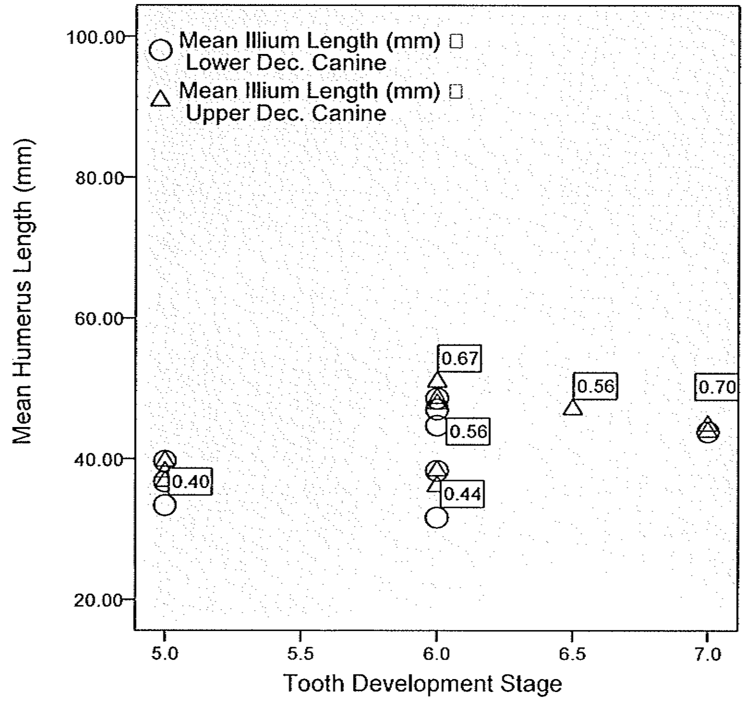



*Fig. 22 Mean Humerus Length (mm) by Tooth Development: Upper and Lower Deciduous First Molars Marked by Age (years)*

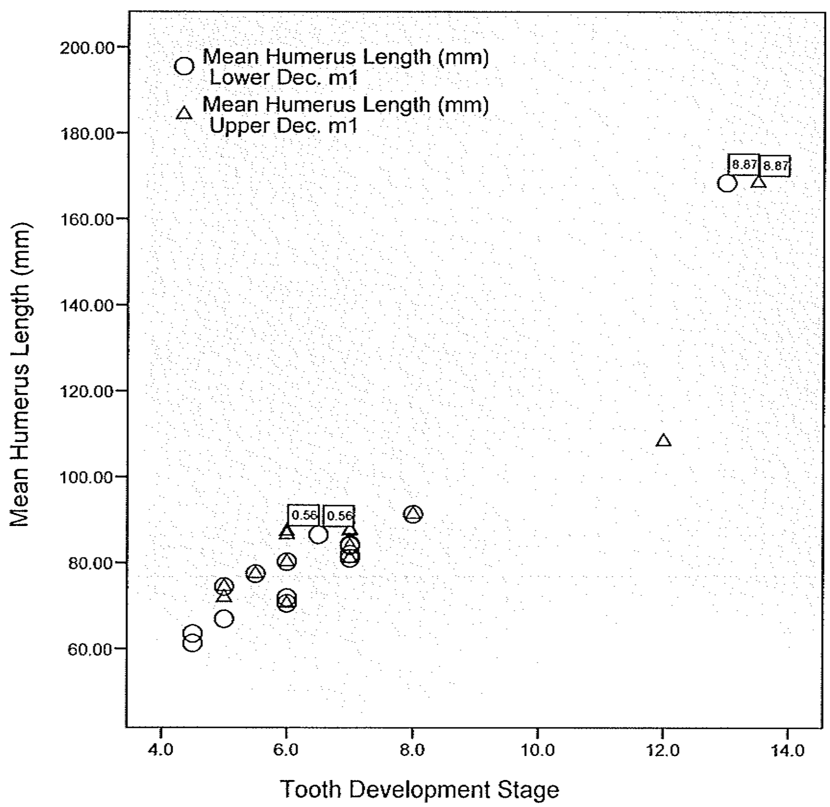


*Fig. 23 Mean Ilium Length (mm) by Tooth Development: Upper and Lower Deciduous First Molars Marked by Age (years)*

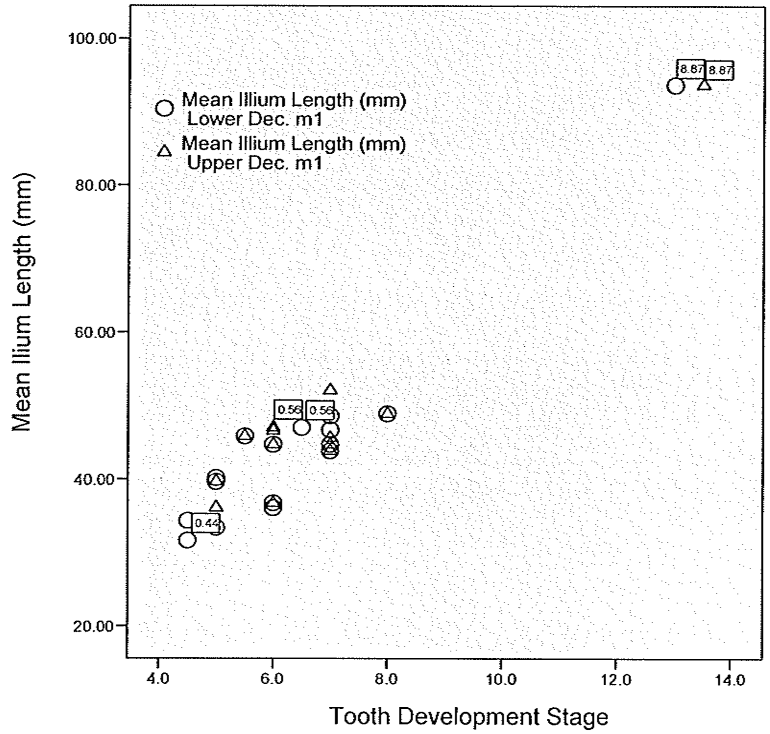



*Fig. 24 Mean Humerus Length (mm) by Tooth Development: Upper and Lower Deciduous Second Molars Marked by Age (years)*

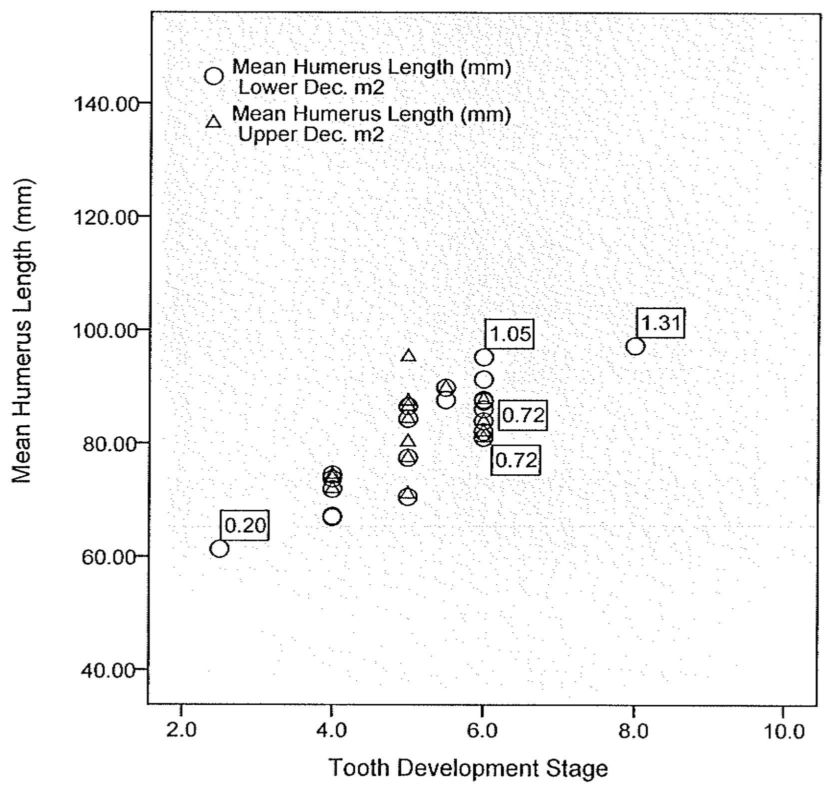


*Fig. 25 Mean Ilium Length (mm) by Tooth Development: Upper and Lower Deciduous Second Molars Marked by Age (years)*

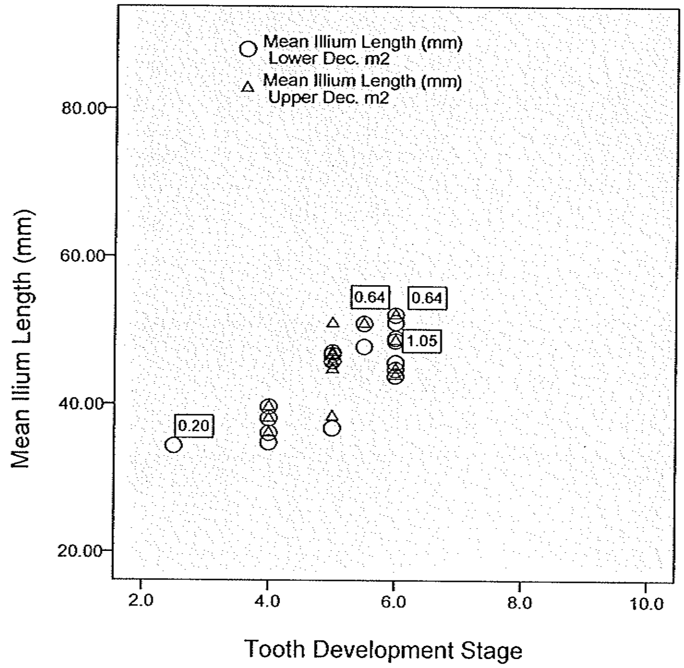



*Fig. 26 Mean Humerus Length (mm) by Tooth Development: Upper and Lower Permanent First Molars – Marked by Age*

