The Mackenzie Site Human Skeletal Material

Shelley R. Saunders

Human bones were recovered on four separate occasions from the Mackenzie Site during the period 1963-1982. Although two infant burials come from a house floor, all others were found in a sandy knoll north-east of the village. These are primary and secondary burials of individuals, not a mixed ossuary bone assemblage. The collection represents a minimum of 18 persons of both sexes and all ages. Detailed descriptions of a variety of intra-individual skeletal age indicators such as dental calcification stages may be useful for developing age standards for Ontario Iroquois. Patterns of dental pathology are comparable to other synchronic Late Ontario Iroquois samples. Similarities to certain Neutral burial practices are noted.

Introduction

The Mackenzie or Woodbridge Site (AkGv-2) is a single component village of the Late Ontario Iroquois Tradition located near metropolitan Toronto on the Humber River. The date of occupation of the site is approximately AD 1520+ 15 based on ceramic seriation, pipe styles and the presence and types of European trade material (Johnson 1980). The site has received substantial archaeological attention during the past because of the interest in its relationship to later developments in historic Huronia.

Four different collections of human skeletal material were available for study, two without specific provenience and two excavated under archaeological supervision (Table 1). Since much of the material represents complete skeletons rather than the more common disarticulated ossuary type burial found in Ontario, it is important that it be analysed and compared to other skeletal studies of Ontario Iroquoians. Craniometric data, incidence of caries, non-metric attributes and stature are given in Tables 2-5.

Although the Iroquoian ossuary represents a unique demographic sampling because it contains individuals from a single village who died over an 8-12 year period, there are limitations to its use. These include the necessity of analysing isolated, disarticulated skeletal elements, substantial post-mortem damage because of the purposeful mixing of bones at the time of interment and ethnohistorical evidence for selective exclusion of certain age classes and persons dying under specified conditions.

The value of the present study is not necessarily to be found in the individual skeletal descriptions but in the information they contribute to building a more complete picture of Ontario Iroquois skeletal development, health and disease. For ex-ample, accumulated information on both the stages of dental calcification and diaphyseal lengths of in-tact subadult Iroquoian skeletons will supply population-specific standards of skeletal development in much the same way that Melbye's (1983) descriptions of dental attrition contributes to the assessment of adult aging.

The Skeletal Remains

The first two lots of skeletal material were removed by untrained local amateurs so that specific provenience and detailed knowledge of burial patterns are lacking. However, based on discussions with the individuals involved, it is quite likely that all of the human material, except for two infants buried in a house floor and some fragments from the midden, came from a sandy beach deposit northeast of the excavated longhouses.

Collection A

The bones dug up in 1963 are designated Collection A. Although specific provenience for this material is unrecorded, it is known that Individual A.1, an adult female, was articulated and buried on her side in a flexed position (Ramsden: personal communication). The bones of the two subadults were not in burial pits but rather scattered on the surface and just beneath it.

Individual A. 1

This is an adult female estimated to be from 164-170 cm in stature. The skeleton is relatively complete, except for some of the smaller facial bones, the sternum and some bones of the hand, but the bones are in poor condition.

Age Determination

The pubic symphysis is a commonly employed morphological method of age determination but unfortunately symphyses were not available for this skeleton. However, an attempt was made to use the auricular surface age standards of Kobayashi

TABLE 1

Summary of Individuals From the Mackenzie Site

Collection	Number	Adult	Subadult	Sex
A		18-24*		female
	2		7.3	?
	3		2-2.3	?
B	1	middle-age		female
	2	29± 5		male
	3	24± 2		male
	4	22		female
	5		13.2	?
	6	young-middle		?
	7	22-30		female
	8		4.7	?
	9		0-6 mos.	?
	10		1-3 yrs.	?
C			0-3 mos.	?
	2		0-3 mos.	?
D			15.5± 1	male
	2	26.5± 2.8*		male
	3		3-3.5	?

*Based on morphological age estimates, histological age estimates for these individuals are higher.

(1967). This individual's auricular surfaces matched Kobayashi's description for an age estimate of 18-21 years. While cranial suture closure is not a particularly reliable age indicator, it was used as a crosscheck of the auricular surface method. Examination of ectocranial and endocranial stages of closure of the coronal and sagittal sutures (Acsadi and Nemeskeri 1970) yielded an age estimate of 18-24 years. Histological age based on osteon density at the femoral midshaft (Thompson 1979) yielded an age estimate of 36 years, a notable discrepancy.

There are 12 intact antemolar teeth with this skeleton. Almost all of these suffer from heavy occlusal wear; all but two are worn below the level of the dentine. Published dental attrition age standards pertain only to the molars and thus cannot be applied to this skeleton.

However, the heavy wear on the anterior teeth of A.1 and the fact that all right molars were lost before death argues for accepting the older histological age estimate as being closer to chronological age at death.

Bone Disease

Some degenerative joint changes were observed on the inferior articular facets of two thoracic vertebrae. In addition, both the right and left tibia bear periosteal reactive bone at their distal ends.

Dental Status

The mandible is broken off posterior to the left second premolar. Eight mandibular teeth are present including the lateral incisors, canines and premolars. The central incisors were lost postmortem while all molars on the right side were lost premortem. Unusual resorption on the right mandibular alveolus has produced a bridge of bone in the area of the third molar. A right maxillary fragment contains the lateral incisor, canine and two premolars.

Dental Disease

Dental attrition is moderate on the mandibular teeth and heavy on the maxilla.

The mandibular right premolars have suffered large carious lesions which have destroyed most of the crowns. Root caries at the cemento-enamel junction are present on seven of the remaining teeth. Alveolar recession indicating periodontal disease was measured according to Patterson's (1984) descriptions and found to be moderate to severe. X-rays confirmed the absence of abscesses.

Individual A.2

This is a child aged approximately 7.3 years of indeterminate sex. Except for the skull much of the axial skeleton is missing, including the teeth.

The bones are in fair condition; many of the diaphyseal lengths could not be measured.

Age Determination

A single loose tooth was found with this skeleton, a maxillary left dm1. The lingual and distobuccal roots had begun to resorb at the time of death (root resorption stage ½) and the tooth crown is well worn. A small patch of dentine is exposed on the occlusal surface of the buccal cusp. There is also a large carious lesion on the mesial side of the crown and enamel hypoplasia on the distal side into which a small carious lesion was beginning to form at the time of death. Moorees, Fanning and Hunt (1963a) have published age standards for calcification stages of the mandibular deciduous molars and deciduous canine. An approximate age estimate for this maxillary dm1 when compared to their standards for mandibular deciduous molars would range from 5.8 to 9.4 with a mean of 7.3 years when standards for both males and females are taken into account.

Age can also be estimated from the diaphyseal lengths of the long bones. Merchant and Ubelaker (1977) have developed aging standards for subadult skeletons by plotting the lengths of long bone diaphyses against dental age estimates using the dental calcification standards of Moorees, Fanning and Hunt (1963a,b). The Merchant and Ubelaker sample is protohistoric Arikara and therefore population specific. However, Melbye (1983) successfully applied this method in estimating the ages of a sample from Huronia. **In** addition, M. Jackes has kindly provided information on the diaphyseal lengths and age estimates of subadult long bones from the Grimsby Site, an historic Neutral Iroquois site. The following are the age estimates for Individual A.2 based on the Merchant and Ubelaker standards and the Jackes data.

	Length		Age	
	Right	Left	Merchant and Ubelaker	Jackes
Femur	285 mm	287mm	7.7	9.5
Tibia	232	232	7.5	9.5
Humerus	—	(205)	7.6	9.5
Ilium (width)	96	94	6.3	—
Ilium (length)	94	94	—	11.0

The age estimates derived from the Jackes data are all older. Jackes used the Schour and Massler chart (1944) for dental development to determine dental age. Compared to the dental age standards of Moorees, Fanning and Hunt, the Schour and Massler chart consistently yields older ages (Merchant 1973), which probably explains the differences between the age estimates. Since the Moorees, Fanning and Hunt study is based on recent observations of dental calcification using a large sample, it seems best to use the Merchant and Ubelaker age estimates. Therefore, the mean age estimate for this individual based on four bone measurements is 7.3 years. The ilium is much narrower than would be expected based on the other long bone age estimates, a result that is presently unexplainable.

Bone Disease

Periosteal reactive bone was found on the left humerus, extending anteriorly and posteriorly approximately 7 cm along the distal shaft. Thin sections taken from this area demonstrate that new periosteal woven bone has formed over the entire surface of the normal cortical bone. However, the presence of woven bone in the marrow cavity, cloacae on the surface of the lesion and the fact that the entire shaft is enclosed in an involucrum of woven bone argues for a diagnosis of osteomyelitis rather than simply periostitis. The unilateral, localized occurrence of the lesion in a young individual suggests that it might be a case of acute hematogenous osteomyelitis (Steinbock 1976).

