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Skeletons in the Walls of Old Québec

Cover Page Footnote

The analysis of the skeletons was undertaken in part under a funding agreement between the Canadian Parks Service, Québec region, and the Canadian Museum of Civilization. I thank Sheila Finlay Jarvis and Katherine Gardner for their help with unpacking and preparing the bones for study; Pierre Beaudet, Chief Archaeologist with the Canadian Parks Service in Québec, and Gisele Piedalue for entrusting me with the analysis and for kindly providing the archaeological and cultural information; Dr. Frank McElligott, Professor of Pathology, and Dr. Nancy Ossenberr, Associate Professor of Anatomy, Queen's University, for suggesting the anatomical origin of the unusual bony elements with 19G35 K12, 19G37 E5, and 19G37 F2; Dr. Robert McGhee, Archaeological Survey of Canada, and Pierre Beaudet for their helpful comments on an earlier draft of this paper. An abbreviated version was presented at the 1988 annual meeting of the Council for Northeast historical Archaeology, Québec City. The remains are currently housed in the collections of the Canadian Museum of Civilization and available for further research on request.

SKELETONS IN THE WALLS OF OLD QUEBEC

Jerome S. Cybulski

Fifty human skeletons were discovered during a Canadian Parks Service project to repair the mid-18th-century fortification wall of Québec City. Laboratory analysis revealed 45 males, three or four females, and one child, a sex and age ratio virtually identical to that gleaned from diaries reporting the 1746-1747 deaths of Protestant prisoners of war. Skulls and teeth showed a prevalence of Caucasoid traits. Long bones indicated statures taller than those documented for European-born contemporaries and more closely resembling those known for North American colonials.

Dental health was poor throughout the series. Most men had lesions suggesting heavy loading stresses on the spine. Just over 20% of the men exhibited traumatic bone fractures; other skeletal changes suggested additional forms of trauma. There were signs of chronic sinus infection, possible scurvy, and illnesses or nutritional deficiencies during childhood. At least 12 men were pipe-smokers, indicated by peculiar toothwear patterns. Other findings included suspected ossified bronchial elements in three men, a growth-stunted shin bone in an adolescent, and a possible tumor (osteochondroma).

Cinquante squelettes humains ont été découverts au cours de travaux de réparation qu'effectuait le Service canadien des parcs au mur de fortification de Québec, érigé vers le milieu de XVIII^e siècle. Les analyses de laboratoire révèlent qu'il s'agit de 45 hommes, de 3 ou 4 femmes et d'un enfant. Cette distribution par sexe et par âge correspond pratiquement aux données colligées à partir de journaux personnels signalant la mort de prisonniers de guerre protestants en 1746-1747. Les crânes et les dents présentent surtout des caractères du type caucasien. La longueur des os révèle des tailles supérieures aux statures documentées en Europe à la même époque et se rapprochant plutôt de celles des colons nord-américains.

Pour toute la série, les dents sont en mauvais état. La plupart des hommes portent des traces de lésions qui indiquent probablement l'imposition de lourdes charges sur la colonne vertébrale. Un peu plus de 20% des hommes présentent aussi des fractures osseuses traumatiques; d'autres modifications des squelettes suggèrent d'autres formes de traumatisme. On relève des indices d'infection chronique des sinus, de scorbut et de maladies ou de carences alimentaires au cours de l'enfance. Au moins 12 des hommes fumaient la pipe, à en juger par un motif particulier d'usure des dents. On a également découvert des indices d'ossification partielle des bronches chez trois hommes, un tibia à croissance interrompue chez un adolescent, et une possibilité de tumeur (ostéochondrome).

Introduction

The human skeletons reported here were excavated in 1986 and 1987 by archaeologists with the Canadian Parks Service, Québec Region, under the field direction of Gisèle Piédalue. The remains were located near the bases of "Courtine Saint-Louis" and "Bastion des Ursulines," two contiguous parts of the mid-18th-century fortification wall of Québec City. These are located between the Saint-Louis and Kent gates along the

western front of the old city and delimit in part the present "Parc de L'Esplanade."