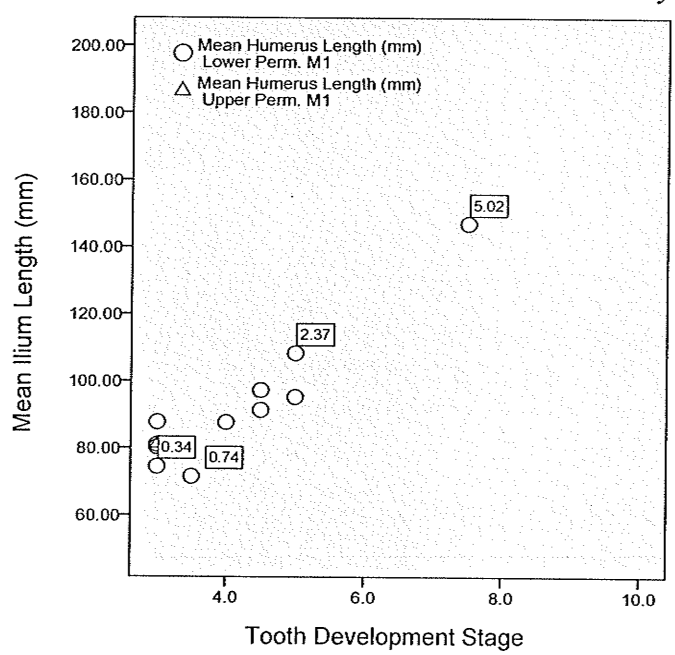
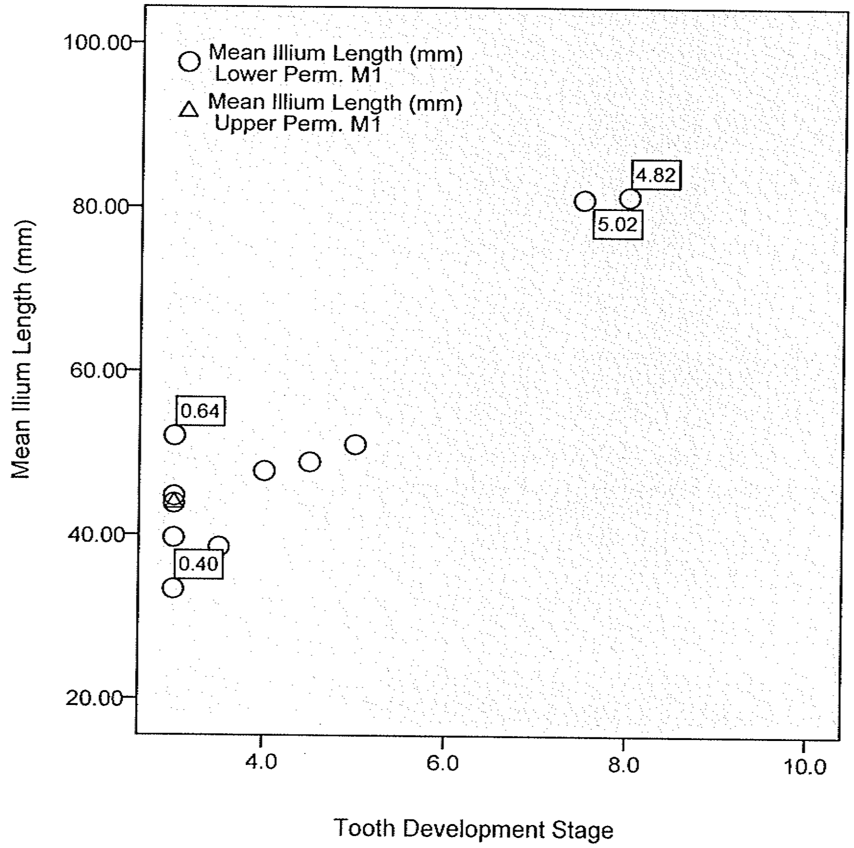


*Fig. 27 Mean Ilium Length (mm) by Tooth Development Upper and Lower Permanent First Molars – Marked by Age*



## Age Determination

The age determination methods using the tooth development standards of Moorrees and colleagues (1963a, b) and Trodden (1981) was compared by generating growth curves that used both methods of age determination (Figs. 29 and 30).

*Fig. 28 Mean Humerus Length (mm) by Dental Age: Comparison of Age Determinations*

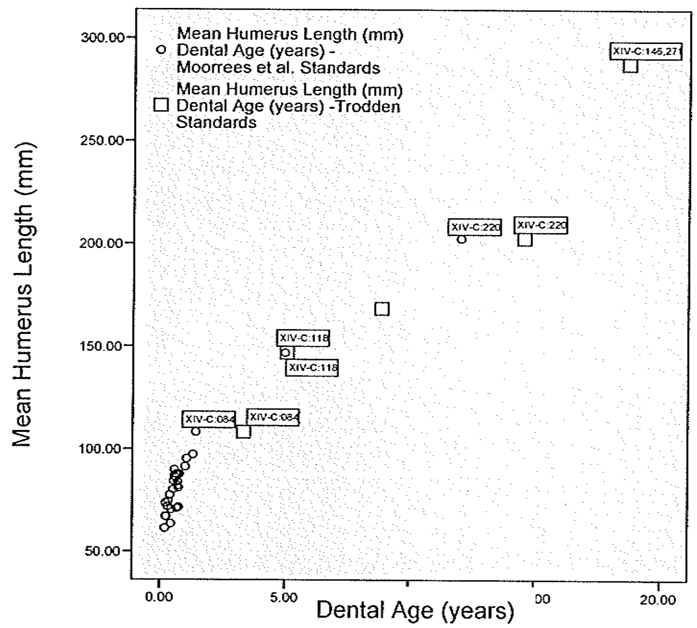
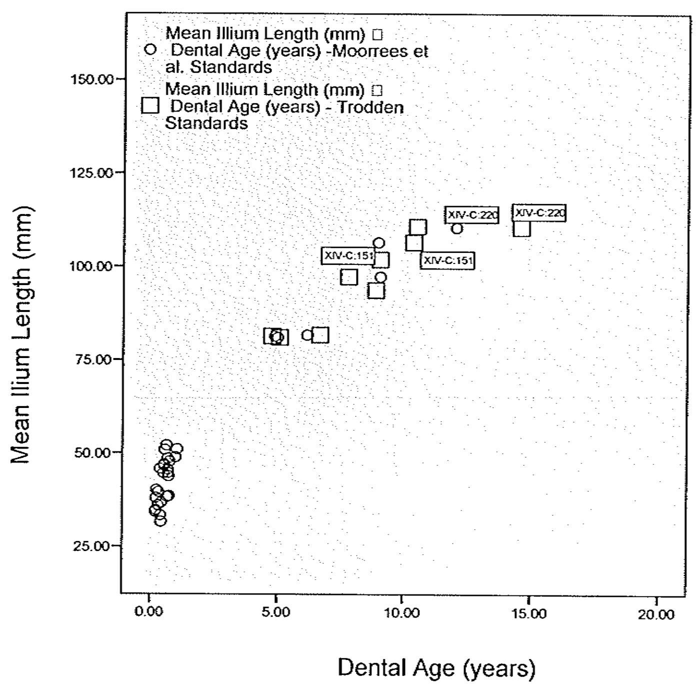



*Fig. 29 Mean Ilium Length (mm) by Dental Age: Comparison of Age Determinations*



# CHAPTER 5: DISCUSSION

## AGE

Contrary to a common complaint by physical anthropologists regarding the paucity of infant skeletal remains, the Native Point sample studied for this research has the greatest number of individuals in this age category. When aged by dentition those 0-1 year old make up 48.3% (29 of 60 individuals with a dental age determination) (Table 5 pg.51). Yet based on age by long bone length, this category jumps to 73%. This means 56 of a total of 76 that could be assigned a postcranial age (see Table 6 pg. 51). This makes those in the 0-1 year age category by far the highest represented in this sample. The preservation of these remains is also excellent, making them a unique sample to work with. Some of the smallest and most fragile elements in the infant skeleton, (i.e. the tympanic ring and the ear ossicles) were recovered. This proves that excellent excavation technique and osteological knowledge of the excavators allows for the recovery of infant skeletal remains (Baker, et al. 2005; Baxter 2005; Chamberlain 2000; Saunders and Barrans 1999).

The large number of infants suggests a high mortality rate for this age category among the Sadlermiut. It is not uncommon for there to be a large number of infant deaths in a hunter-gatherer society, which has been linked to both maternal health, malnutrition and/or under nutrition and the infants susceptibility to respiratory and diarrheal diseases (Cook 1979; Eveleth and Tanner 1990; Lovejoy, et al. 1990; Ruowei 1998; Saunders and Melbye 1990). Research on parasitic infections among the Eskimo in the Northwest Territories and of Southampton island in the mid 1950's shows a high incidence of such infection (Brown, et al. 1949; Brown, et al. 1950; Brown, et al. 1948). In addition, a high occurrence of parasitic infection, respiratory infection and diarrhea in Eskimo children has been linked to a high infant mortality rate in the 1940's throughout the arctic (Albrecht 1965). Based on a diet high in seal meat, sometimes eaten raw, fish and caribou, it is not unlikely that the Sadlermiut also experienced parasitic infection. Such infection would have played an important role in the health and lives of children.

A high mortality rate in infants has been linked to weaning at approximately six months of age in historic populations in Canada (Saunders et al. 1993) and between ages of two and five in archaeological populations (Goodman, et al. 1984; Lovejoy, et al. 1990). Inuit commonly breast feed their children until the age of two and in some cases until they are three or four, supplementing their diet with solid food (Jenness 1922a; Mathiassen 1928). A similar pattern occurred among the Sadlermiut (Mathiassen 1927). Despite the fact that children were breastfed until 3 or 4 years old, there still might not have been adequate nutrition. Lactation in women begins to decline after six months and breast milk after this point lacks sufficient nutrition for the rapidly growing child (Eveleth and Tanner 1990). Therefore, the diets of infants and children had to have been supplemented in some manner. The decline in nutrition available in breast milk, paired with a diet that was likely also lacking in nutrition due to limited resources, may help account for the large number of individuals in the 0-1year age category, as they may not have had the nutrition necessary to survive.

Another variable that may have impacted the mortality of infants is the practice of adoption. Among the Iglulik Eskimo adoption of very young infants is common. This practice is hard on the infant as he/she is unable to breast feed and is raised instead on a diet of soup and chewed meat from a very early age (Mathiassen 1928), which would have drastically affected their nutritional intake. Mathiassen (1928) links this adoption practice to the high infant mortality rate among the Iglulik Eskimo and a similar practice may have played a role in the high infant mortality rate of the Sadlermiut.

Among a number of Inuit groups, including the Sadlermiut, there exist taboos regarding the birth of a child and what the mother can and cannot do during the first year of the infant's life. A woman must give birth in a separate snow house or tent, and have her meals passed to her for the duration of her stay (Birket-Smith 1971; Mathiassen 1927, 1928; Rasmussen 1931a). For the first year of the infant's life the mother must use her own cooking pot and eating utensils and must not eat intestines, eggs and raw meat (Rasmussen 1931). These taboos probably served to protect the mother and by extension her child , from infectious disease and from parasites contained in intestines or raw meat. Despite having these taboos in place a large number of infants still died before their first year of life.