X-rays of the distal tibiae revealed the presence of four Harris lines close to the distal metaphysis in this individual.

Individual A.3

This is a child aged approximately 2 years of indeterminate sex. The skeleton is partially represented by bones of the cranial vault, a right maxilla, a right mandibular fragment, some loose teeth and the lower limb bones. The bones that are present are in good condition and show no evidence of pathological processes.

Age Determination

Using the dental calcification data of Moorees, Fanning and Hunt (1963a, 1963b) the dentition of this skeleton yielded the following dental age estimates:

Tooth	Calcification Stage	Moorees, Fanning and Hunt	$\bar{X}$
Maxillary			
M1	Cr3/4	1.25-2	1.5
Mandibular			
C	Cr3/4	2.1-3.9	2.9
dm1	Rc	1-1.75	1.35
dm2	R1/2-3/4	1.1-2.4	1.8
MI	Cr3/4-Crc	1.6-2.9	2.4

The derived mean age estimate would be 2 years.

The following are the measurable diaphyseal lengths for this child, and the age estimates based on the standards of Merchant and Ubelaker (1976):

	Right	Left	Age Estimate
Femur	175mm	—	2.4
Tibia	-	142mm	2.2

Dental Status

The mandible is present but it is broken distal to the left lateral incisor root socket. Of the remaining portion, the deciduous left lateral and central incisors, deciduous right canine and developing M2 crown have been lost postmortem. The deciduous right lateral incisor is congenitally absent. Intact teeth include the right dm1, dm2 and unerupted MI crown. The crowns of the permanent right I I , I2 and canine are visible in x-rays. The right maxilla contains the dm 1 and dm2 and forming crowns of I1, 12 and MI.

Dental Disease

Only the distolingual cusp of the dm2 shows slight blunting indicative of attrition. There are no caries, abscesses or evidence for periodontal disease.

Collection B

In the 1970s a local amateur, Jay Orton, removed what he claimed to be six skeletons from an area just northeast of the site (Dods 1982). This is likely the same sandy knoll from which the skeletal material of Collections A and D have been recovered. For the purposes of this analysis the Orton material of 1970 is designated Collection B.

Individual B.1

This is an adult female approximately 156-165 cm in height. The skeleton is incomplete, missing the skull, lower limbs, hands and feet. The bones are in good condition. There is no evidence of disease on any of the bones.

Age Determination

Unfortunately, no hip bones or cranium were available for use in age determination. Measurement of the anterior heights of the lumbar vertebrae suggested that the individual was possibly of middle age (Ericksen 1973). Thin sections from the left humerus revealed that bone quality was poor and therefore not suitable for histological aging.

Sex Determination

As much of the skeleton was missing, only the scapula and humerus were available for sex determination. The glenoid cavity length of the scapula and the maximum head diameter of the humerus are in the female range of values published by Stewart (1979). The humerus measure also suggests a female when compared to Anderson's (1963) values from the Fairty population.

Individual B.2

This is an adult male. Only small bones of the face, parts of the carpus and hand and foot phalanges are missing. This man is estimated to have been between 171 and 177 cm in stature. The surface appearance of the bones is good but compared to the other material from the site these bones have lost more organic content and are brittle and chalky in texture.

Age Determination

The left pubic symphysis was available for aging. Using the McKern and Stewart (1957) models the result is:

Component I= 4
Component II= 4
Component III= 3
11 = 23-39 years (or 31± 8)

Todd (1920) Method:
Stage 6 = 30-35 years (32.5 ± 2.5)

The auricular surface aging method of Kobayashi (1967) yielded an estimate of 22-30 years (or 26± 4).

Measurements of the minimum height, anterior height and minimum breadth of the lumbar vertebrae reveal little evidence of vertebral body height degeneration and suggest a young adult age based on the data of Ericksen (1973).

Cranial suture closure was examined as a cross-check. The coronal suture provided a maximum age estimate of 30 years and the sagittal suture a minimum age estimate of 20 years, thus 25± 5 years.

Unfortunately, thin sections from the long bones revealed that the bone is of poor microscopic quality, probably because of its brittle, chalky texture, so that histological age estimation was not possible.

Sex Determination

The hip bones were examined for sciatic notch size, subpubic angle, pre-auricular sulcus and the three traits described by Phenice (1969). All are clearly male.

The skull is characterized by moderate supra-orbital ridges, blunt upper margins of the orbits,

TABLE 2

Craniometrics of the Mackenzie Adults*
(in millimeters)

	A.1	B.2	D.2
Glabello-occipital length	181	195	192
Maximum cranial breadth		—	135
Basion-bregma height		142	(138)**
Auricular height		120	114
Basion-prosthion length		107	106
Basion-nasion length	—	113	112
Minimum frontal breadth	91	99	90
Nasion-gnathion height		124	**118**
Bizygomatic breadth		141	144
Fronto-nasal breadth		13	15
Nasal breadth		30	29
Alveolar length	—	60	57
Biasterionic breadth	—	(109)	108
Bijugal breadth	—	118	120
Simotic chord	—	12	11
Nasion bregma chord	113	116	(110)
Bregma-lambda chord	(117)	(118)	(121)
Lambda opisthion chord	—	(100)	98
Frontal arc	125	130	(124)
Parietal arc	(125)	(134)	(133)
Occipital arc	—	(117)	115
Basion subnasal point length	—	97	99
Glabella lambda length	—	189	186
Nasion lambda length	—	(188)	185
Basion-lambda length	—	(125)	119
Prosthion-lambda length	—	(219)	**211**
Prosthion bregma chord	—	180	(167)
Bregma asterion chord	—	140	(132)
Asterion-lambda chord		(83)	(92)
Asterion-lambda arc		(90)	100
Foramen magnum breadth		32	34
Foramen magnum length		38	39

* Measurements follow the University of Toronto Data Bank descriptions.

** Measurements in parentheses are estimated.

a large palate, square chin, prominent muscle markings and large mastoid processes, all indicative of a male. Both glenoid cavity length of the scapula and maximum head diameter of the humerus fall on the border between the male and female ranges of published standards (Stewart 1979). The maximum head diameter and shaft circumference of the femur are within male ranges (Stewart 1979; Anderson 1963; Black 1978).

Bone Disease

Slight to moderate osteophytosis has affected the fourth and fifth lumbar vertebrae. Osteoarthritic pitting is observable on the right inferior articular facet of the second lumbar vertebrae and there are small Schmorl's nodes formed between the bodies of the sixth to tenth thoracic vertebrae. Both tibiae show periosteal reactive bone at their distal ends, particularly concentrated on the anteromedial surfaces of the bones.

Dental Status

All six mandibular molars had been lost premortem. All anterior mandibular teeth are in-tact. In the maxilla, only the left fourth premolar had been lost premortem. All other teeth are in-tact. By examining the presence or lack of wear on the maxillary molars it was possible to deter-mine that the left mandibular MI and M2 were lost earliest, probably between 12 and 15 years. The third mandibular molar erupted and was lost later. The right molars were lost next, probably in the early twenties as indicated by wear facets on the maxillary molars. Because of this loss it is not possible to compare maxillary molar tooth wear to the data published by Melbye (1983).

Dental Disease

All anterior teeth display moderate attrition. The mandibular incisors and canines are worn flat while the corresponding maxillary teeth are worn obliquely in a labiolingual direction. The premolar cusps exhibit a cup-shaped attrition pattern. A small occlusal carious lesion is present on each maxillary second molar and interproximal caries were found (at the cemento-enamel junction) on the left maxillary canine and left mandibular p.4. Alveolar recession is moderate, indicating the presence of periodontal disease. There are small calculus deposits on the buccal and lingual surfaces of the maxillary molars. However, the intact teeth are in good condition.

Individual B.3

This is a young adult male. The skull, most of the vertebrae and some lower limb bones are missing. Stature is estimated from 164-172 cm. The bones are in fair condition.

Age Determination

The head of the humerus still shows a faint epiphyseal line along its inferior border as does the left ischial tuberosity. McKern and Stewart (1957) state that fusion of the proximal humeral epiphysis is complete by 24 years and the ischial tuberosity fuses between 17 and 22 years in males.

The pubic symphyses were slightly damaged.

However, the Todd method (1920) yielded a pubic symphysis age estimate of 22-24 years based on commencing formation of the dorsal plateau. Observation of the auricular surfaces following Kobayashi's standards (1967) produced an age of 22-30 years. Measurement of the lumbar vertebrae also suggest this is a young adult.