The remains were unexpectedly discovered during a Parks Service project to repair the wall (Henderson 1986). The graves were unmarked, and there were no known historical indications of a cemetery in the area. In the following months, Québec historians brought forth documents that indicated the remains might be those of Protestant prisoners held by

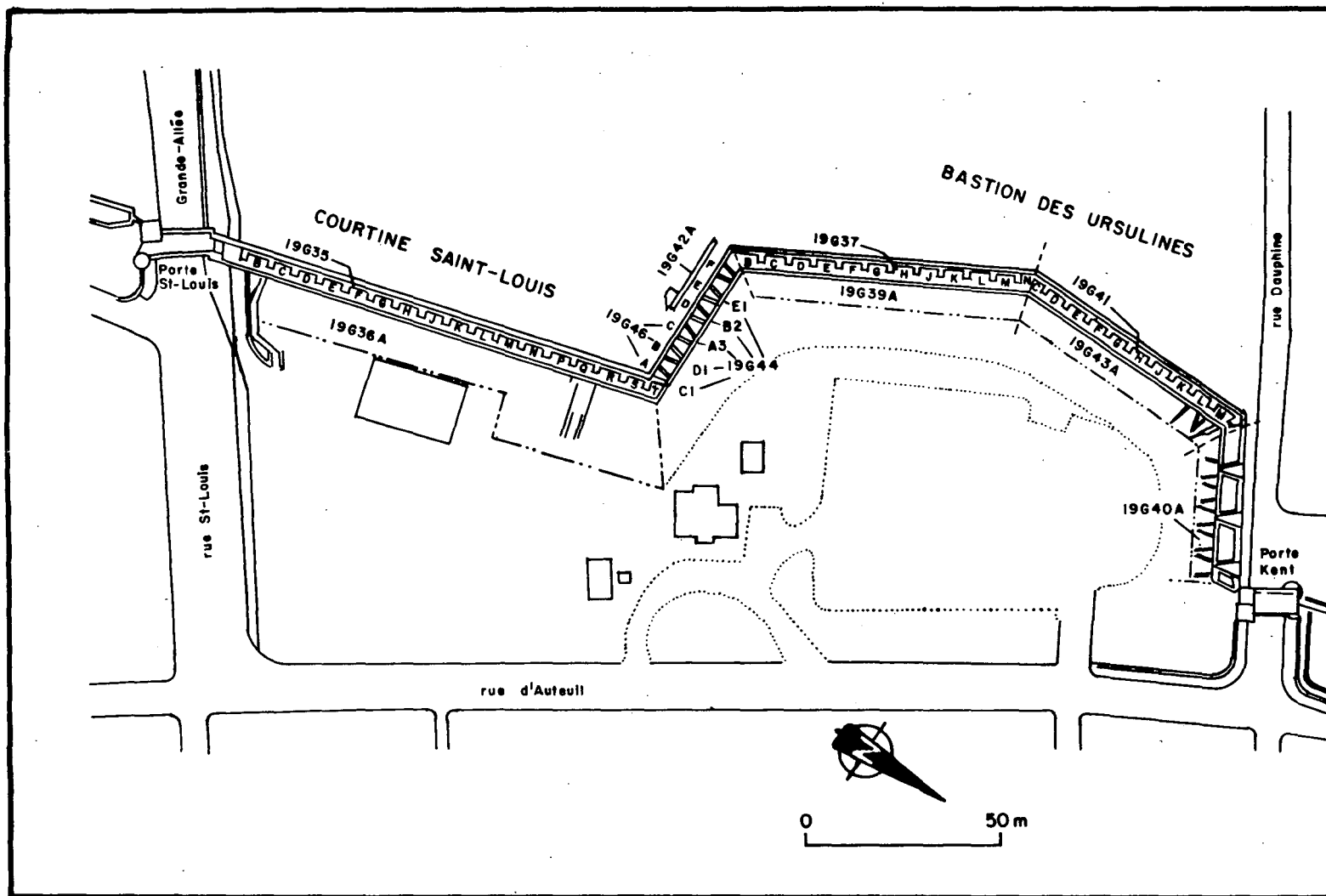
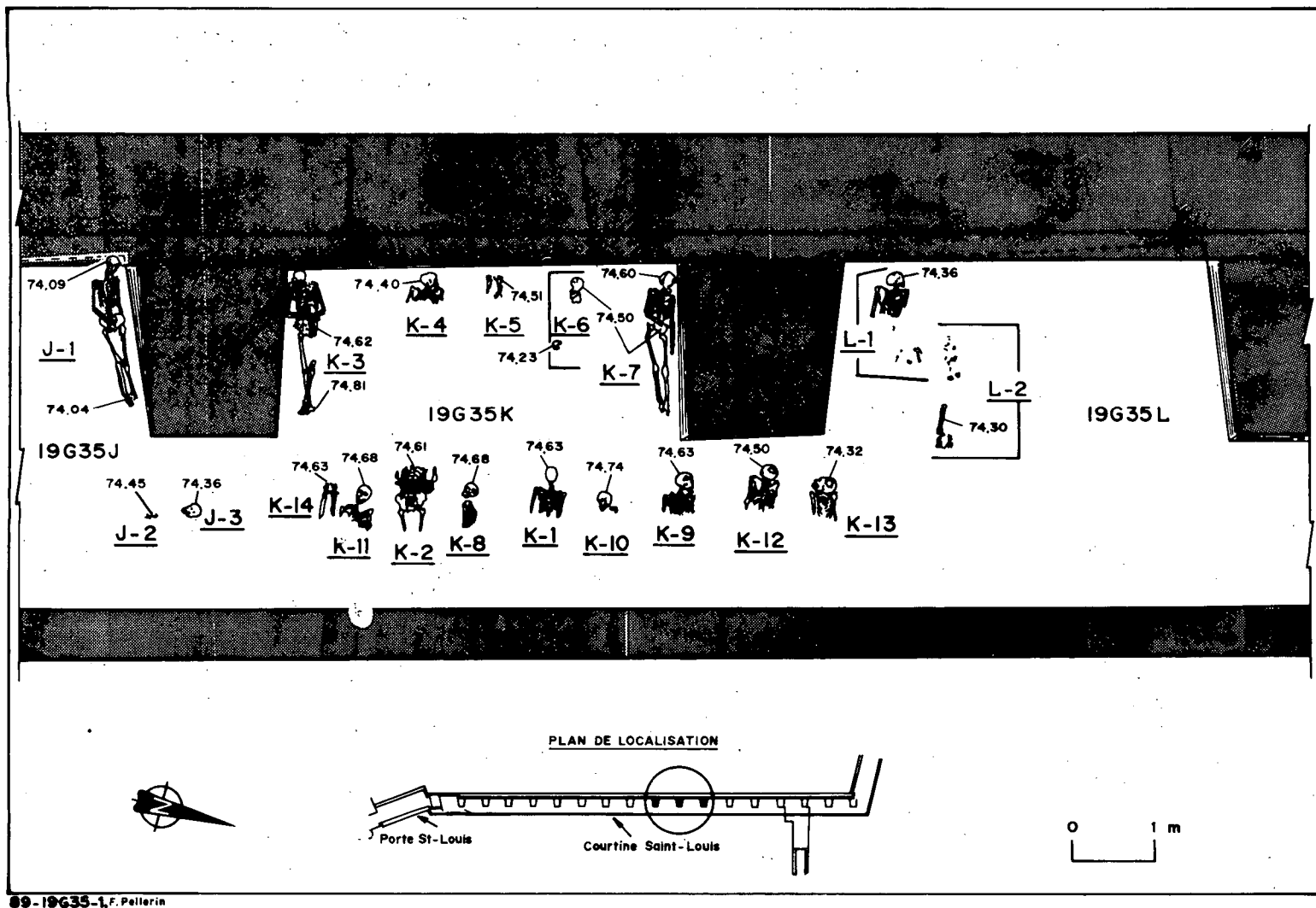