***Methodological Issues***

The ability to assign an age to individuals within this sample was limited due to a number of factors. First, the standards for aging deciduous tooth development created by Moorrees and colleagues (1963a) only uses three mandibular deciduous teeth (canines, first and second molars). If there are other teeth present, such as maxillary canines, first and second molars or even upper and lower incisors, it is not possible to assign an age using these standards. It is, however, possible to assign a development stage score, because these teeth follow the same process of development as the other teeth yet the ability to age individuals who are missing the three teeth used by Moorress and colleagues is compromised.

Secondly, the incisors are the first teeth to erupt in infants yet there is no developmental age data for these teeth (Ubelaker 1978). Being unable to assign an age to their development stage could potentially result in the over-aging of very young infants, as the age data regarding the development of other teeth may not represent the youngest individuals. Ubelaker's (1989) classic chart of dental eruption allows for age determination, incorporating the incisors and all deciduous teeth, including in utero age assignments. In fact, the youngest individual aged in this sample (XIV-C:284), with an assigned age of newborn and a range of -2 to +2 months, was aged using Ubelaker's chart. Although this age suggests that the individual was extremely young it is not possible to say whether or not he/she was fetal. The age ranges using this method are broad ranging from two to six months; therefore it is not possible to clearly identify a fetus or newborn infant with great accuracy. Age data regarding deciduous tooth development, particularly that which will allow for the identification and differentiation of fetus or newborn has great possibilities.

Thirdly, the standards used by Moorrees and colleagues (1963a, b) are based on a healthy modern white population, which might not accurately reflect the same process of tooth development experienced by the Sadlermiut. There is also a problem in using modern dental development standards to age archaeological populations because of differences between populations. For example, Inuit children have earlier ages for tooth formation stages and tooth eruption (Garn and Moorrees 1951; Trodden 1982). By using modern standards it is possible that the Sadlermiut were assigned an age older than their chronological age, because they may have attained a tooth development stage at an earlier age than those of the comparative sample. Despite these issues, in a review of dental aging techniques, Saunders and colleagues (1993a) note that the combined standards (deciduous and permanent) of Moorrees and colleagues (1963a, b) are consistently accurate in assigning an age to both North American and European children.

In order to obtain a more accurate age based on the population represented by the Sadlermiut, I also used Trodden's (1982) age data for Inuit children. This age data is from modern Inuit children living in Manitoba. While these Inuit children differ from the Sadlermiut temporally, it is likely that they are more closely linked genetically than are children of European (white) descent, allowing for a more accurate age determination. It was not possible to assign an age to any deciduous teeth using Trodden's data as she did not (or was unable to) use deciduous teeth in her study. The first permanent molar begins formation in utero and is the first permanent tooth to erupt, which suggests that its development can assign an age to very young infants. Trodden does not supply age data for the first permanent molar for any dental development score less than 6 (complete crown). It is therefore not possible to assign an age less than 3 years old based on the dental development of the first permanent molar despite the fact that it begins formation in utero.

In an attempt to get as refined an age as possible the age determination according to Moorrees and colleagues (1963a, b) and the age determination based on Trodden's data were averaged. It was hoped that this would allow for a greater degree of accuracy by incorporating deciduous teeth with permanent teeth and tooth data from a similar population.

To determine the degree of difference between the age determinations based on Moorrees and colleagues (1963a,b) data and that of Trodden (1982), graphs were plotted that listed the final age along the bottom, but controlled for the age determination based on which standards were used (Fig.26 and 27). Based on these graphs, it does not look like the age data that was based on a modern white population (Moorrees et al. 1963a, b) over aged the Sadlermiut subadults. Rather, it looks like in the few cases where an individual was aged with both standards the age assigned based on the white sample data is younger than that based on the Inuit sample data.

It must be kept in mind that there are only dental ages for those that physically had teeth. There were a number of individuals who by their size would have fit in the infant category and yet are not represented here due to an inability to age them dentally. If an age is assigned based on long bone length the distribution changes (Table 7) and there are in fact a much larger number of infants and of those in the 0-1 age category 60% are 0.25 years or 3months old. The overall spread of individuals in age categories changes as well, due to the lower accuracy of age determination using the postcranial skeleton. There is also a limited amount of information for comparison for those older than 12 years of age in the comparative data. Despite the fact that there are a number of individuals who are aged dentally as 15 years old, there is no corresponding age available based on long bone length (Table 6 pg. 51).

**SEX**

Of particular interest is the large number of female infants in this sample (Fig.1). There are more than double the number of females compared to males in this sample, which is statistically significant (p=.011). This raises a number of questions regarding differential treatment of female versus male children among the Sadlermiut.

Female infanticide was practiced in the past among Inuit societies throughout the Arctic (Balikci 1967; Jenness 1922a; Rasmussen 1932a). However, in some populations, like the Iglulingmiut, there is no evidence of infanticide (Mathiassen 1928). Infanticide has been linked to periods of stress such as an increase in bad weather and starvation (Balikci 1967; Jenness 1922a). Among the Copper Eskimo, a child was commonly seen as an extra burden on the mother, because she must carry and nurse it for a long period of time (Jenness 1922a). Unwanted children, one child of a pair twins, and defective children were commonly the victim of infanticide (Jenness 1922a; Rasmussen 1932a). These unwanted children were usually suffocated and then left outside, although exposure to cold and snow was noted to occur (Jenness 1922a). Clothing for a new baby and the naming of a new baby were commonly postponed until after birth and until it was ensured that the child was wanted and would survive (Jenness 1922; Rasmussen 1931). Naming was associated with becoming a social person and so an infant was not named and did not become a social person until approximately four days after birth, and death before this time was not considered murder (Guemple 1979).

Taboos regarding death among the Copper Eskimo were easy to follow for children that were stillborn or who died immediately after birth. There were no death taboos for those who were deliberately killed, (i.e. the igitat - "those thrown away") because they were strangled before they could breathe, and thus were not believed to have lived at all (Rasmussen 1932a). Yet among the Netsilik there was no difference in observed death taboos between children and adults (Rasmussen 1931a), suggesting that in this group, children were given the same social standing as adults. Both the delay in naming and the easily observed death taboos for infanticide victims suggest an attempt to deal with the ramifications of infanticide.

Male children were rarely the victims of infanticide as they were the children that would grow up to take care of their parents (Balikci 1967; Jenness 1922a). Female infants were more commonly victims of infanticide because women were not seen as self-sufficient given their dependence on men for hunting and were not seen as useful until there were old enough to marry, at which time they would leave home and join their husband's household, making them a potential economic drain (Balikci 1967:622).

The importance of male children in Inuit society is reflected in the use of amulets. Male children were given amulets, in some cases as very young infants, to ensure their strength, ability to hunt both sea mammals and land mammals and to ensure their safety at sea (Jenness 1922a; Rasmussen 1931a, 1932a). Female children on the other hand, although given amulets in order to become good seamstresses, most commonly wore amulets to ensure that when grown they would bear sons (Rasmussen 1931a, 1932a).

Rasmussen (1931) emphasized an example of a Netsilik boy who by the age of six years had 80 amulets attached to his person. The large number of amulets designed to ensure his survival and hunting ability points to the fact that childhood was a particularly precarious time for the Inuit as the need to ensure survival of children occurred frequently.

While female infanticide may not be the only explanation for the high number of female versus male infants in the Sadlermiut study sample, the killing of females is something that could have occurred in times of severe weather conditions and/or food shortages. If the Sadlermiut practiced female infanticide it would be expected that there would be a larger pooling of infants at the zero area of the graphs. This does not occur. Rather, most infants were in fact at least three months old at death. In addition, Merbs (personal communication 2007) noted that a large proportion of the infants recovered from Native Point were recovered from meat caches that were reused for burial. It is unlikely that there was any meat in these structures at the time they were used for burial, and it is not uncommon for stones from other structures, even other burial structures to be reused for burying other individuals.

***Methodological Issues***

Due to the immature nature of a large number of the ilia and the fact that a number of mandibles were not fused, sex assessment within this study sample was difficult. The variables that could be identified confidently for all individuals were those of the ilia (sciatic notch angle, depth and breadth, iliac crest curvature and arch criteria). Therefore, they were used to estimate sex. Each trait was scored as either male or female and the sex that occurred most frequently within this suite of traits per individual was the estimated sex. It was not possible to confidently assign a sex based on mandibular morphology despite the intention to do so.

The ability to accurately estimate the sex of sub-adult skeletal remains has long been an issue in physical anthropology, and it is related to the fact that most sex specific traits do not become reliably identifiable until the individual reaches puberty (Boucher 1957; De Vito and Saunders 1990; Hunt and Gleiser 1955; Loth and Henneberg 2001; Scheuer 2002; Schutkowski 1993; Sundick 1977; Sutter 2003). A common issue found in sex estimation methods is that the criteria determine a female sex for the very young and a male sex as the age increases, and some of the criteria used assign a sex of female to the very young and a sex of male as the age of the infants increases (Sundick 1977). In addition some of the criteria have been found to be population specific. Despite these difficulties the method used in this research have been found to produce some reliability (Schutkowski 1993). Minimally, sex estimation in this study provides at least a cursory examination of sex differences in distribution by age.

## SKELETAL GROWTH PROFILES

The skeletal growth profiles of all six long bones and the left and right ilia (Fig. 3-20) illustrate the increase in long bone length in relation to an increase in age. There is pooling between 0 – 2 years of age because there are proportionately more individuals in this age category. Despite the small number of individuals of 2 years and older, the growth follows the expected curve of an increase in bone length with an increase in age. The growth of the Sadlermiut was then plotted against the growth of a modern white sample (Maresh 1943) and other archaeological populations including Arikara (Merchant and Ubelaker 1977), Eskimo and Aleut (Y'Edynak 1976) and Californian Amerindian (Wall 1991; see Figures 31- 42). The comparative information is based on diaphyseal length, so the Sadlermiut data includes those without any epiphyses fused, that is the diaphysis only, which means the data end at 15 years. In addition, the comparative data uses the mean lengths of the long bones per age group, whereas the Sadlermiut data are direct plots of individual long bone lengths and ages. Skeletal growth profiles are presented for both birth to 20 years of age, and birth to 5 years of age. The latter were generated as the largest number of Sadlermiut individuals fall into this category, and to illustrate growth in relationship to the other populations in this age range, particularly that of the Amerindian population.

The Sadlermiut growth falls below that of the modern and Arikara populations for the entire age range (Fig.30-35, pgs. 80-82) and falls below the Amerindian population up to the age of five (Fig. 36-41, pgs. 83-85). The Sadlermiut growth is intermingled with that of the Eskimo/Aleut, a result expected given their close population affinity and similarity in environment.

When compared to the Eskimo/Aleut population under the age of five, the Sadlermiut growth for all long bones is slightly higher (Fig. 36-41, pgs. 83-85). This reflects a rapid rate of growth among the Sadlermiut in this age group. This trend changes after the age of five, when the Eskimo/Aleut long bone length increases and surpasses that of the Sadlermiut. At age 15, the Sadlermiut growth exceeds that of the Eskimo/Aleut to meet with that of the Arikara (ex. Fig. 31 this page). This may reflect the timing of a growth spurt. Due to the very small sample size of Sadlermiut at age 15, this jump in growth may just represent growth variation. It should be noted that the individual who illustrates this jump in growth at age 15 consistently for all long bones, is the same individual, XIV-C:198. Individual XIV-C:158 is in this category for the radius, tibia and fibula as well.