Thin sections from the left humerus and left femur yielded a histological age estimate of 26 years according to Thompson's standards (1979). Based on all of these methods I suggest this individual is age 24 years ± 2.

Sex Determination

The hip bones are characterized by the absence of a ventral arc, a medial ridge and a narrow sub-pubic concavity on the pubis indicating a male (Phenice 1969) as well as a narrow sciatic notch and a shallow preauricular sulcus. The ischio-pubic index and the sciatic notch/acetabular index (Kelley 1979) fall within the male range. Observation of the sacrum using the method of Dunlap (1980) indicates a male as well.

Bone Disease

No osteophytosis or osteoarthritis was observed. The right ulna of this individual is abnormally shortened at its distal end, making it 75% of the length of the left ulna (Fig. 1). The shaft is slightly thicker than the left ulna (as indicated by osteosclerotic thickening of the cortex as seen in x-rays) and the head and styloid process are present, though flattened and distorted. The shaft is also flattened or "pinched" just proximal to the head. The shaft of the right humerus is slightly thinner than the left humerus suggesting there was restricted movement of the right arm causing disuse atrophy. The ulna can only articulate with the humerus in a flexed position, angled laterally. The articular facet for the head of the radius is almost in-distinguishable. The incompleteness of this skeleton makes differential diagnosis of the lesion a dubious exercise.

Individual B.4

This is an adult female. The skeleton is missing the skull and some lower limb bones. Stature is estimated at 164-173 cm.

Age Determination

The secondary epiphyses of the iliac crest and ischial tuberosity of the hip bones are incompletely fused suggesting an age range of 16-20 years. Analysis of the pubic symphysis according to the standards of Gilbert and McKern (1973) suggests

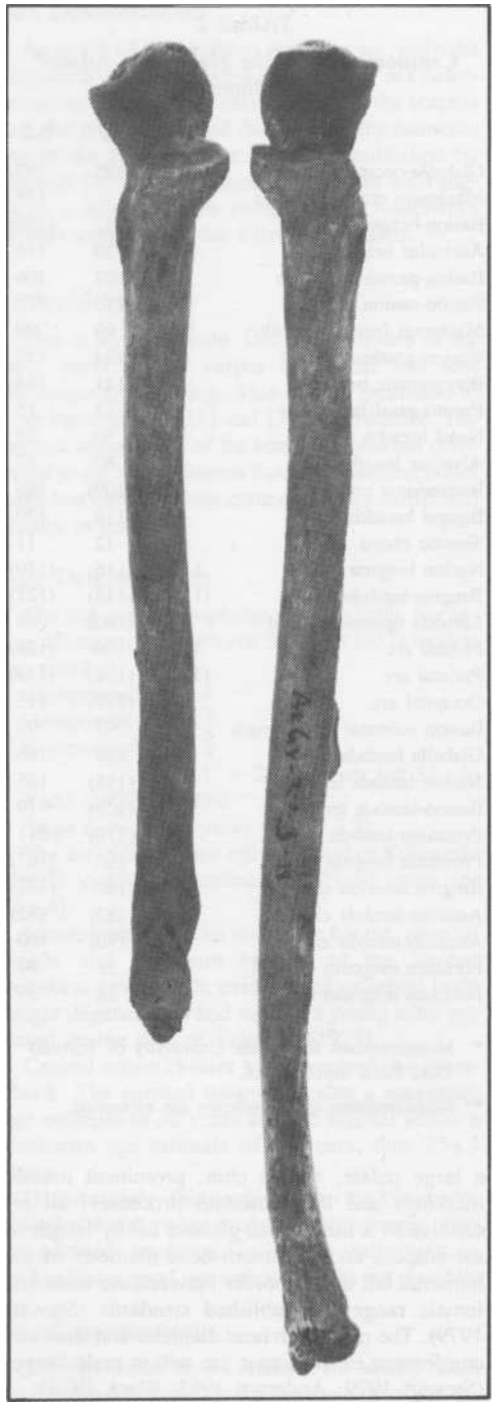

Fig. I
Individual B.3. Anterior view of the abnormally short right and normal left ulna. The abnormality may have been caused by trauma to the distal growth plate.

a mean age of 20 years ± 2. Thin sections from the left humerus and left femur yielded an age estimate of 22 years according to Thompson's standards (1979).

Sex Determination

Observations of the hip bones sacrum, glenoid cavity length of the scapula and maximum head diameter of the humerus all indicate that this individual is female.

Bone Disease

There is slight osteoarthritic pitting on the inferior articular facet of the seventh thoracic vertebrae and a Schmorl's node on the superior surface of the body of thoracic vertebrae #11.

Individual B.5

This is an adolescent of indeterminate sex. The skeleton is missing the skull, hip bones, vertebrae and hands and feet. The bones are in poor condition.

Age Determination

Only diaphyseal length of the right tibia is measurable (300 mm) and it yields an age estimate of 13.2 years (Merchant and Ubelaker 1977). All epiphyses are open including the trochlea of the humerus, suggesting that the individual was less than 15 years of age at death (Ubelaker 1978). No dentition is available for age determination. Therefore, the age estimate is 13.2 years.

Individual B.6

This is an adult of indeterminate age and sex. The remains, consisting of 21 vertebrae and 20 ribs, are in poor condition.

Age Determination

An attempt was made to estimate age by measuring the lumbar vertebrae (Ericksen 1973). The results, however, fell within both the young and middle adult ranges.

Sex Determination

Sex could not be determined from the remains. Measurements of the lumbar vertebrae fell into both the male and female ranges (Ericksen 1973).

Bone Disease

None is apparent although the vertebrae are too damaged to allow for any accurate observations of osteoarthritis or osteophytosis.

Individual B.7

This is an adult female, age 20-30 years. The remains consist of a left hip bone, femora and tibiae and seven tarsal bones. There is no apparent disease on any of the bones. Although the skeletal elements of B.6 and B.7 do not overlap they are judged to belong to separate individuals because of marked differences in colouration of the bones and size differences.

Age Determination

Aging of the auricular surface of the hip bone using Kobayashi's standards (1967) produced an estimate of 22-30 years. There were no suitable samples for histological age determination.

Sex Determination

The hip bone is characterized by a very wide sciatic notch, a deep preauricular sulcus and a raised auricular surface, all indicative of a female. As well, the sciatic notch/acetabular index is high, falling within the female range (Kelley 1979).

Individual B.8

This is a child of indeterminate sex. The skeleton is represented by parts of the skull, some vertebrae, the pectoral girdles and upper arms, one femur, the two tibiae and a few tarsal bones. The bones are in poor condition and very fragmentary. Those that can be examined show no evidence of disease.

Age Determination

The maxilla and mandible are available for age estimation. The first and second deciduous molars are fully erupted while the first permanent maxillary and mandibular molars are unerupted. Age estimates based on crown calcification of the permanent tooth crowns using three sources are summarized below.

TABLE 3

Incidence of Caries in Mackenzie Dentitions

Tooth	No.	Carious **Teeth**	%	Surface 0*	C*	**R***
Incisors	27	3	11.1	0	0	3
Canines	14	4	28.6	1	1	2
Premolars	37	11	29.7	1	8	3
Molars	32	12	37.5	9	2	5
Totals	110	30	27.3	11	11	13
Maxilla	49	15	30.6	6	8	3
Mandible	61	15	24.6	5	3	10

*O = occlusal, C = crown, R = radicular.

Trodden's (1982) estimates are based on panoramic radiographs of 128 female and 108 male Indians. She states that both Inuit and Indians show earlier dental calcification and emergence than comparative White samples. Thus, one would expect her standards to yield a lower age estimate for this individual. However, this was not the case. The slightly higher age estimates based on incisors and canines may be influenced by her relatively small samples in the 4 year chronological age category. The third source is Anderson, Thompson and Popovich (1976) who examined calcification of the permanent teeth in a large sample of Canadian children.

There is no evidence of periodontal disease or dental abscesses.

Individual B.9

This is an infant of indeterminate sex. The remains consist primarily of ribs, long bone fragments and vertebral fragments, all of which lack any evidence of disease.