Figure 1. Site plan of Courtine Saint-Louis (19G35) and Bastion des Ursulines (19G37 and 19G41).



89-19635-1, F. Pellerin

Figure 2. Site plan of section of Courtille Saint-Louis showing skeletons in varying states of completeness.

the French in 1746–1747 following an outbreak of war between France and England, the war of the Austrian succession, 1744 to 1748 (Charbonneau, Desloges, and Lafrance 1982). Subsequent research by Gisèle Piédalue (personal communication, 1988), centered on a diary of one of the captives (Pote 1976) and supplemented by other journals, has tended to support this hypothesis. She concluded that as many as 67 Protestant prisoners died and that most probably were buried in the area, located a short distance from the Casernes Royales prison where some 300 captives were held, between March 15, 1746, and July 27, 1747. They were individuals mainly from New England and eastern New York State, but there were also a few Scottish and English sailors. They were captured during staccato raids to the east and south of Québec by the French and their Indian allies, aimed at keeping the enemy disorganized and unable to launch a large-scale campaign. According to the diaries, all of the prisoners seem to have been Caucasian including some individuals of known Dutch, Irish, German, or Norwegian descent. The significance of the qualification by religion is that deceased prisoners known to be of the Catholic faith were buried in a consecrated cemetery within the city.

This paper summarizes findings from a laboratory analysis of the remains carried out at the Canadian Museum of Civilization in Hull, Québec. Study entailed identifications of age at death and sex, morphological observations directed toward race identification, estimates of living stature, and elements of

paleopathology (health status and disease). Sample sizes for different observations varied depending on the completeness of individual remains.

Field Recovery

The skeletal remains of 50 individuals were recovered, 26 in 1986 and 24 in 1987. Three archaeological sites were designated within the Canadian Parks Service system, one of which, 19G35, corresponded with the Courtine Saint-Louis location. The other two, 19G37 and 19G41, identified the left face and right face respectively of the Bastion des Ursulines (FIG. 1). These designations form an integral part of the burial catalogue numbers and are so used in this report.

The individual skeletal remains varied in terms of their completeness. They ranged from virtually whole skeletons missing only a few hand or foot bones to individuals represented only by feet and leg bone parts (cf. FIG. 2). In many instances, only upper or lower body segments were recovered, the rest of the skeleton being inaccessible because of its position in the rampart. The fortification consists of an earth rampart with outer and inner revetment walls. The remains were located between them at a depth of more than 5 m (16.4 ft) beneath the summit of the walls. Some rested partly under the inner wall, the construction of which began in 1753, or under an adjoining Canadian Parks Service retaining structure (FIG. 3). The outer revetment wall, begun in 1745, was only partly raised (1.8 m [5.9 ft]) at the time of the burials. Two skeletons had evidently been disturbed by construction of the outer wall

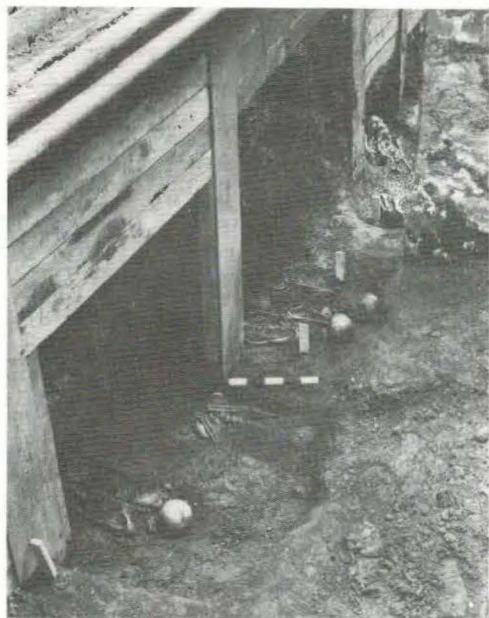


Figure 3. Skeletons along inner revetment wall, Bastion des Ursulines. Steel I-beams and wooden ties form a Canadian Parks Service retaining structure.

during the 18th century. During the repair project, some skeletons suffered extensive damage by a cable-operated clam shovel used to remove earth fill between the walls. Several others were unwittingly damaged by steel I-beams driven to shore up the inner wall prior to removal of the earth fill.

Aside from two individuals buried one on top of the other, the remains were found in separate burial repose. Four skeletons lay roughly parallel to the walls, while all others were perpendicular. All appear to have been extended burials, mainly on their backs, though six individuals were recorded face down. There was no evidence for coffins, but in several instances shallow burial pits were apparent. The fact that some individuals were found face down suggested that burial sacks or shrouds

were used, a detail also suggested by the discovery of copper pins lying in and about the remains of a French-made glass bottle next to one of the burial sites and the presence of blue-green copper stains on the bones of 15 skeletons.

Age and Sex Composition

Table 1 lists the individuals by burial catalogue number, sex, and age at death. Sex evaluations were based on pelvic and cranial criteria (Krogman and Iscan 1986) and related elements of size and robustness elsewhere in the skeletons. Except for one person of prepubertal age (19G37 K2) and a qualification for one very incomplete female skeleton (19G37 F1), there was little difficulty in sex identification. Most of the individuals were male ($n = 45$), and there were only three or, possibly, four females in the series.