*Fig. 30 Comparison of Sadlermiut humerus growth to other populations*

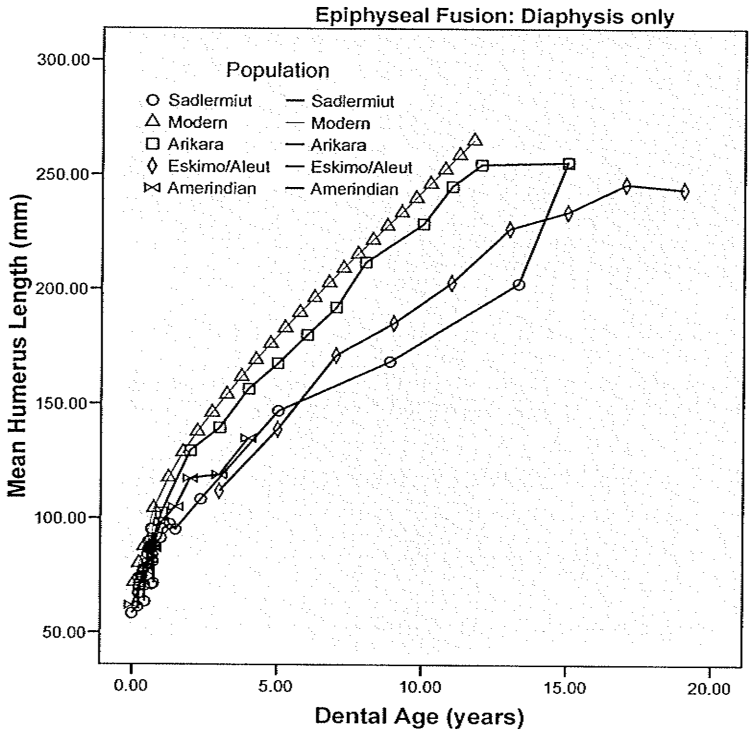



*Fig. 31 Comparison of Sadlermiut ulna length to other populations*

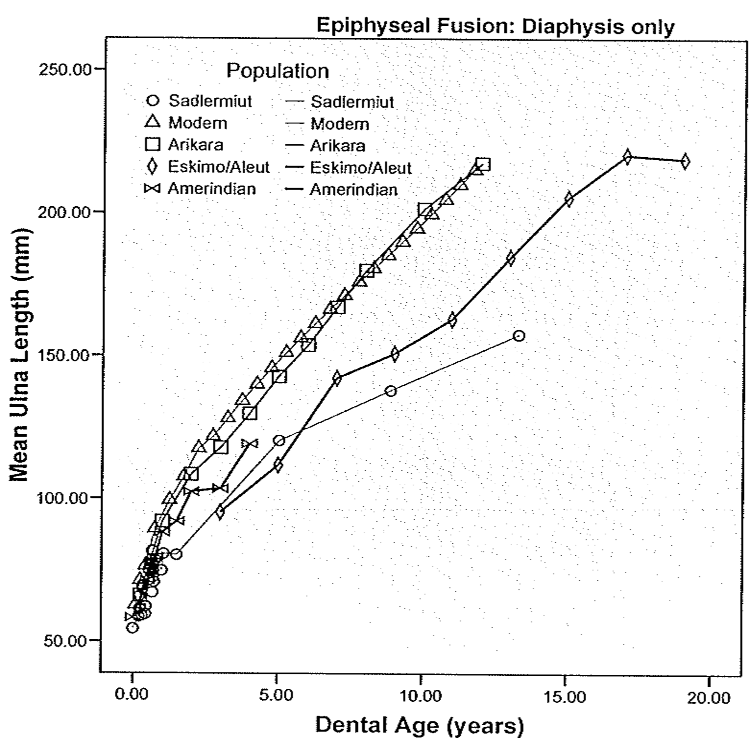


*Fig. 32 Comparison of Sadlermiut radius length to other populations*

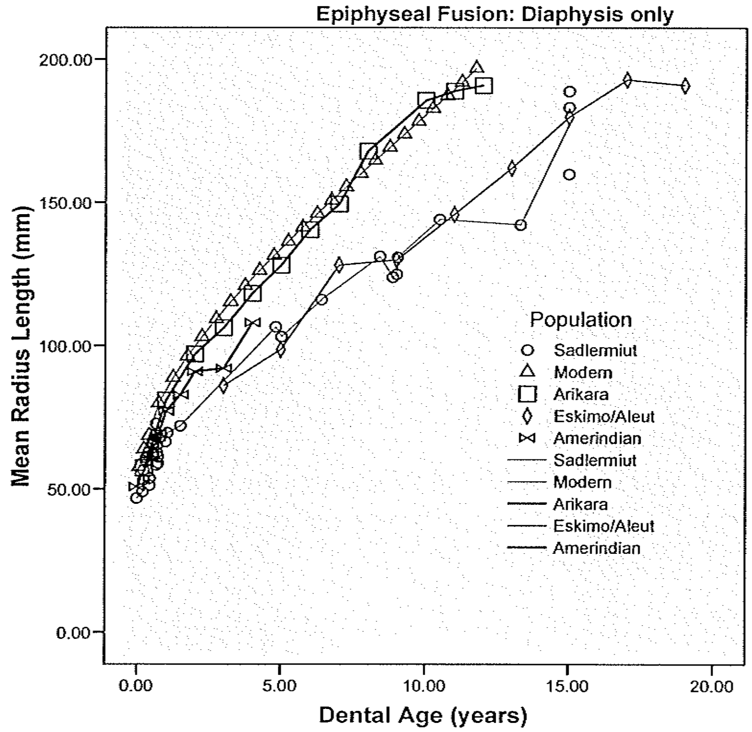



*Fig. 33 Comparison of Sadlermiut femur length to other populations*

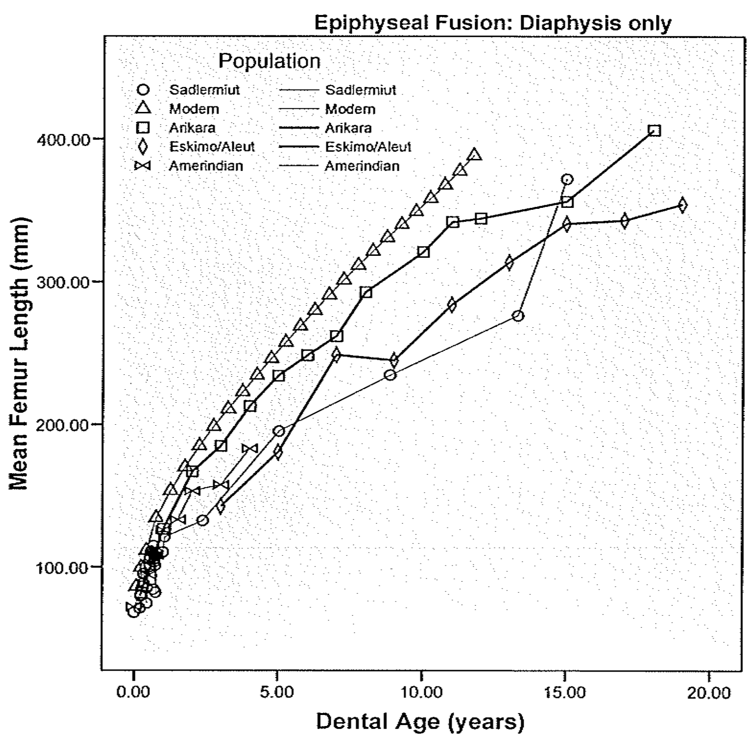


*Fig. 34 Comparison of Sadlermiut tibia length to other populations*

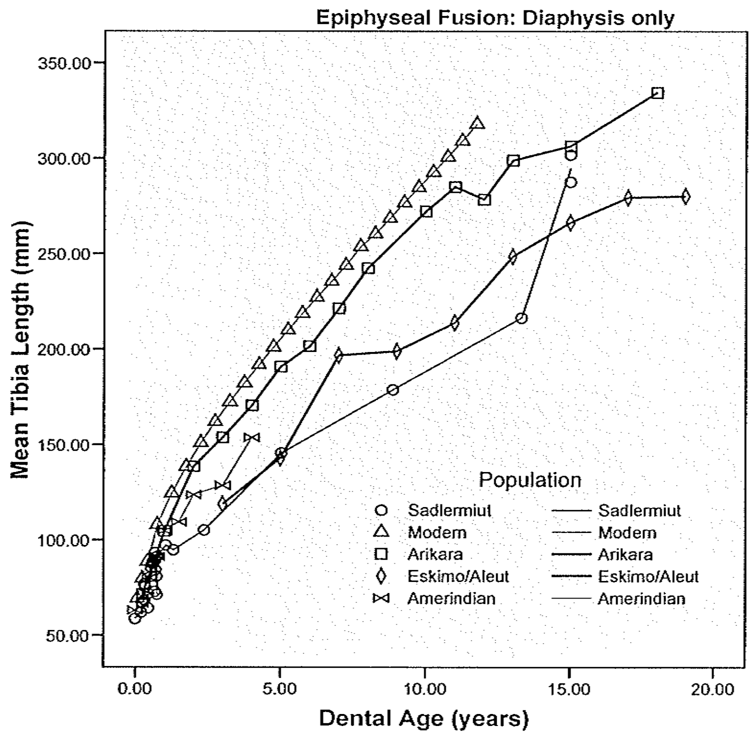



*Fig. 35 Comparison of Sadlermiut fibula length to other populations*