Age Determination

No dentition is available for this individual. Measurement of the maximum width of the ilium (34 mm) provides an age estimate of 0-6 months

Tooth	**Calcification Stage**	**Moorees, Fanning and Hunt**		**Anderson, Thompson and Popovich**		**Trodden**	
		Male	Female	Male	Female	Male	Female
Maxilla							
I1	Crc	5.3	5.9	3.7	3.6	5.5	-
I2	Crc	5.9	5.5	4.0	3.8	5.6	4.7
P1	Cr3/4	-	-	4.9	4.4	5.5	4.4
M1	R1/4	-	-	4.9	4.6	4.9	4.6
Mandible		-	-				
I1	Cli			4.7	4.3	5.4	4.8
I2	Ri	-	-	4.8	4.3	4.9	3.6
C	Crc	4.0	4.0	4.8	4.1	5.5	5.2
M1	R1/4	5.0	4.3	4.9	4.6	5.0	4.4
M2	Coc	4.4	4.3	4.8	4.6	4.4	4.6
Mean Age		4.8		4.4		4.9	

None of the long bone diaphyses of this individual could be measured for age estimation.

Dental Status

The maxilla contains the erupted left deciduous canine, dm1 and dm2 and right canine and dm2. The alveolus contains the unerupted forming crowns of all permanent teeth but the M3's. The mandible contains the deciduous left canine, left dm1, right dm2 and the unerupted forming crowns of all permanent teeth except the M3's. The left mandibular deciduous canine has an unusual root with a central lingual groove giving it the appearance of being two roots fused together.

Dental Disease

The mandibular right dm2 has a large occlusal caries that has almost destroyed the entire crown and the left dm2 has an occlusal carious lesion which has destroyed the distal cusps.

The intact canines are worn to the level of the dentin as is the maxillary left dm2 which shows tiny dots of exposed dentin. The cusps are only slightly blunted on the maxillary deciduous molars.

(Merchant and Ubelaker 1977). This skeleton is almost identical in size to Individual C.2, an infant found in a house floor. Therefore, based on this size comparison, Individual B.9 may be a newborn.

Individual B. 10

This is a child of indeterminate sex. The skeletal remains consist of vertebrae and ribs. The bones are in poor condition, broken at their ends and exhibiting postmortem erosion. There is no evidence for bone disease.

Age Determination

The age estimate for this individual is based on the state of fusion of the vertebrae. The neural arches of all vertebrae represented, including cervical, thoracic and lumbar, are fused. The bodies of the cervical vertebrae have begun to fuse to their arches. Sundick (1972) states that the union of the neural arches takes place somewhere between 6 months and 2 years while the fusion of the arches to the centra begins around 4½ years and is complete by 8 years of age. Fusion of the arches to the centra starts in the cervical and lumbar regions and spreads through the thoracic part of the column. This would suggest that Individual B.10 is aged approximately 4-6 years.

However, the bones of this individual are considerably smaller than those of Individual A.3 and therefore this child may be a year or two younger, 1-3 years.

Besides the ten documented individuals from Collection B, there are additional miscellaneous bones consisting mainly of carpals, tarsals and fragmentary long bones. Although many of these appear to belong to the known individuals either because the individuals are missing the appropriate parts or because the miscellaneous bones appear to match by size, colour, weight and state of preservation, it is impossible to make definite associations. Therefore, the four individuals, based on counts of the calcaneus and talus, represented in the miscellaneous bones are thought to be parts of the ten identified individuals of Collection B.

Collection C

In 1974 two infant burials were discovered at Mackenzie in shallow pits, underneath the floor of House 1 opposite the doorway in the house center (Johnson 1980). They comprise Collection C. Both infants were extended, facing upward. C.1 was oriented in a northeast-southwest direction with its head turned sideways and pointing to the south. C.2 was oriented at a 90 degree angle to C.1 with its head pointing southwest. No grave goods were found with the exception of a small chert flake associated with C.1. Kapches (1976) refers to these burials in her discussion of the interment of infants on Ontario Iroquoian sites. She aged them 0-3 months and has suggested that they may have been twins. The following descriptions provide more detailed information on the skeletons as well as age determinations using some recent methods. No attempt was made to determine the sex of these individuals due to their immaturity.

Individual C. 1

This infant is aged approximately 0-3 months. The skeleton is complete with the exception of the left radius, ulna and hand and the left lower limb. The bones are in excellent condition.

Age Determination

The stages of mineralization of the unerupted deciduous teeth were compared to the published standards of Moorees, Fanning and Hunt (1963a). Based on the observation that half of the crowns of the deciduous first and second mandibular molars were calcified, an age of 3 months is obtained. However, the full range of age variation in the standards extends from birth to months.

In addition, the diaphyseal lengths of the long bones were also measured and compared to the published standards of Hoffman (1979) (Hoffman's values were chosen for comparison in this case in an attempt to narrow the age estimate to the number of months. It should be noted though that the diaphyseal lengths of both of the infants fall at the low end of the N.B. — 0.5 age group according to Merchant and Ubelaker (1977)). The results are as follows:

	Right	**Left**	**Age**
Scapula			
length	37mm	38mm	
width	36	35	-
Clavicle	47	46	—
Humerus	72	72	2-3 mos.
Radius	58	—	2 mos.
Ulna	67	-	3 mos.
Tibia	75	-	3 mos.

(the femur and fibula could not be measured)

Although there are no aging standards for measurements of the scapula and humerus, they are included here for possible use by other workers. Kapches (1976) has previously reported that the method of aging infant skeletons by measuring the pars lateralis and pars basalis of the occipital bone (Redfield 1970) yields an age of 0-3 months. There is no evidence of pathological lesions on any of the bones.

Dental Status

All forming deciduous crowns are present except for the maxillary left canine. An unusual maxillary right tooth crown appears to be either fused central and lateral incisors or a case of gemmination of a central incisor; it is difficult to con-firm because of the incomplete calcification of the crown. The mandibular crown sockets for the first permanent molar are present but no enamel fragments were found. They could have been lost during excavation or lab preparation. There is no evidence for dental disease.

Individual C.2

This infant is also aged 0-3 months. The skeleton is complete and in excellent condition.

Age Determination

One-half crown formation of the deciduous first and second mandibular molars also suggests an age

TABLE 4

Incidence of Non-metric Traits in Mackenzie Adults

Cranial Traits*

/ = left/right, A = absent, P = present

	A.1	**B.2**	**D.1**	**D.2**
Frontal Grooves	P/P	A/A	A/A	A/A
Infraorbital Suture	-/-	A/A	P/-	A/A
Supraorbital foramen	A/-	-/P	P/A	P/A
Supratrochlear Spur	-/-	-/A	-/-	A/A
Trochlear Spur	-/-	-/A	-/-	A/A
Accessory Optic Canal	-/-	-/-		A/A
Infraorbital For. Divided	-/-	A/A	A/-	A/A
Zygomtico-facial For.	-/-	P/P	-/-	P/A
Os Japonicum	-/-	A/A	A/-	A/A
Spinobasal Bridge	-/-	A/A	-/-	A/A
Pterygobasal Bridge	-/-	A/A	-/-	A/A
Access Palatine For.	-/-	P/P	P/A	P/P
For. Lateral Pter. Plate	-/-	A/A	-/-	A/A
Vesalian Foramen	-/-	A/A	-/-	A/A
Marginal Foramen	A/-	A/A	A/A	P/P
Ant. Cond. Canal Divided	-/-	A/A	A/A	A/A
Posterior Condylar Canal	P/-	-/P	P/-	P/P
Inter. Condylar Canal	-/-	-/P	-/-	P/P
Paramastoid Process	A/-	-/-		A/-
For. Spinosum Open	-/-	-/-	-/-	A/A
Basilar Tubercle	-	P	A	A
Pharyngeal Fossa	-	A	A	A
Tympanic Dehiscence	A/-	P/P	P/P	P/P
Parietal Pro. Temporal	-/-	-/A	-/-	A/P
Clino-Clinoid Bridge	-/-	-/-	-/-	A/A
Carotico-Clinoid Bridge	-/-	-/-	-/-	A/A
Parietal Foramen	P/P	A/A	P/P	P/P
Corona] Wormians	A	A	A	
Bregmatic Ossicle	A	A	A	
Sagittal Wormians	A	A	A	
Lambdoid Wormians	-	-	A	
Lambdic Ossicle	-	-	A	A
Pterion Ossicle	-/-	-/P	-/-	
Asterionic Ossicle	-/-	-/-	-/-	A/A
Occipito-Mastoid Oss.	-/-	-/P	-/-	A/A
Parietal-Notch Oss.	-/-	-/A	-/-	A/A
Mylohyoid Arch	A/-	A/A	P/P	A/A
Acc. Mandibular For.	A/-	A/A	A/A	P/P
Acc. Mental Foramina	A/A	A/-	A/A	A/A

* Trait list derived from Molto 1983.

** Trait list derived from Saunders 1978; observations of infracranial traits by individual available from the author upon request.