Age at death estimates were derived from study of the pubic symphyses (Todd 1920; McKern and Stewart 1957; Gilbert and McKern 1973), ilium auricular surfaces (Lovejoy et al. 1985), cranial suture closure (Montagu 1960; Meindl and Lovejoy 1985), epiphyseal union in long bones, clavulae, vertebrae, and innominata (McKern and Stewart 1957; Ubelaker 1978), dental development (Ubelaker 1978), elements of sacral development (McKern and Stewart 1957), and where present, degree of ossification of the thyroid cartilage (Krogman and Iscan 1986: 127-129). The degree of occlusal tooth wear and the variable presence and extent of degenerative changes in each person were also taken into account. All of the criteria were

Table 1. Courtine Saint-Louis/Bastion des Ursulines individuals by burial number, sex, and age (in years).

Burial	Sex	Age	Burial	Sex	Age
19G35 C 2	M	20-24	19G35 L 2	F	18-21
19G35 C 3	M	35-44	19G37 E 3	M	20-24
19G35 C 4	M	20-24	19G37 E 4	M	28-34
19G35 D 1	M	18-22	19G37 E 5	M	40-49
19G35 H 1	M	20-24	19G37 E 6	M	35-44
19G35 H 2	M	30-39	19G37 F 1	F?	20-34
19G35 H 3	M	25-34	19G37 F 2	M	55-64
19G35 J 1	M	22-28	19G37 F 3	M	60-69
19G35 J 2	M	20-34	19G37 F 4	M	20-24
19G35 J 3	M	45-54	19G37 F 5	F	28-34
19G35 K 1	M	25-34	19G37 F 6	M	14-16
19G35 K 2	M	16-18	19G37 H 1	F	28-34
19G35 K 3	M	16-18	19G37 K 1	M	17-20
19G35 K 4	M	40-49	19G37 K 2	?	8-11
19G35 K 5	M	30-49	19G37 L 1	M	18-21
19G35 K 6	M	25-34	19G37 M 1	M	25-29
19G35 K 7	M	14-16	19G37 M 2	M	18-21
19G35 K 8	M	25-29	19G37 M 3	M	18-22
19G35 K 9	M	20-24	19G37 M 4	M	25-34
19G35 K10	M	28-34	19G41 N 1	M	18-21
19G35 K11	M	22-28	19G41 C 1	M	28-34
19G35 K12	M	65-74	19G41 C 2	M	28-34
19G35 K13	M	17-20	19G41 C 3	M	22-28
19G35 K14	M	20-29	19G41 D 1	M	45-54
19G35 L 1	M	18-21	19G41 D 2	M	18-21

considered comparatively within the study sample and individuals seriated to arrive at the age ranges shown in Table 1.

The males ranged from 14-16 to 65-74 years with an average age at death of 29.4 years. Including the one uncertain individual, the four females ranged from 18-21 to 28-34 years with an average age of 26.9 years.

Of special interest is the grossly unequal sex ratio and the existence of only one prepubertal individual. In her study of the prisoner diaries, Gisèle Piédalue found the recorded deaths of 55 males, five females, and seven children. She believes that six of the immature individuals were not

buried with the other Protestant prisoners because they were infants, likely baptized, and buried in a Catholic cemetery. This leaves only one immature individual and a sex and age distribution (90.16% males, 8.2% females, 1.64% immature) virtually identical to that of the group of skeletons (90%, 8%, and 2% respectively). The seventh immature individual listed in the diaries was a girl of 10 or 12 years, possibly coincident with the child's skeleton, 19G37 K2, aged at 8-11 years on the basis of dental development.

The journals were not detailed enough to test how closely the average ages of the Courtine/Bastion men and

Table 2. Summary of male cranial measurements.