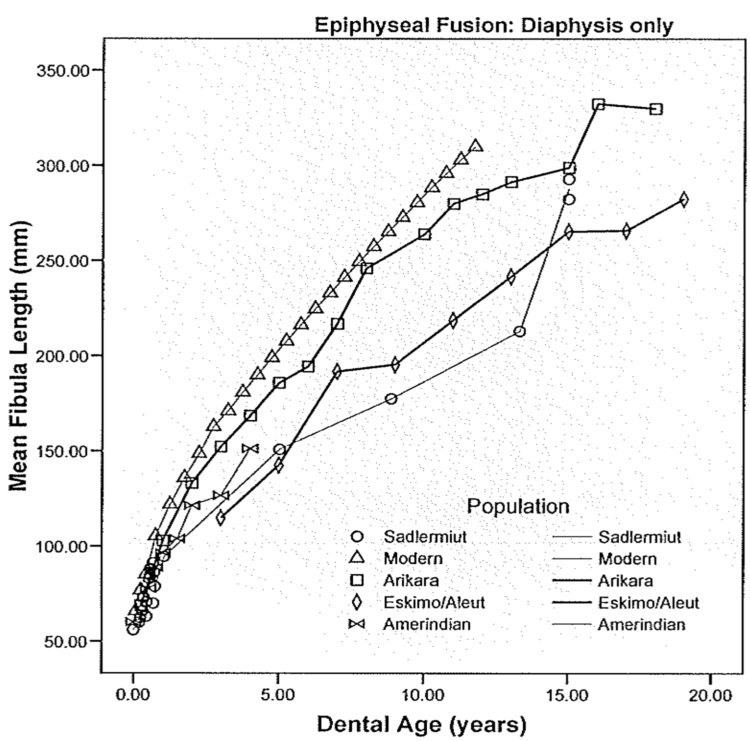


*Fig. 36 Comparison of Sadlermiut humerus growth up to the age of 5*

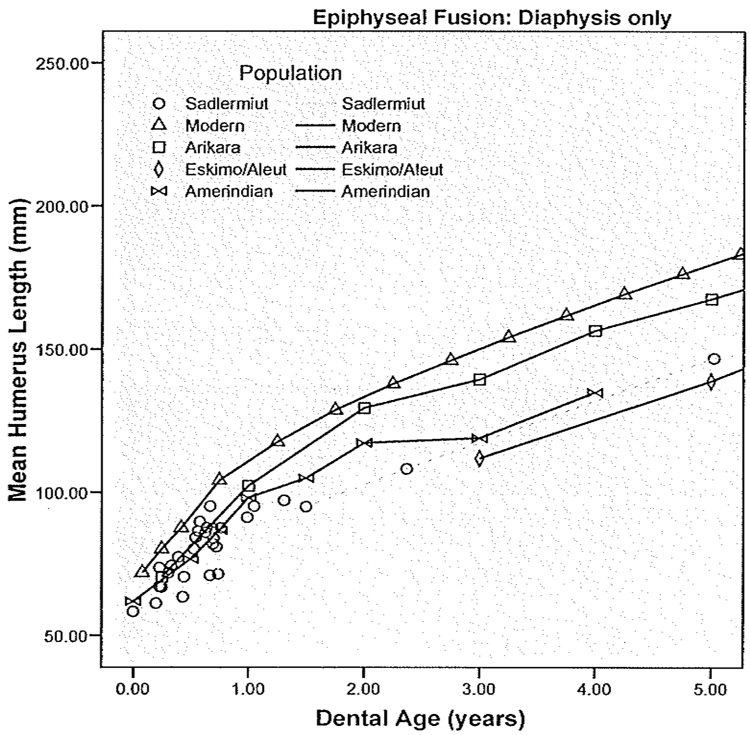



*Fig. 37 Comparison of Sadlermiut ulna length up to the age of 5*

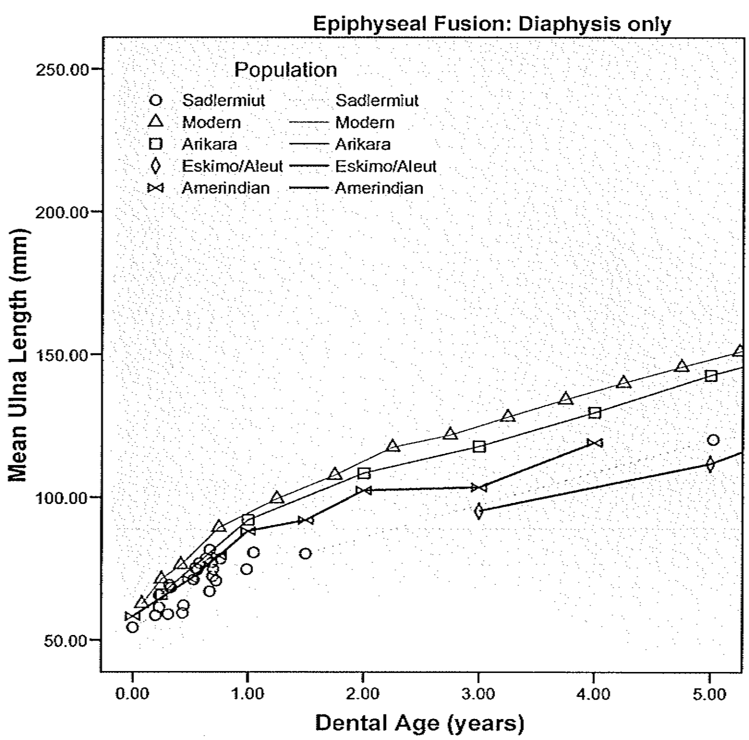


*Fig. 38 Comparison of Sadlermiut radius length up to the age of 5*

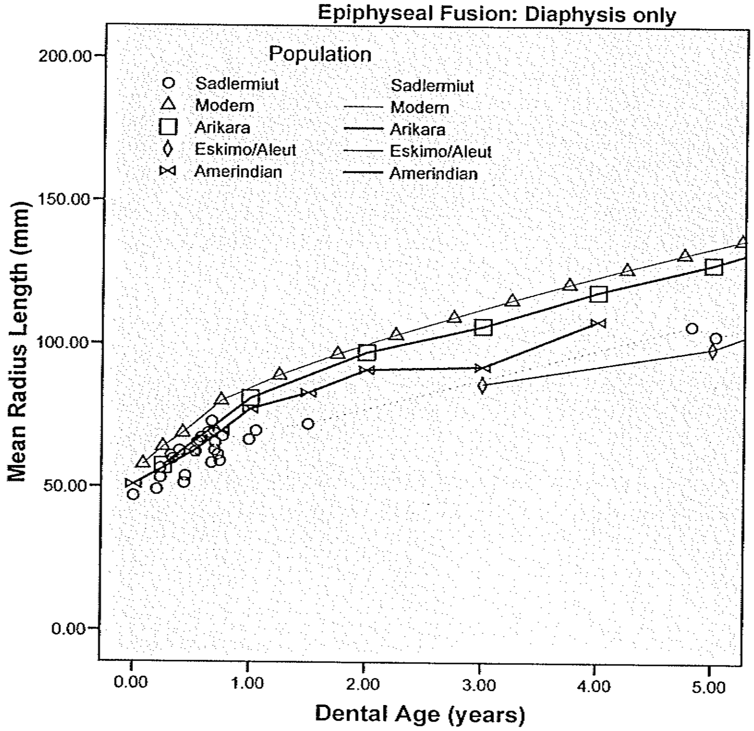



*Fig. 39 Comparison of Sadlermiut femur length up to the age of 5*

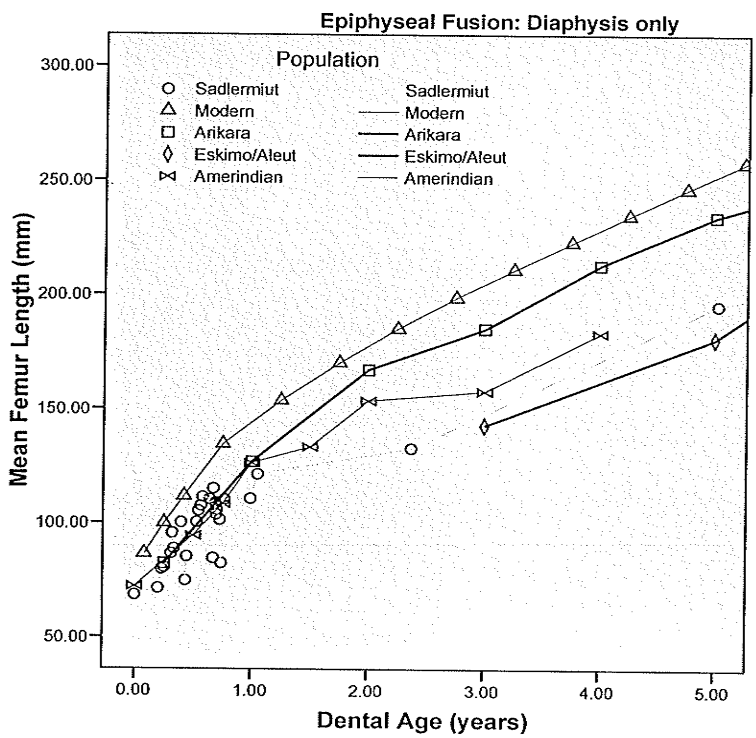


*Fig. 40 Comparison of Sadlermiut tibia length up to the age of 5*

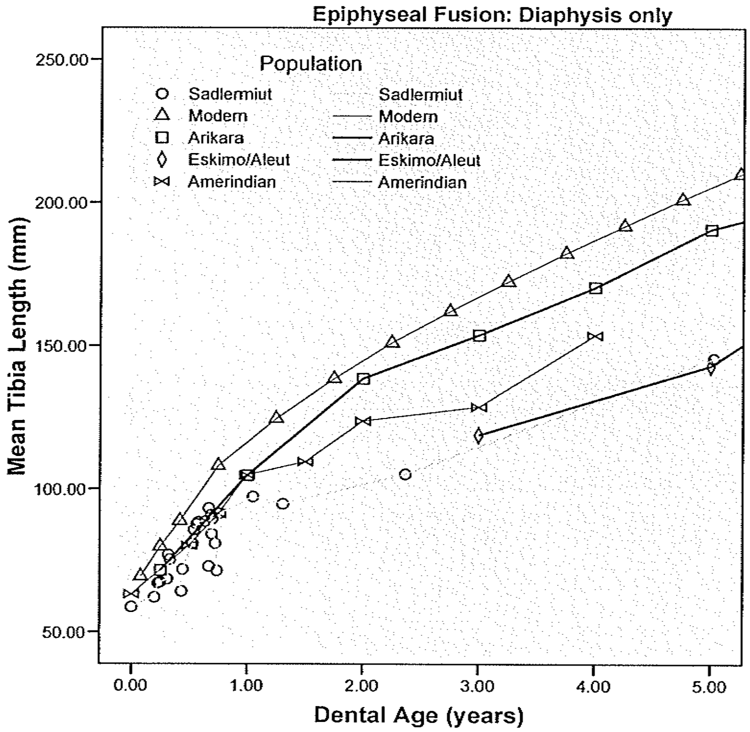
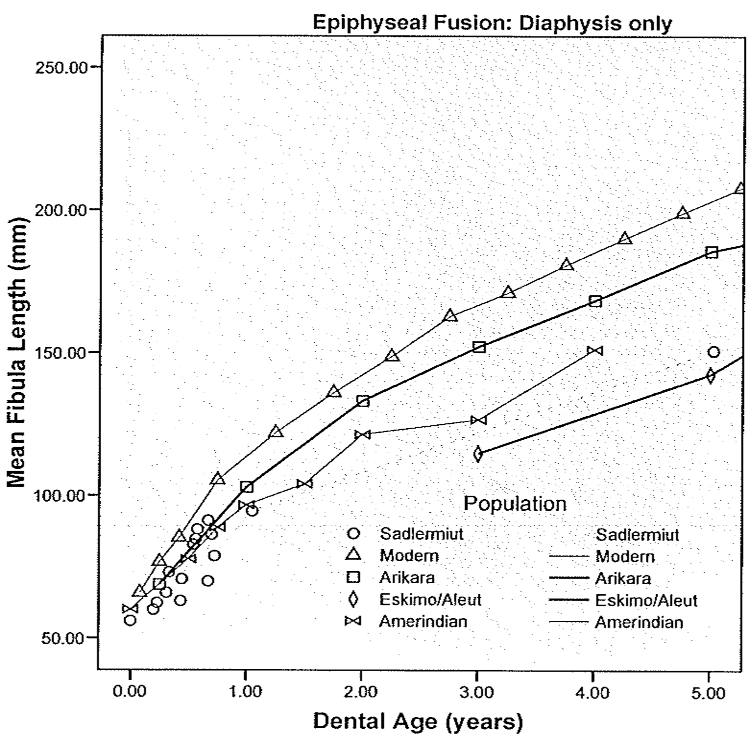