Infracranial Traits**

	# of Bones		
	Right		**Left**
Clavicle			
Subclavian Facet	2/6		2/6
Supraclavicular Nerves Pierce Clavicle	0/6		0/6
Scapula			
Unfused Acromion	0/2		0/5
Humeral Facet	0/3		0/5
Suprascapular Notch	0/3		1/5
Circumflex Sulcus	1/7		1/8
Humerus			
Septal Aperture	2/9		3/10
Supratrochlear Spur	1/9		0/11
Hip Bone			
Acetabular Mark	3/5		3/5
Acc. Sacral Facets	0/4		0/4
Femur			
Third Trochanter	0/8		1/8
Extension	0/9		0/9
Patella			
Bipartite Patella	0/6		0/6
Tibia			
Squatting Facets	0/6		0/6
Talus			
Os Trigonum	1/9		0/6
Squatting Facets Anterior Facet Divided	1/9		0/5
Calcaneus			
Ant/Middle Facets Div.	3/8		4/8
Anterior Facet Bip.	1/8		1/8
Peroneal Tubercle	3/4		2/4
Vertebral Column			
Atlas			
For. Transversarium	0/4		0/2
Condylar Facet Double	0/4		0/3
Retroarticular Bridge	0/4		0/2
Lateral Bridge	0/4		0/2
Posterior Bridge	0/4		0/2
Axis			
For Transvarsarium Div.	0/2		0/2
Ossified Apical		1/2	
C3-5			
C3 For. Trans. Div.	0/3		0/3
C4 For. Trans. Div.	0/4		0/4
C5 For. Trans. Div.	0/3		0/3
C6 For. Trans. Div.	0/4		0/5
C7 For. Trans. Div.	2/4		1/3
Lumbar Vertebrae			
Spondylolysis-L5	2/8		1/8
Transitional Lumbo-Sac		0/6	
Sacrum			
Acc. Hip Facets	0/4		0/4
Sacral Canal Open Above 3rd Foramen		1/5	

of 3 months when compared to the standards of Moorees, Fanning and Hunt (1963a). Measurements of the pars lateralis and the pars basalis of the occipital bone give an estimated age of 0-3 months (Redfield 1970).

Results of diaphyseal length measurements when compared to the standards of Hoffman (1979) are as follows:

	Right	Left	Age
Scapula			
length	37mm	37mm	
width	30	29	-
Clavicle	47	45	—
Humerus	67	66	1-2 mos.
Radius	55	54	1 mo.
Ulna	63	63	1 mo.
Femur	—	77	0-1 mo.
Tibia	-	68	1 mo.
Fibula	-	65	1 mo.

The long bone measurements show that C.2 is slightly smaller than C.1 and therefore yield a younger age estimate for this infant. In addition, C.2 has smaller teeth than C.1 although the crowns are at the same stage of development. This raises an interesting question. Are these results possible if the two infants are twins? Certainly, even if they are twins, zygosity is still not known. Either dizygotic or monozygotic twins can vary in size within a twin pair since there is competition for placental attachment and space within the womb (Novitski 1977). On the other hand, the size difference might simply mean a sex difference, C.1 is male and C.2 is female, although sexual dimorphism is usually slight at this age. The size difference could also mean that these infants were not in fact twins but 1-3 months apart in age and died and were buried at different times. Any of these interpretations is plausible.

It was not possible to test the twin hypothesis by means of non-metric trait concordance. The very young age of these individuals means that many non-metric traits are unobservable because of the immature development of the bones (Saunders 1978).

Considering that Amerindians have faster rates of dental calcification and that there could be substantial variation in skeletal dimensions that are used for aging, it seems quite plausible to suggest that these infants are newborns.

Bone Disease

This infant was found to have an unusual left secondary palatal process of the maxilla. The left palatal process is unfused to the right in the midline. At present this feature is unexplained. There was no other evidence of skeletal lesions.

Dental Status

Only the forming mandibular second deciduous molar crowns are missing from this otherwise complete primary dentition. There is no evidence for dental disease.

Collection D

In 1982 R. Dods under the auspices of the Ontario Archaeological Society conducted fieldwork at the Mackenzie Site for the purpose of salvaging the remaining settlement area, testing the middens and determining the maximum extent of the site. This excavation uncovered two skeletons in one grave, an adult and an adolescent in the northeast quadrant of the site away from the village area on the west — facing sandy knoll (Fig. 2). These are secondary bundle burials. Although some bones of the adult were in articulation, such as the vertebral column and tibia and fibula of each leg, most of the bones were disarticulated at the time of interment. The subadult was apparently fully "skeletalized" at the time of interment as no bones were in proper anatomical relationship. However, there are no cutmarks on either skeleton which would indicate purposeful dismemberment. Several small grooves around the foramen magnum at basion of the adolescent's skull were produced by rodent gnawing. The grave itself measured 63 by 43 cm (Dods 1982). In addition, a small scatter of bone was found to the south consisting of the bones of a young child along with some displaced bones from the first burial and some faunal bone. These three individuals are referred to as Collection D.

Finally, a portion of a human cranium and a piece of hip bone were recovered from the midden area during the 1982 field season.

Individual D. 1

This is an adolescent male, aged 15.5 years. The skeleton is relatively complete except for parts of the face, hands, feet and some of the vertebrae. The bones are in fair condition; postmortem erosion has damaged the surfaces of the shafts of a number of long bones.

Age Determination

Age estimates based on dental calcification standards, diaphyseal length measurements and standards of epiphyseal union are reported here. Root formation of the third mandibular molars corresponds to an age estimate of 14.5 years based on Moorees, Fanning and Hunt (1963b) and 15.4 year (if female) or 15.5 years (if male) based on the dental calcification standards of Anderson, Thompson and Popovich (1976). Trodden's (1982) standards for Indian children yields an age estimate of 15.9-16.3 years.

The following is a list of diaphyseal length measurements and the corresponding age estimates derived from Merchant and Ubelaker (1977) (it is noted that the suggested age estimates are broad because of small sample sizes in the Merchant and Ubelaker study):

	Right	Left	Age Estimate
Humerus	—	271 mm	12.5-
Radius	204mm	204	12.5-
Ulna	225	—	12.5-
Femur	375	378	16.2
Tibia	320	—	16.5
Ilium	121	120	9.5-12.5

The ilium is narrower than might be expected when compared to the bones of the appendicular skeleton as was the case for Individual A.2. In addition, the ilia are not fused to the joined ischia and pubes, a development that normally begins around 12 years of age (Bass 1971). In fact, no other long bone epiphyses have begun to fuse in this individual including the trochlea and the lateral epicondyle of the humerus which usually start fusing long before 15 years (Bass 1971). However the degree of dental calcification has been accepted as the best age indicator since it is known to be closest to chronological age. Therefore, this individual is assumed to be 15.5 years ± 1 year.

Sex Determination

Although the ilia have not fused to the ischio-pubic segments, observations of the ischio-pubic index on each hip bone as well as visual observations of the narrowness of the subpubic angle indicate that this individual is probably a male. In addition, the teeth are extremely large and the long bones quite robust in girth.

Bone Disease

The fifth lumbar vertebrae displays unilateral spondylolysis (separate neural arch) on the right side (Fig. 3).

Dental Status

Intact teeth include the mandibular canines, maxillary right premolars, maxillary left first premolar and all molars. The third molars are incompletely calcified and unerupted. All other teeth have been lost postmortem.

Observations of the root sockets show that there was a supernumerary tooth, a mesiodens, between the central maxillary incisors.

Dental Disease

The intact teeth are in excellent condition. Slight to moderate attrition has blunted the cusps of the second molars. The first molars show their greatest wear on the supporting cusps of centric occlusion, the maxillary lingual and the mandibular buccal cusps.

There are no signs of caries, periodontal disease or abscesses in this individual's dentition.

Individual D.2

This is a robust, somewhat tall adult male. Stature was estimated at 177-184 cm. The skeleton is almost complete except for the sternum, hands, part of the right foot, all of the left foot and atlas and axis. The bone surfaces are in excellent condition except for localized, eroded areas of postmortem erosion on the left scapula, pelvic bones, right tibia, left femur, left radius, left ulna, ribs and vertebrae.