	Sample size	Mean	Standard deviation	Maximum value	Minimum value
Glabello-occipital length	29	192.00	7.47	205	178
Maximum transverse breadth	21	141.76	4.52	150	133
Minimum frontal breadth	23	97.30	4.23	105	88
Bizygomatic width	8	135.13	9.75	154	124
Basio-bregmatic height	15	136.40	7.86	152	122
Basion-nasion length	15	104.20	6.97	120	97
Basion-prosthion length	9	93.00	4.42	99	85
Upper facial height	13	72.77	2.20	76	69
Total facial height	11	123.55	5.11	131	115
Orbital height	14	34.93	1.77	37	31
Orbital breadth	13	41.85	1.52	45	40
Nasal height	15	52.47	2.45	57	50
Nasal breadth	19	24.32	1.42	27	21
Superior alveolar length	13	53.69	3.20	58	48
Superior alveolar breadth	10	61.90	4.15	71	57

women corresponded to those of the deceased prisoners. In the diaries, the ages or approximate ages of less than half the men were reported. We know that there were five "young men," eight or nine from 20 to 30 years of age, two or three in their 30s, one at 40 years, and eight at 45 years or older, including three in their 60s and one possibly as old as 70 years. Figure 4, which distributes the skeletal data in 5-year increments, shows that most of the men were quite young: 64% less than 30 years old and 77% less than 35. Young men may have been selected for capture because of their potential for military service with the enemy, and this would also explain the great prevalence of male over female captives. Judging from information in the diaries, the female skeletons and that of the juvenile likely represent family members.

Morphology and Race

Cranial measurements and morphological observations may be used to delineate racial affinities for the skeletal remains of unknown individuals (Krogman and Iscan 1986; Gill 1986). Many of the Courtine/Bastion crania were fragmented and incomplete. Though repair of broken parts was undertaken where possible, all potential morphological features could not be studied in all individuals, and discriminant function analyses (cf. Giles and Elliot 1962) were not feasible.

Table 2 summarizes cranial measurements for the male series, taken according to the techniques of Olivier (1969). Though there is expected individual variability, the measurements indicate a prevalence of Caucasoid features, especially in terms of long, narrow skull vaults and

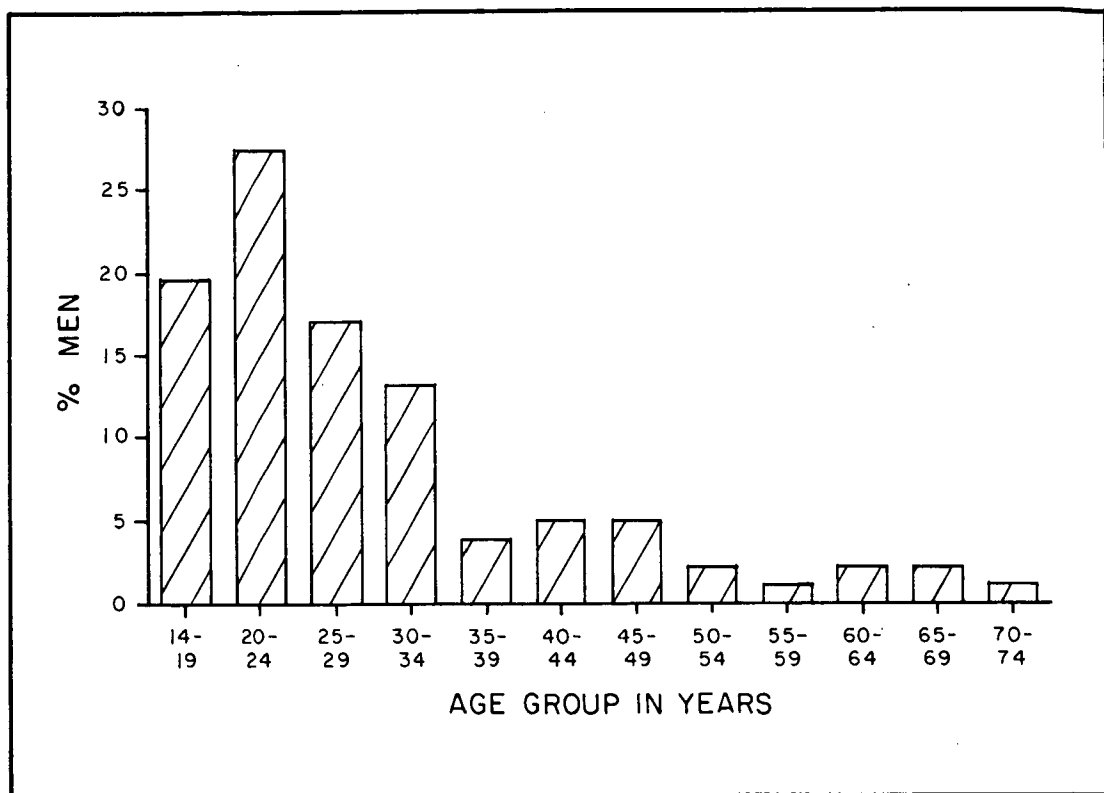


Figure 4. Age distribution of male skeletons ($n = 45$) from Courtine Saint-Louis/Bastion des Ursulines.