*Fig. 41 Comparison of Sadlermiut fibula length up to the age of 5*



## EPIPHYSEAL FUSION

The skeletal growth profiles for Sadlermiut long bone length with respect to dental age, (Fig.6-17 pgs. 56-61) were marked by the state of epiphyseal fusion for each element. Those individuals who have one or more epiphysis fused or fusing have been summarized in Table 8, this page. In the case of XIV-C:193 there is no corresponding metric data for the left humerus and therefore no plot on the left humerus graph because it is in two pieces. Despite this, it is possible to include it in the epiphyseal fusion table since both ends are present.

*Table 8 Timing of Epiphyseal Union*

| | XIV-C:220 | | XIV-C:158 | | XIV-C:198 | | XIV-C:146 | | XIV-C:193 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Dental Age | 13.3 | | 15 | | 15 | | 18.7 | | 19.5 | |
| Sex | M* | | M* | | M | | M | | M | |
| Humerus | L | R | L | R | L | R | L | R | L | R |
| Proximal | O | O | O | O | O | O | ⊙ | O | ⊙ | ⊙ |
| Distal | O | ⊙ | ⊙ | ⊙ | O | O | ■ | ■ | ■ | ■ |
| Ulna | | | | | | | | | | |
| Proximal | O | O | ⊙ | ⊙ | ⊙ | ⊙ | ■ | ■ | ■ | ■ |
| Distal | O | O | O | O | O | O | O | O | ⊙ | ⊙ |
| Radius | | | | | | | | | | |
| Proximal | O | O | O | O | O | O | ■ | ■ | ■ | ■ |
| Distal | O | O | O | O | O | O | O | O | ⊙ | ⊙ |
| Femur | | | | | | | | | | |
| Proximal | O | O | ⊙ | na | O | O | ■ | ■ | ■ | ■ |
| Distal | O | O | O | na | O | O | ⊙ | ⊙ | ■ | ■ |
| Tibia | | | | | | | | | | |
| Proximal | O | O | O | O | O | O | ⊙ | ⊙ | ⊙ | ⊙ |
| Distal | O | O | ⊙ | O | O | O | ■ | ■ | ■ | ■ |
| Fibula | | | | | | | | | | |
| Proximal | O | O | O | O | O | O | ⊙ | ⊙ | ⊙ | ⊙ |
| Distal | O | O | ⊙ | O | O | O | ■ | ■ | ■ | ■ |

*CMC database lists as female
O = no fusion
⊙ = fusing – epiphyseal line visible
■ = fused – epiphyseal line not visible

As illustrated in Table 8, epiphyseal fusion begins for the distal humerus as early as 13.3 years of age. In the case of XIV-C:220 and XIV-C:158 this might in fact suggest that this individual is female (as determined by the CMC) rather than male (as determined in this research). Females have been found to mature earlier skeletally than males, that is the epiphyses of females will fuse to the diaphyses before the same event occurs in males.

The proximal ulna (XIV-C:158 and 198) is in the process of fusing by 15 years of age, which suggests that it started to fuse before this. The age and fusion of the Sadlermiut compares favourably to that of the Indian Knoll population (Johnston 1961) Table 9. In addition, when the skeletal growth profiles of the Sadlermiut are compared to those of the people from Indian Knoll (not illustrated in this study due to a lack of raw data need with which to create skeletal growth profiles) the Sadlermiut fall below them in long bone length. This suggests that despite the similarities in the timing of epiphyseal fusion, the degree of long bone growth of the Sadlermiut is smaller in magnitude. Epiphyses will fuse at the same time in these two populations, but the length of the bones will differ considerably. This suggests that the Sadlermiut are shorter overall, likely a reflection of the combined effects of environment and genetic growth potential.

Of particular interest is XIV-C:158, with a dental age of 15 the same as XIV-C:198, yet they have different states of fusion. XIV-C:158 has fusion of the distal humerus, proximal ulna, and distal femur, tibia and fibula, whereas XIV-C:198 only has fusion of the proximal ulna. This difference in fusion could be due to an incorrect sex estimation of XIV-C:158. Based on the CMC database XIV-C:158 is female, yet was scored as male in this study. If XIV-C:158 is considered female then the timing of epiphyseal fusion coincides with that of the females of Indian Knoll (Johnson 1961), and would explain the more advanced fusion versus XIV-C:198. This suggests that timing of epiphyseal fusion when partnered with a dental age determination can assist in the estimation of sex. This also illustrates the fact that there is difficulty in assigning subadult individuals accurately to a sex category.

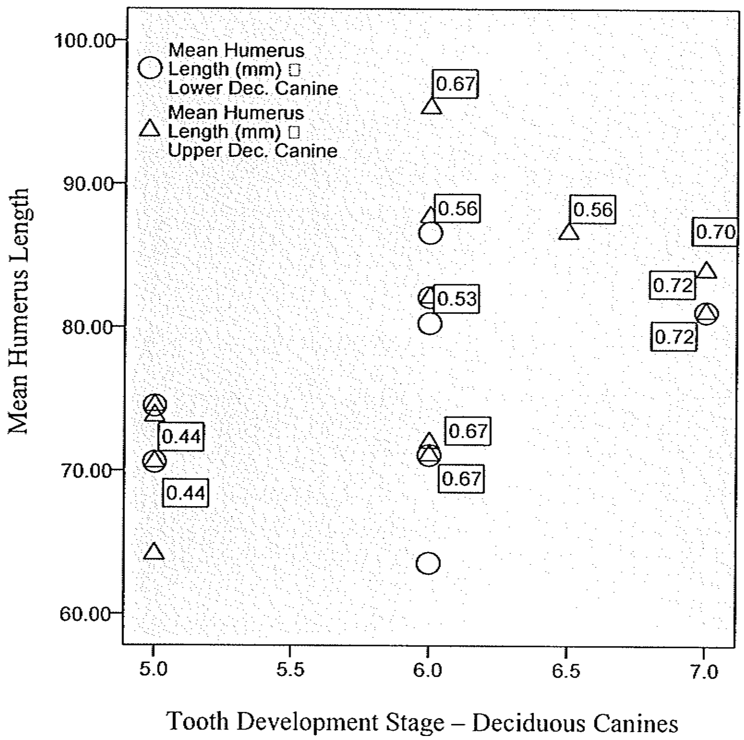
*Table 9 Timing of Epiphyseal Union: Indian Knoll (Johnson 1961)*

| **Indian Knoll** | Females | | Males | |
|---|---|---|---|---|
| | Begin | Comp. | Begin | Comp. |
| Humerus | | | | |
| Proximal | 16 | | 18.5 | |
| Distal | 11.5 | 15.5 | 14 | 16 |
| Ulna | | | | |
| Proximal | 11.5 | 17 | 14 | 17 |
| Distal | 18 | 19 | 18.5 | |
| Radius | | | | |
| Proximal | 12 | 15.5 | 17.5 | 19 |
| Distal | 16 | | 18.5 | |
| Femur | | | | |
| Proximal | 14.5 | | 17 | |
| Distal | 17 | | 18.5 | |
| Tibia | | | | |
| Proximal | 16 | | 18 | |
| Distal | 15 | | 17 | 18 |
| Fibula | | | | |
| Proximal | 16 | | 18 | |
| Distal | 15 | | 17 | |

## LONG BONE LENGTH AND TOOTH DEVELOPMENT

Long bone length was also plotted with respect to individual tooth development in order to better understand dental development and long bone growth. Fig. 42 illustrates that in stage six of development for the deciduous canine, there is considerable difference in humerus length despite the dental age determined for each individual. This means that this stage of development for the canine represents a long period of growth through ages of 4.8 months (0.435y) to 8.34 months (0.695y) and illustrates variation in the lengths attained at each age. This could illustrate that some individuals experience a faster rate of long bone growth than others within the same tooth development stage. This trend for the lower deciduous canine is repeated for all the long bones and the ilia.

*Fig. 42  Mean humerus length by canine tooth development*




## ASSOCIATED ARCHAEOLOGICAL MATERIAL

The archaeological material associated with the Sadlermiut subadult burials is summarized in Table 10 (pg.90). Age determination based on dentition or long bone length, where applicable and sex estimation have been included in order to illustrate potential differences in artifacts with respect to age and sex of the individual. Upon consultation with Dr. Pat Sutherland most of these "associated burial artifacts" were considered to be a result of incorrect association due to lack of provenience control and are thought not to be burial goods but rather scatter. The only artifact that may in fact be a true burial good is a necklace made of 75 fox canines associated with catalogue # XIV-C:204.

*Table 10 Associated archaeological material*

| Catalogue Number | Field ID | Associated Burial Artifact | Age | Sex |
|---|---|---|---|---|
| XIV-C:080 | NP B37 | Projectile point - rough | 3mon | na |
| XIV-C:091,172 | NP B60 | Ivory finger rest? | 12.63y | na |
| XIV-C:109 | NP B71 | Point - harpoon | 3mon | F |
| XIV-C:118 | NP B54 | Ulu blade fragment | 5.03y | M |
| XIV-C:119 | NP B175B | Point tip & Projectile point | 6.6mon | F |
| XIV-C:121 | NP B171 | Projectile point | 3mon | M |
| XIV-C:124 | NP B55 | Projectile point | 8.87y | M |
| XIV-C:151 | NP B156 | Bone harpoon head & soapstone fragment | 9.66y | Na (m?) |
| XIV-C:186 | NP B131 | 2 broad flint points & 1 ivory knife handle (?) | 6.8mon | M |
| XIV-C:198 | NP B5 | Bi-face blade & bone object | 15y | M |
| XIV-C:202 | NP B70 | Ivory toggle (?), scapula scraper & Knife (bone & metal) | 8.4mon | F |
| XIV-C:204 | NP B38 | Necklace of drilled fox teeth (75canines) | 3mon | F |
| XIV-C:222 | NP B170 | scapula scraper | 8.8mon | F |
| XIV-C:236 | NP B4B | Projectile point | 3mon | F |
| XIV-C:278 | NP B182B | Harpoon head & projectile point | 6.4mon | M |
| XIV-C:285 | NP B182C | Harpoon head & projectile point | 3mon | F |
| XIV-C:286-1 | NP B199 | Worked flake – blade & ivory point | 3mon | F |

Please note that the descriptions were copied directly from the artifact catalogue at the CMC. The question marks were retained in order to illustrate that in some cases the identification of an artifact was questionable.