Age Determination

The pubic symphyses are available for age deter-

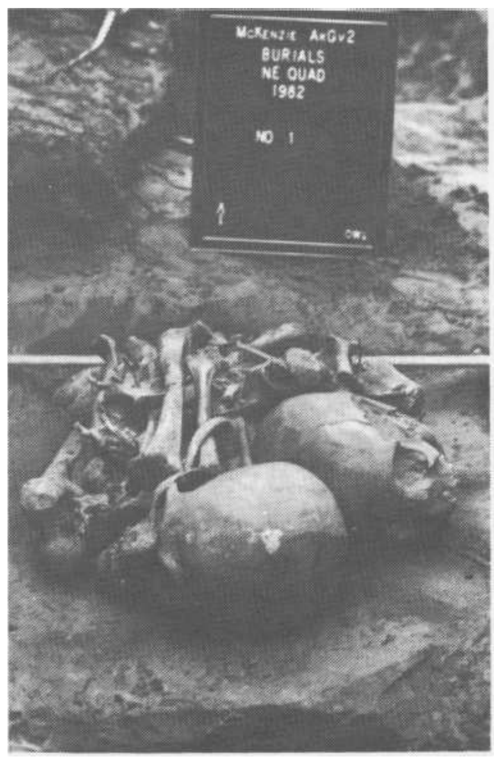

Fig. 2
Individual D.1 and D.2 exposed during 1982 excavations (photo courtesy of Roberta O'Brien, Ontario Ministry of Citizenship and Culture).

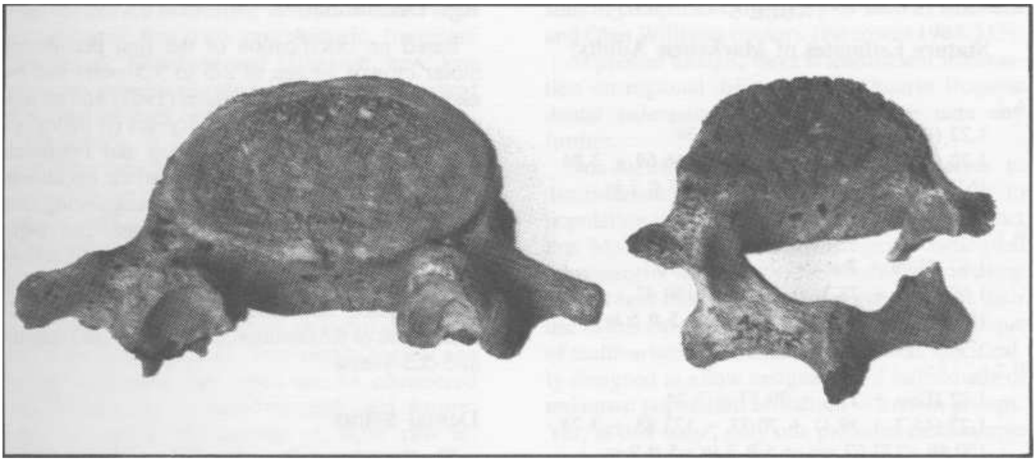

Fig. 3
Superior view of the fifth lumbar vertebrae of individuals D.1 and D.2. D.2 has bilateral spondylolysis as indicated by the separated pars interarticulares and the missing posterior neural arch. Individual D.1 has unilateral spondylolysis on the right side.

mination. According to the method of McKern and Stewart (1957) the age is:

Component I =4
Component II =3
Component III=2
9 22-28 years (or 25 ± 3 years)

According to the Todd method (1920) the age is: Stage 5=27-30 years or 28.5 ± 1.5 years.

Based on changes at the auricular surface (Kobayashi 1967) the age estimate is 22-30 years or 26 ± 4 years.

Histological aging using the method of Thompson (1979) yielded an age estimate of 47 years from thin sections of the major longbones, a notable discrepancy with the morphological age estimate which yields a mean age of 26.5 ± 2.8 years.

Sex Determination

The skull of this individual is characterized by prominent brow ridges, blunt upper margins of the orbits, a large palate, moderate muscle markings and large mastoid processes. The hip bones also possess male characteristics (Phenice 1969). A number of metric observations also support this conclusion including tibial shaft circumference (Iscan and Miller-Shaivitz 1984), glenoid cavity length of the scapula (Stewart 1979), maximum head diameter of the femur (Stewart 1979) and shaft circumference of the femur (Black 1978).

Bone Disease

The third and fourth lumbar vertebrae exhibit moderate osteophytoses. There is slight osteoarthritic lipping around the margin of the right acetabulum, the left lateral condyle of the left femur and the head of the left ulna. The fifth lumbar vertebrae is affected by bilateral spondylolysis, an interesting observation since the adolescent (D.1) buried with this individual has the same defect, only unilaterally (Fig. 3). Both genetic and environmental factors have been implicated in the etiology of this defect (Saunders 1978; Merbs 1983; Bradtmiller 1984). Although apparently increasing in frequency with increasing age, cases of spondylolysis have been observed in pre- and postnatal infants and the defect has a high familial incidence. Though it is not possible to assign ultimate causation to the defect in these two skeletons, it is certainly reasonable to suggest that they may have a close familial relationship.

Dental Status

Twenty-five teeth are present. Lost postmortem are the I1 , C and I2. The maxillary right M2, M3 and left M1 and M2 were lost premortem as evidenced by vascular, reactive alveolar bone at these tooth sites.

Dental Disease

Attrition is moderate to heavy, particularly on the incisors. Dentin is exposed on all teeth with the exception of the third molars. The maxillary incisors and canines are worn obliquely in a labio-lingual direction.

Occlusal caries have destroyed the crown of the right P4 and 75% of the crown of the right Ml.

TABLE 5

Stature Estimates of Mackenzie Adults*

A.1
1.22 (Fem. + Tib) +70.37 ± 3.24
1.22 (42.6 + 36.4) + 70.37 = 166.69 ± 3.24
163.45 - 169.93 cm or 5 ft 4 in - 5 ft 7 in

B.1
1.67 (Hum + Rad) + 74.83 ± 4.16
1.69 (29.0 + 22.3) + 74.83 = 160.42 ± 4.16
156.26 - 164.58 cm or 5 ft 2 in - 5 ft 5 in

B.2
1.22 (Fern + Tib) + 70.37 ± 3.24
1.22 (45.7 + 39.1) + 70.37 = 173.83 ± 3.24
170.59-177.07 cm or 5 ft 7 in - 5 ft 9 in

B.3
1.67 (Hum + Rad + 74.83 ± 4.16
1.67 (30.8 + 25.0) + 74.83 = 168.02 ± 4.16 cm
163.86- 172.18 cm or 5 ft 5 in-5 ft 7 in

B.4
1.67 (Hum + Rad) + 74.83 ± 4.16
1.67 (31.2 + 24.9) + 74.83 = 168.43 ± 4.16
164.27-172.59 cm or 5 ft 5 in - 5 ft 8 in

D.2
1.22 (Fem + Tib) + 70.37 ± 3.24
1.22 (48.0 + 42.2) + 70.37 = 180.41 ± 3.24 cm
177.17-183.65 cm or 5 ft 9 in - 6 ft 1 in

* Based on the formulae for Mongoloid populations published by Trotter and Gleser 1958.

Smaller carious lesions were found on the right M3 and all mandibular M2's and M3's. Radicular or root caries at the cementoenamel junction were found on eight teeth as well as buccal caries at the cementoenamel junction of the right M3 and left M3. There are three severe premortem enamel fractures on the left mandibular canine, P3 and P4.

Alveolar recession is moderate indicating the presence of periodontal disease but there is no evidence for dental abscessing.

Individual D.3

These bones constitute the remains of a child, aged approximately 3.5 years of indeterminate sex. The material is fragmentary and the bones are in poor condition, but those that can be examined have no apparent lesions or other evidence of disease.

Age Determination

Based on calcification of the first permanent molar crowns an age of 2.5 to 3.5 years can be assigned according to Trodden (1982) and an age of 3.6 years (if female) or 3.7 years (if male) according to Anderson, Thompson and Popovich (1976). However, root formation of the deciduous molars and canine is not complete suggesting that this individual is closer to the lower age. The single ulna has a diaphyseal length of 135 mm which suggests an age of 3.9 years according to the Merchant and Ubelaker standards. Based on an overall assessment of the dentition I would age this skeleton at 3-3.5 years.

Dental Status

The dental remains consist of a right maxillary fragment containing the fully erupted crowns of the deciduous central incisor, canine and deciduous molars and the unerupted crowns of I1, 12, C and M I . Much of the enamel on the deciduous crowns has chipped away after death but there is no evidence of occlusal caries or attrition on the intact surfaces. A right mandibular fragment contains the erupted dm2 and unerupted M1. Again, there is no evidence of attrition or dental disease.

Discussion

The Merchant and Ubelaker diaphyseal length standards used to estimate the age of subadults seem to work well when compared to dental calcification stages (see also Melbye 1983). However, it is interesting that two ilia from two individuals were narrower than expected when compared to the Merchant and Ubelaker standards. These observations do not concur with those of Katzenberg and White (1979) who believe that Iroquoians are larger people than the Ankara and would tend to be overaged by the Merchant and Ubelaker standards.