There is no clear differentiation between items that may be associated with female or male infants or children.

Ethnographic accounts include information on naming rituals, birth and death taboos and clothing worn by children. Such events and materials have important significance in the lives of past children, yet they are impossible, or at least extremely difficult, to locate or identify in the archaeological record. Therefore, it is necessary to identify those things that will survive time and allow researchers to make the connection between it and the life of a child. Such potential items are toys and amulets. Although amulets are important and often associated with shamans, there is consistent evidence that children, especially male children, started wearing them at a young age (Jenness 1922; Rasmussen 1931, 1932). Amulets worn by children and identified in ethnographic accounts, range from feathers, to pieces of hide (both bird and mammal), to bones, teeth and claws (Rasmussen 1931, 1932; Jenness 1922). Of these, only the bones and teeth are most likely to survive archaeologically. It is possible then that the fox canine necklace associated with XIV-C:204 is not only a burial item but an item of ritual significance (i.e. an amulet perhaps worn by the child). The sex estimated for this individual is female and she had no dentition but if an age is estimated using long bone length she is three months old. Given that amulets of animal teeth are more often associated with male children (Rasmussen 1931, 1932) the inclusion of such items with a female infant is interesting as it may suggest that females played a role in hunting as well as males. It is not uncommon for female children to be taught to hunt and to have toy bows and arrows with which to practice (Boas 1901). It is more common for a female child to wear an amulet in order to ensure that she will bear sons, (Rasmussen 1932) so it could be that the fox canines were meant to ensure her male children. Three months is extremely young to have worn such an amulet, therefore, the association between this item and this child may not be valid.

It is also not uncommon for children to be buried with the toys they played with (Boas 1888), so a number of these items may in fact represent toys with which the children played. There are many ethnographic accounts of children's games in Inuit society; however, only a few of them have archaeological correlates: playing with dolls; practicing with a bow and arrow made to fit their physical strength and size; ring and pin, where a ring is hung from the inside of a house and they try to throw sticks through it; play hunting and play sealing (Birket-Smith 1929; Boas 1888, 1901; Rasmussen 1931, 1932). Linking ethnographic accounts of such games to archaeological material is possible (Park 1998, 2006), yet it is not possible at this time, to say conclusively whether or not the artifacts associated with these burials are in fact toys used by the infants and children with whom they were found.

# CHAPTER 6: CONCLUSIONS

Euro-American whaling had a large and negative affect on the health of the Inuit. The introduction of infectious diseases to which the Inuit had no immunity drastically reduced their populations (Keenleyside 1990). There is no better example of this than the Sadlermiut. The last known village of these people perished in the winter of 1902-03 from an introduced infectious disease as a result of the whaling industry.

Considerable research has been conducted on the skeletal remains of the Sadlermiut excavated from Native Point, yet to date those less than 18 years of age have never been the focus such research. This study tackles this issue directly by concentrating solely on the subadults in this population. By incorporating archaeological and ethnographic information with osteological analysis of growth and development it has been possible to better understand the lives of these people.

The osteological analyses performed illustrate that infants make up the largest portion of those less than 20 years old and that there are more females in this category than males. A high proportion of infant deaths is commonly associated with archaeological populations due to their susceptibility to infection and malnutrition (Saunders and Barrans 1999). In consulting ethnographic literature it is noted that female infanticide was practiced across the arctic in the past. In addition, male children were commonly preferred over female children as it is the male that hunts and will ultimately take care of the parents. They are given amulets at a young age to ensure their survival and hunting ability, whereas female children more commonly wore amulets to ensure that when grown they will bear sons (Rasmussen 1931; Jenness 1922), a reflection of the sex bias in Inuit groups. Whether or not the large number of females in the 0 -1 year age category is due to the practice of female infanticide remains to be determined conclusively.

If infanticide was practiced by the Sadlermiut, a pooling in the 0-1year age category closest to zero would be expected. In order to get a refined age determination an analysis of tooth histology and incremental structures would be worthwhile. This would allow for an age determination in the order of weeks of age, rather than months. In addition, the identification of the neonatal line, or more aptly its absence would help identify those individuals who were stillborn. The neonatal line is a line that occurs in the enamel that is linked to the actual birthing process, therefore, those who do not have a neonatal line were in fact stillborn (Hillson 1996).

Furthermore, due to the issues experienced with the determination of sex, other methods would assist in refining the sex distribution. A DNA study would allow for a concrete understanding of the sex distribution in the subadults (Saunders and Barrans 1999). Although both tooth histology and DNA analysis would assist in attaining a better understanding of both age and sex distribution, both methods are destructive, and require a considerable amount of time and money.

When the growth of the Sadlermiut was compared to the growth of a modern white sample (Maresh 1943), and the archeological populations of the Arikara (Merchant and Ubelaker 1977), the Eskimo and Aleut (Y'Edynak 1976) and the California Amerindian population (Wall 1991), it was found to fall behind that of the modern population and the Arikara, yet comparable to the Eskimo and Aleut. The similarity in growth between the Sadlermiut and the Eskimo and Aleut is likely a reflection of their close genetic relationship and similar environments and therefore similar stressors.

Extending the skeletal growth profiles with data regarding final attained stature, that is adult stature, for the Sadlermiut would help in the understanding of the growth pattern experienced by this population and its relationship to other populations.

The jump in long bone length between the age of 12 and 15, could point to the occurrence of the adolescent growth spurt, which occurs at the time of puberty. This suggests then that puberty occurred in this population between the ages of 12 and 15. It must be kept in mind that this jump in length could be a reflection of the fact that the individual who 15 is taller than the individual who is 12 years old, and not a true reflection of puberty. This is a drawback inherent in the use of cross-sectional analyses as it is not possible to get a true look at the occurrence of puberty because it is not possible to look at the growth spurt that occurs in individuals.

An analysis of long bone radiographs would further the interpretation of the nutritional stresses that may have occurred within this population. It is through x-rays that Harris lines are visible and through their location and frequency of occurrence it would be possible to identify when the halting in growth occurred and whether or not there are multiple occurrences within an individual.

In addition, the timing of epiphyseal fusion of the Sadlermiut was found to comparable to that of the archaeological population of Indian Knoll (Johnston 1961). This suggests that despite the differences in population affinity, and final adult stature, the sequence of epiphyseal union occurs at the same age in both those of Indian Knoll and the Sadlermiut.

In an examination of artifacts associated with the burials from which these individuals were recovered it was only possible to identify one item that may have been a burial association with confidence. This is a necklace of fox canines which is associated with the burial of a female infant.

**The Sadlermiut Children**

Through the ethnographic accounts of (Jenness 1922a; Mathiassen 1927, 1928; Rasmussen 1931a, 1932a), it is possible to get a glimpse into what childhood may have been like for the Inuit of the Canadian arctic. There is little ethnographic information on the Sadlermiut as they perished before extended contact with Europeans, yet some of what is known is similar to other Inuit groups. Mothers bore their children in separate houses from their families and other community members, a measure that surely helped prevent infection. Their clothes, although commented on as vastly different from those of the mainland, likely changed as the child aged, from being carried in the mothers hood, to wearing their own coat and pants, to wearing clothes similar to those of adults around the age of 6 - 8, to finally being able to wear all aspects of adult clothing when grown. They likely grew up rarely disciplined and unfettered by adult interference as the Inuit believe children to be born with a latent personality that just needs to be brought out (Guemple 1979, 1988). They surely played numerous games of tag, house, and practiced seal hunting and with the bow and arrow and helped with household chores. Their roles in the household probably increased as they got older and their manual dexterity increased, with girls being taught to sew and make their own dolls and cut and dress meat, and boys to hunt. The attainment of adulthood may have been associated with the first independent kill for a boy, and the beginning of menses for a girl. It is around the age of 12 that Sadlermiut girls got their first facial tattoo, which could in fact coincide with their first menses. It is also around this age that boys began to braid their hair to wear in a top knot above their forehead. These changes in physical appearance emerge at an age that suggests the timing of puberty, and given the growth data (a large jump in growth between the ages of 12 and 15) it is likely that these changes do in fact coincide with a pubertal growth spurt. This allows a link to be made between the osteological analyses and ethnographic data, to suggest that between 12 and 15 not only were boys and girls undergoing a biological change but also a cultural and social one, that moved them from the realm of a child to that of an adult. The lives of the Sadlermiut children were not easy, but were likely not unhappy, as both Lyon (1825) and Comer (1910) reported that although odd of dress and language the Sadlermiut were a happy and chatty people.

As Seltzer (1933:354) so profoundly puts " It is the complete devotion to all the evidence at our command, - the somatological, the ethnological, the archaeological, and the ethnographical – which will reveal to us the true history, the true cultural pattern of a people." This is particularly valid when applied to understanding children and childhood in the past, but even more applicable to the Sadlermiut as all areas of research must be included in order to get a picture of an extinct people. Their peculiar dress, different language and material culture has set them apart from other Inuit groups yet they survived at Native Point for at least 500 years (Merbs 1983).

It is by incorporating all the evidence available on the Sadlermiut, from the osteological to the archaeological and the ethnographical, that it has been possible to understand the lives and childhood of the Sadlermiut. It is only through the use of all three of these avenues of investigation that it has been possible to generate hypotheses as to the reason behind the high infant mortality, such as a high incidence of parasitic and or infectious disease, female infanticide, and the potential adoption of the very young. This methodology has also allowed for the identification of timing of puberty and associated social changes for girls and boys. Using multiple avenues of investigation is important for all areas of research in anthropology, but is specifically true when applied to the archaeology of children and childhood, as the inclusion of them in anthropological research can greatly enhance our understanding of past peoples.

## APPENDIX A: MEASUREMENTS

| Element | Measurement | Definition | Reference |
|---|---|---|---|
| Parietal | Height | midsquamous border to midsagittal border across parietal eminence parallel to coronal suture | Scheuer and Black 2000 Table 5.7 pg.101 (Kosa 1989) |
| | Width | frontal to occipital borders across parietal eminence parallel to sagittal suture | Scheuer and Black 2000 Table 5.7 pg.101 (Kosa 1989) |
| Frontal | Length | middle of superior margin of orbit to superior peak of bone across frontal eminence | Scheuer and Black 2000 Table 5.9 pg.108 (Kosa 1989) (Young 1957) |
| | Width | width across frontal eminence at right angles to length (width at superior border of orbit in younger fetuses) | Scheuer and Black 2000 Table 5.9 pg.108 (Kosa 1989) |
| Occipital | Height | posterior border of foramen magnum to tip of squama (chord: direct distance) (arc: distance on surface of bone) | Scheuer and Black 2000 Table 5.2 pg.61 |
| | Width | max distance across bone at right angles to height | Scheuer and Black 2000 Table 5.2 pg.61 |
| Pars basilaris | Midsagittal Length (MSLPB) | midsagittal distance from anterior border of foramen magnum to anterior border | Scheuer and Black 2000 Table 5.2 pg.61 |
| Pars basilaris | Maximum Length (MLPB) | max length from most prominent to most prominent- sliding calipers with parallel jaws across anterior and posterior ends | (Scheuer and MacLaughlin-Black 1994) |
| Pars basilaris | Width (WPB) | max width at level of lateral angles | (Scheuer and MacLaughlin-Black 1994) |
| Pars lateralis | Length (LPL) | max distance between anterior and posterior intra-occipital synchondrosis | Scheuer and Black 2000 Table 5.2 pg.61 |
| Pars lateralis | Width (WPL) | max distance between medial and lateral margins of the posterior intra-occipital synchondrosis | Scheuer and Black 2000 Table 5.2 pg.61 |
| Sphenoid body | Length | midline distance between the synchondrosis intraspenoidalis and sheno-occipitalis | Scheuer and Black 2000 Table 5.6 pg.95 |
| | Width | max transverse distance in the mid-hypophyseal fossa | Scheuer and Black 2000 Table 5.6 pg.95 |

| | | | |
|---|---|---|---|
| Sphenoid lesser wing | Length | Lateral tip of lesser wing to midline of synchondrosis intrasphenoidalis (lateraltip of lesser wing to medial end of lesser wing in younger fetuses) | Scheuer and Black 2000 Table 5.6 pg.95 |
| | Width | max distance of lesser wing across optic canal | Scheuer and Black 2000 Table 5.6 pg.95 |
| Sphenoid greater wing | Length | max distance between medial pterygoid plate and lateral tip of greater wing | Scheuer and Black 2000 Table 5.6 pg.95 |
| | Width | max distance between spenoidal spine and anterior end of pterygoid plate | Scheuer and Black 2000 Table 5.6 pg.95 |
| Temporal | Height | max distance from centre of tympanic nothc to superior border of bone | Scheuer and Black 2000 Table 5.5 pg.83 |
| | Length | postero-inferior point on bone to anterior end of zygomatic process | Scheuer and Black 2000 Table 5.5 pg.83 |
| | Width | max distance across bone parallel to length measurement | Scheuer and Black 2000 Table 5.5 pg.83 |
| Pars petrosa | Length | max anteroposterior distance across bone | Scheuer and Black 2000 Table 5.5 pg.83 |
| | Width | max distance at right angles to length across arcuate eminence | Scheuer and Black 2000 Table 5.5 pg.83 |
| Tympanic ring | Diameter | max distance across ring at level of anterior. tympanic tubercle | Scheuer and Black 2000 Table 5.5 pg.83 (Kosa 1989) |
| Nasal | Length | superior to inferior margin in midline | Scheuer and Black 2000 Table 5.11 pg.112 |
| | Width | max distance across inferior border | Scheuer and Black 2000 Table 5.11 pg.112 |
| | Height | highest point of internasal suture | Scheuer and Black 2000 Table 5.13 pg.112 (Lang 1989) |
| | Breadth | distance across both nasal bones at point at which frontal process of maxilla meets lateral border of nasal bones | Scheuer and Black 2000 Table 5.13 pg. 112 (Lang 1989) |

| | | | |
|---|---|---|---|
| Piniform aperature | Height | max height from superior to inferior piriform aperture | Scheuer and Black 2000 Table 5.12 pg.112 (Lang 1989) |
| | Superior Width | width across aperture at level of inferior lateral border of nasal bones | Scheuer and Black 2000 Table 5.12 pg.112 (Lang 1989) |
| | Inferior Width | max width across aperture | Scheuer and Black 2000 Table 5.12 pg.112 (Lang 1989) |
| Vomer | Length | max length from anterior end to posterior end of alae | Scheuer and Black 2000 Table 5.16 pg.122 |
| Zygomatic | Length | medial end of infra-orbital border to posterior end of temporal process | Scheuer and Black 2000 Table 5.17 pg.125 |
| | Width | medial end of infra-orbital border to superior end of frontal process | Scheuer and Black 2000 Table 5.16 pg.122 |
| Maxilla | Height | alveolar process to tip of frontal process in vertical plane | (Kosa 1989) |
| | Length | anterior nasal spine to posterior border of plalatal process in sagittal plane | Scheuer and Black 2000 Table 5.18 pg.134 |
| | Width | posterior border palatal process and lateralend of zygomatic process | Scheuer and Black 2000 Table 5.18 pg.134 |
| | Longest oblique length | anterior nasal spine to lateralend of zygomatic process in oblique plane | Scheuer and Black 2000 Table 5.18 pg.134 |
| Palatine | Height | length of perpendicular plate/oblique distance from tip of pyramidal process to max height of orbital process | Sheuer and Black 2000 Table 5.20 pg.139 |
| Mandible | Body length BL | from tuberculum mentale to mandibular angle | Sheuer and Black 2000 Table 5.21 pg.147 |
| | Width W | posterior border of condyle to tip of coronoid process | Sheuer and Black 2000 Table 5.21 pg.147 |
| | Longest Length (Half mandible full length) | from tuberculum mentale to posterior border of condyle | Sheuer and Black 2000 Table 5.21 pg.147 |
| Clavicle | Length | max length medial to lateral end (sliding) | (Kosa 1989) (Black and Scheuer 1996) |

| | | | |
|---|---|---|---|
| Scapula | Length | distance between superior (upper medial) and inferior angles | Scheuer and Black 2000 Table 8.6 pg. 271 (Saunders et al. 1993) |
| | Width | distance between margin of glenoid fossa and medial end of spine | Scheuer and Black 2000 Table 8.6 pg. 271 (Saunders et al. 1993) |
| | Spine Length | max distance between the medial end of the spine and the tip of the acromion process | Scheuer and Black 2000 Table 8.3 pg.270 |
| Humerus | Length | max length | Scheuer and Black 2000 Table 9.2 pg.288 |
| | Width | max mediolateral width at distal end | Scheuer and Black 2000 Table 9.2 pg.288 |
| Ulna | Length | max length | (Kosa 1989) (Ghantus 1951) |
| Radius | Length | max length | (Kosa 1989) (Gindhart 1973) (Ghantus 1951) |
| Metacarpals (I-V) | Length | max length | Scheuer and Black 2000 Table 9.22 pg.339 (Kimura 1976) (Odita et al. 1991) |
| | Width | width at midshaft | Scheuer and Black 2000 Table 9.22 pg.339 (Kimura 1976) (Odita et al. 1991) |
| Atlas | Maximum Length | max length of vertebral half arch | Scheuer and Black 2000 Table 6.1 pg.218 |
| Axis | Maximum Length | max length of vertebral half arch | Scheuer and Black 2000 Table 6.1 pg.218 |
| Lumbar Vertebra | Posterior transverse diameter | a ventrally facing identification of the posterior margin of the vertebral body was observed in all vertebrae examined. A line was (AB) was drawn horizontal to this indentation, across the vertebral body, extending laterally between the limits of the internal pe | (MacLaughlin and Oldale 1992) |

| | | | |
|---|---|---|---|
| | Anteroposterior diameter | using a set square, a perpendicular line (CD) was drawn from the midpoint of AB to the ventral epiphyseal margin | (MacLaughlin and Oldale 1992) |
| | Anterior transverse diameter | a line (EF) was drawn at the midpoint of CD, perpendicular to CD and parallel to AB | (MacLaughlin and Oldale 1992) |
| | Maximum Width | width across entire diameter of body | (MacLaughlin and Oldale 1992) |
| | Length | length of body from posterior of body at canal to ventral surface | |
| | Thickness | max thickness of body - taken ventral to dorsal - really is maximum thickness at midlineSdig.C | |
| Ilium | Maximum length | max distance between the anterior to the posterior superior iliac spines | (Kosa 1989) |
| | Max width | max distance between the middle point of the iliac crest and the convexity of the acetabular extremity | Kosa 1989 |
| | max width | the distance between the middle point of the curvature of the iliac crest and the area of the posterior superior iliac spine | Saunders et al. 1993 |
| Ischium | Length | max distance between the convexity of the acetabular extremity and the tip of the ischial ramus | Scheuer and Black 2000 Table 10.1 pg.373 |
| | Width | max distance across the broad superior extremity | Scheuer and Black 2000 Table 10.1 pg.373 |
| Pubic bone | Length | max distance between the symphysis and the iliac articulation | Scheuer and Black 2000 Table 10.1 pg.373 |
| Femur | Length | max length | Scheuer and Black 2000 Table 11.2 pg.393 (Kosa 1989) (Maresh 1970) |
| | Width | max mediolateral width at distal end | Scheuer and Black 2000 Table 11.2 pg.393 (Kosa 1989) (Maresh 1970) |
| Tibia | Length | max length | (Kosa 1989) (Gindhart 1973) |

| | | | |
|---|---|---|---|
| Fibula | Length | max length | (Kosa 1989) (Maresh 1970) |
| Metatarsals (I-V) | Maximum length | max length | (Scheuer and Black 2000) |
| Calcaneus | Maximum length | projected line from the most posterior point of the tuberosity of the calcaneus to the most anterior/superior point of the cuboidal facet | (Steele 1976) |
| | Minimum width | projected line of minimum horizontal width through the body of the calcaneus. This line usually lies anterior to the tuberosity of the calcaneus and posterior to the posterior facet for the talus | (Steele 1976) |
| | Body height | greatest projected height of the calcaneus and measured from the most inferior point of the tuberosity of the calcaneus to the most superior point of the posterior facet of the calcaneus | (Steele 1976) |
| Talus | Maximum length | projected line from the sulcus for the flexor hallucis longus muscle at the posterior aspect of the talus to the most anterior point on the articular surface for the navicular | (Steele 1976) |
| | Width | max projected line laterally/medially perpendicular to the sagittal plane. The lateral point is the most lateral point on the articular surface for the lateral malleolus and the line generally bisects the articular surface for the tibia slightly forward o | (Steele 1976) |
| | Body height | max height of the body in an inferior/superior plane. The measurement is taken by placing the talus on a flat surface and then determining the most superior point of the articular surface for the tibia. The superior point is generally along the medial rim | (Steele 1976) |

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