The wide discrepancy between morphological age and histological age for two of the adult individuals was not expected but also not surprising. Pfeiffer and Wade (1983) have shown that histological age estimates for prehistoric Amerindian skeletons are usually greater than their morphological age estimates.

I also examined cortical thickness of the bones of these individuals. The thickness of the anterior femoral midshaft of Individual D.2 is comparable to Thompson's values (1979) for his mid-40s age cohort of New England whites. The A.1 female has a cortical thickness comparable to Thompson's mid-60s age cohort. Therefore, the cortices of both these individuals are thinner than would be expected for their assessed morphological ages. These observations are interesting in that it has also been demonstrated that two protohistoric Iroquoian populations, Kleinberg and Uxbridge, have low values for amounts of cortical bone when compared to normal Britons (Pfeiffer and King 1983).

The female, A.1, possesses moderate to heavy tooth wear which also suggests that the older age estimate is the better one. The male, D.2, lost his lower molars during adolescence so that tooth wear on the remaining teeth is not a useful indicator of age.

The histological age estimates for two other individuals closely match their morphological age estimates (B.3 and B.4). The morphological age estimates in these two cases can be considered reliable since they are based on epiphyseal closure. Anterior cortical thicknesses of these two individuals are also low when compared to Thompson's data suggesting that this is a population difference.

Because of premortem loss of molar teeth or postmortem destruction, comparisons of molar tooth wear to the observations published by Melbye (1983) for the Ball site are not particularly useful. Although Individual B.2 retains maxillary molars the mandibular molars were lost several years before death and therefore the wear on the upper molars is not indicative of normal wear at death. Only the two individuals from Collection D retained molars. These data are reported here simply for information:

Stage of Dental Attrition
(after Melbye 1983)

D.1	M1-E	M2-D	M3-A
D.2	M1-F	M2-G	M3-E

By far the most interesting question is whether the Mackenzie sample can be compared biologically to other regional prehistoric populations in southern Ontario. To this end, one can examine Patterson's (1984) study of temporal trends in dental pathology in indigenous Iroquoian populations. Although an admittedly small sample, the Mackenzie site material can offer some comparative dental data to be added to present knowledge of Iroquoian dental paleopathology.

The overall incidence of caries is a good indicator of subsistence patterns in prehistoric populations and, therefore, temporal trends in resource exploitation. As is shown in Table 3, the Mackenzie teeth demonstrate some of the typical patterns for caries incidence. For example, caries are most prevalent in the molars and in the maxilla. The overall incidence of caries (27.3%) is very similar to caries incidences in other Late Ontario Iroquois sites of comparable time periods such as Roebuck and Glen Williams ossuary (Patterson 1984:313). At present though, there is insufficient information on regional differences in Ontario Iroquois dental paleopathology to take these data any further.

Non-metric traits do not lend themselves to discriminant analyses of single skeletons or to population studies of very small samples. The fact that Motto (1983) has shown regional biological homogeneity in prehistoric southern Ontario using cranial non-metric traits also argues against their use in this case. However, the statistical technique of multivariate discriminant analysis was specifically designed to allow assignment of individuals of unknown population affiliation to known groups. Yet, at this stage, only one previous multisample study of Late Ontario Iroquois has utilized craniometrics (Webb 1972). Craniometric study incorporating the Mackenzie material is presently in progress.

It is dangerous to make demographic interpretations from such a small sample size. But it is probably noteworthy that the full age range (although old adults are lacking in this sample) and both sexes were buried in the sandy knoll and that it was no doubt a cemetery area. This could have some bearing on interpretations of burial patterns.

How does the skeletal sample compare to the Mackenzie village size? It is believed that the site once covered 3.6 hectares or 9 acres (Johnson 1980). Population size estimates for other Ontario Iroquoian villages varying in size from 6-8 acres range from 1200 to 2000 people (Pendergast 1983). Because much of the Mackenzie site has been destroyed by modern construction it might be better to estimate population size from the number of identified longhouses. Emerson (1954) reported a possible 17 longhouses from testing in the western half of the site but only one was completely excavated. A further eight houses in the eastern half of the site were identified and mapped between 1974 and 1982. Lengths of the houses varied greatly, from 30-174 feet (Johnson 1980). In addition, House 5 was small, perhaps containing one family, and House 6 was probably razed early in the occupation of the site (Kapches 1982).

Taking these variations into account and based on estimates of longhouse occupation from Heidenreich (1971), the population at Mackenzie may have ranged from 580-870. Previous calculations of mortality rates on Ontario Iroquois sites seem to agree on a figure of 4% per annum (Knight and Melbye 1983). Iroquoian village lifespans are said to range from 8-20 years (Tooker 1964). The number of expected dead from the Mackenzie site throughout its occupation should be anywhere from

185-696. Even the lower figure is much greater than the total skeletal sample of 18 individuals and suggests a great many burials have been missed. Although the postulated variables of longhouse population density and village lifespan come from historic Huronia and may not apply to earlier protohistoric times, Mackenzie village size alone is a strong argument that the skeletal sample is meager.

Is it possible that several hundred or more burials could have been destroyed or lost to the looting that was common prior to organized excavations? Or were there other cemetery areas at the site? All indications, from discussions with previous investigators, suggest that the sandy knoll is the only known burial area. Did the Mackenzie people also use an ossuary? The closest known ossuary is Kleinberg, dated to 1600 by associated trade goods (Melbye 1983), apparently too late in time to have been used by the Mackenzie people.

Does the sandy knoll cemetery area represent a special burial situation? It is known that among the historic Huron individuals who died a violent death, from the cold, in war or by drowning were not exhumed for ossuary burial (Tooker 1964). Yet in such a burial situation one might expect a preponderance of adult males. Such is not the case with the Mackenzie sample which includes all ages and both sexes. Other examples of non-ossuary interments on Late Ontario Iroquois sites are located in longhouses or along palisades (Fitzgerald 1979; Knight and Melbye 1983), represent special situations of torture (Kolar 1983; Salter 1983), or are found as fragmentary remains in refuse pits. Two of these situations occur at Mackenzie but the majority of the skeletons come from the sandy knoll burial area which is approximately 100 m northeast of the village and well beyond the palisade (Dods 1982). From this place we know that at least one individual was fully articulated and flexed and that two others were disarticulated bundles buried in a common pit. It is also significant that none of the skeletons from Mackenzie bear cutmarks. The lack of cutmarks has been noted as a feature of Neutral burial because of the practice of allowing the bodies of the dead to completely decompose before reinterment (Jackes n.d.). I would suggest that the Mackenzie burial characteristics show similarities to Neutral burial practices and therefore suggest relationships between the Mackenzie and the Neutral. Nevertheless, one can only lament that the lack of sufficient detailed information on burial patterns of the protohistoric period in conjunction with associated, fully excavated villages makes any further speculation unwise.

Acknowledgements

This research was funded by a grant from the Ontario Heritage Foundation. I wish to thank Anne Keenleyside for her excellent job of sorting, cataloguing and helping to prepare the skeletal descriptions. Drew Barnes, Carol De Vito and Peter Bernier also provided valuable technical assistance during the analysis. The following individuals gave generously of their time, advice and/or information as well as cheerfully answering my many questions: Robin Dods, Roberta O'Brien, Donna McNeil, Gary Heathcote, Mima Kapches, John Mayhall, Jerry Melbye, E1 Molto, Peter Ramsden, John Reid and Mike Spence. I especially thank Gary Heathcote for his helpful comments on the manuscript.

References Cited

Acsadi, G., and J. Nemeskeri
1970 *History of Human Life Span and Mortality.* Akademia Kiado. Budapest.

Anderson, D.L., G.W. Thompson and F. Popovich
1976 Age of Attainment of Mineralization Stages of the Permanent Dentition. *Journal of Forensic Sciences* 21:191-200.

Anderson, J.
1963 The People of Fairty: An Osteological Analysis of an Iroquois Ossuary. *National Museum of Canada Bulletin* 193:28-129.

Bass, W.M.
1971 *Human Osteology: A Laboratory and Field Manual of the Human Skeleton.* The Missouri Archaeological Society, Inc. University of Missouri. Columbia, Missouri.

Black, T.K.
1978 A New Method for Assessing the Sex of Fragmentary Skeletal Remains: Femoral Shaft Circumference. *American Journal of Physical Anthropology* 48:227-231.

Bradtmiller, B.
1984 Congenital Anomalies of the Lower Spine in Two Ankara Skeletal Series. *Plains Anthropologist* 29:327-333.

Brothwell, D.R.
1965 *Digging Up Bones.* The British Museum. London.

Dods, R.
1982 *The Woodbridge-MacKenzie Project.* Report on file at the Ontario Ministry of Citizenship and Culture, Toronto.

Dunlap, S.S.
1980 A New Visual Method for Sexing the Human Sacrum. *American Journal of Physical Anthropology* 52:222.

Emerson, J.N.
1954 The Archaeology of the Ontario Iroquois. Unpublished PhD dissertation, Department of Anthropology, University of Chicago, Chicago, Illinois.

Ericksen, M.
1973 Age-related Bone Remodeling in Three Aboriginal Populations. Unpublished PhD dissertation, Department of Anthropology, George Washington University, Washington, D.C.

Fitzgerald, William R.
1979 The Hood Site: Longhouse Burials in an Historic Neutral Village. *Ontario Archaeology* 32:43-60.

Heidenreich, C.
1971 *Huronia: A History and Geography of the Huron Indians 1600-1650.* McClelland and Stewart. Toronto.

Hoffman, J.M.
1979 Age Estimations from Diaphyseal Lengths: Two Months to Twelve Years. *Journal of Forensic Sciences* 24:461-469.

Iscan, M. Yasar, and Patricia Miller-Shaivitz
1984 Determination of Sex from the Tibia. *American Journal of Physical Anthropology* 64:53-58.

Jackes, M.
n.d. *The Osteology of the Grimsby Site: A Neutral Indian Cemetery of the Early 17th Century.* Royal Ontario Museum. Toronto.

Johnson, D.
1978 A Preliminary Report on the Excavations at the MacKenzie Site. Report on file at the Department of Anthropology, University o1 Toronto, Toronto, Ontario.
1980 The MacKenzie or Woodbridge Site (AkGv-2) and its Place in the Late Ontario Iroquois Tradition. *Archaeology of Eastern North America* 8:77-87.

Kapches, M.
1976 The Interment of Infants of the Ontario Iroquois. *Ontario Archaeology* 27:29-39.
1978 Analysis of the MacKenzie Site Burials Report on file at the Department of Anthropology, University of Toronto, Toronto Ontario.
1982 Boyd Field School Project (1982) at the MacKenzie Site. Report on file at the Ontario Ministry of Citizenship and Culture Toronto.

Katzenberg, M.A., and R. White
1979 A Paleodemographic Analysis of the O: *Coxae* from Ossossane Ossuary. *Canadian Review of Physical Anthropology* 1:10-28

Kelley, M.A.
1979 Sex Determination with Fragmented Skeletal Remains. *Journal of Forensic Sciences* 24:154-158.

Knight, Dean, and Jerry Melbye
1983 Burial Patterns at the Ball Site. *Ontario Archaeology* 40:37-48.

Kobayashi, K.
1967 Trend in the Length of Life Based on Human Skeletons from Prehistoric to Modern Times in Japan. *Journal of the Faculty of Science, University of Tokyo* 3:107-162.

Kolar, J.C.
1983 The Quackenbush Site (BdGm-1) and the Iroquois Algonkian Interface I-The Biochemical Evidence. Paper presented at the 11th Annual Meeting, Canadian Association for Physical Anthropology, Montreal, Quebec.

McKern, T.W., and T.D. Stewart
1957 *Skeletal Age Changes in Young American Males.* Headquarters, Quartermaster Research and Development Command, Technical Report EP-45. Natick, Massachusetts.

Melbye, Jerry
1983 The People of the Ball Site. *Ontario Archaeology* 40:15-36.

Merbs, C.
1983 Patterns of Activity-Induced Pathology in a Canadian Inuit Population. *National, Museum of Man, Mercury Series, Archaeological Survey of Canada Paper* 119.

Merchant, V.
1973 A Cross-Sectional Growth Study of the Protohistoric Arikara From Skeletal Material Associated With the Mobridge Site (39WW1), South Dakota. Unpublished MA thesis, Department of Anthropology, The American University, Washington, D.0

Merchant, V., and D. Ubelaker
1977 Skeletal Growth of the Protohistoric Arikara. *American Journal of Physical An thropology* 46:61-72.

Molto, J.E.
1983 Biological Relationships of Southern Ontario Woodland Peoples: The Evidence of Discontinuous Cranial Morphology *National Museum of Man, Mercury Series. Archaeological Survey of Canada Pape* 117.

Moorees, C.F.A., E.A. Fanning and E.E. Hunt, Jr.
1963a Formation and Resorption of Three Deciduous Teeth in Children. *America) Journal of Physical Anthropology* 21:205-213.
1963b Age Variation of Formation Stages for Tel Permanent Teeth. *Journal of Dental Research* 42:1490-1502.

Novitski, E.
1977 *Human Genetics.* MacMillan Publishing Company. New York.

Patterson, D.K.
1984 A Diachronic Study of Dental Paleopathology and Attritional Status of Prehistoric Ontario Pre-Iroquois and Iroquois Populations. *National Museums of Man, Mercury Series, Archaeological Survey of Canada Paper* 122.

Pendergast. James F.
1983 St. Lawrence Iroquoian Burial Practices. *Ontario Archaeology* 40:49-56.

Pfeiffer, Susan. and Patricia King
1983 Cortical Bone Formation and Diet Among Protohistoric Iroquoians. *American Journal of Physical Anthropology* 60:23-28.

Pfeiffer, Susan, and William Wade
1983 A Histological Re-Evaluation of Age Estimates of Gray Site Adults. *American Journal of Physical Anthropology* 60:238.

Phenice, T.W.
1969 A Newly Developed Visual Method of Sexing the Os Pubis. *American Journal of Physical Anthropology* 30:297-301.

Ramsden. P.G.
1969 A Refinement of Some Aspects of Huron Ceramic Analysis. *National Museum of Man, Mercury Series, Archaeological Surrey of Canada Paper* 63.

Redfield, A.
1970 A New Aid to Aging Immature Skeletons: Development of the Occipital Bone. *American Journal of Physical Anthropology* 33:207-220.

Salter, E.M.
1983 The Quackenbush Site (BdGm-l) and the Iroquois Algonkian Interface 1I-Trauma. Paper presented at the 11th Annual Meeting, Canadian Association for Physical Anthropology. Montreal. Quebec.

Saunders. S.R.
1978 The Development and Distribution of Discontinuous Morphological Variation of the Human Infracranial Skeleton. *National Museum of Man, Mercury Series, Archaeological Survey of Canada Paper* 81.

Schour. I., and M. Massler
1944 *Development of the Human Dentition* (second edition). American Dental Association, Chicago.

Steinbock, R. Ted
1976 *Paleopathological Diagnosis and Interpretation.* Charles C. Thomas. Springfield, Illinois.

Stewart. T.D.
1979 *Essentials of Forensic Anthropology.* Charles C. Thomas. Springfield, Illinois.

Sundick. Robert I.
1972 Human Skeletal Growth and Dental Development as Observed in the Indian Knoll Population. Unpublished PhD dissertation. Department of Anthropology, University of Toronto, Toronto, Ontario.

Thompson, D.
1979 The Core Technique in the Determination of Age at Death in Skeletons. *Journal of Forensic Sciences* 24:902-9I5.

Todd, T.W.
1920 Age Changes in the Pubic Bones in the Male White Pubis. *American Journal of Physical Anthropology* 3:205-334.

Tooker. Elisabeth
1964 An Ethnology of the Huron Indians. 1616-1649. *Smithsonian Institution, Bureau of American Ethnology Bulletin* 190. Washington, D.C.

Trodden, B.J.
1982 A Radiographic Study of the Calcification and Eruption of the Permanent Teeth in Inuit and Indian Children. *National Museum of Man, Mercury Series. Archaeological Survey of Canada Paper* 112.

Trotter, M., and G. Gleser
1958 A Pre-evaluation of Estimation of Stature Based on Measurements of Stature Taken During Life and of Long Bones After Death. *American Journal of Physical Anthropology* 16:79-123.

Ubelaker, D.H.
1978 *Human Skeletal Remains.* Aldine Publishing Company. Chicago.

Webb, J.D.
1972 A Multivariate Analysis of Some Prehistoric and Historic Crania. Unpublished PhD dissertation, Department of Anthropology. University of Toronto. Toronto. Ontario.

Wright, J.V.
1966 The Ontario Iroquois Tradition. *National Museum of Man Bulletin* 210.

Department of Anthropology
McMaster University
1280 Main Street West
Hamilton, Ontario L8S 4L9

Saunders, Shelley R.
1986 The Mackenzie Site Human Skeletal Material. *Ontario Archaeology* 45:9-26.