facial skeletons, very flat (orthognathic) faces, and narrow nasal openings. Nonmetric variables also point to Caucasoid origins: rounded sagittal skull contours, sharp lower nasal margins, and parabolic palates with jagged palatine sutures.

Crowding, rotation, or displacement of teeth, common to many contemporary white dentitions, was virtually the norm for the Courtine/Bastion series. These circumstances reflect small jaw size, a feature that also has been associated with whites. Concomitantly, 53.5% of the dentitions featured congenitally missing or impacted teeth (FIG. 5), or teeth reduced in size or peg shaped. Congenitally missing teeth, mainly third molars but also one case of lower

central incisors, were specifically recorded in 48.3% of 43 individuals.

Given the prevalence of Caucasoid features, it is well worth noting that shovel shaping of the upper incisors, a feature usually associated with Mongoloid and American Indian dentitions, was also present in the Courtine/Bastion group. According to the degrees of expression illustrated and discussed by Carbonell (1963), three individuals exhibited distinct shovelling, five showed semi or moderate shovelling, while 11 exhibited a trace of shovelling. Carbonell (1963) reported that 45% to 50% of American whites in one study exhibited the semi or trace condition. In the Courtine/Bastion group, 45.7% of 35 dentitions with incisors showed

Table 3. Best estimates of living stature (in cm) for Courtine Saint-Louis/Bastion des Ursulines skeletons by burial number, grouped by sex

Burial	Stature	Standard Error	Bones used
Males			
19G35 C 2	185.53	3.62	Femur + fibula
19G35 C 3	181.88	3.74	Femur + tibia
19G35 D 1	181.21	3.62	Femur + fibula
19G35 H 1	168.24	3.62	Femur + fibula
19G35 H 2	174.80	3.94	Femur
19G35 H 3	177.59	3.94	Femur
19G35 J 1	176.89	3.62	Femur + fibula
19G35 K 1	159.49	3.94	Femur
19G35 K 2	174.55*	4.66	Radius
19G35 K 3	175.32*	3.62	Femur + fibula
19G35 K 8	176.94	4.57	Humerus
19G35 K 9	179.63	4.31	Humerus + radius
19G35 K 11	177.17	4.31	Humerus + radius
19G35 K 12	173.80	4.31	Humerus + radius
19G35 K 13	176.94*	4.57	Humerus
19G35 K 14	174.37	4.00	Tibia
19G37 E 3	162.74	3.62	Femur + fibula
19G37 E 4	171.55	3.94	Femur
19G37 E 5	172.30	3.74	Femur + tibia
19G37 E 6	168.77	3.62	Femur + fibula
19G37 F 2	170.44	4.31	Humerus + radius
19G37 F 3	167.03	3.94	Femur
19G37 F 4	179.91	3.94	Femur
19G37 K 1	178.72*	3.62	Femur + fibula
19G37 L 1	168.14	3.74	Femur + tibia
19G37 M 1	160.84	3.62	Femur + fibula
19G37 M 2	160.84*	3.62	Femur + fibula
19G37 M 3	174.56	3.86	Fibula
19G37 M 4	174.40	3.62	Femur + fibula
19G37 N 1	174.53	3.62	Femur + fibula
19G41 C 1	169.00	3.94	Femur
19G41 C 2	175.31	4.66	Radius
19G41 C 3	174.20	3.62	Femur + fibula
19G41 D 1	169.68	3.62	Femur + fibula
19G41 D 2	177.81	3.62	Femur + fibula
Females			
19G35 L 2	148.68	3.57	Fibula
19G37 F 5	161.17	3.72	Femur
19G37 H 1	157.45	3.55	Femur + Tibia

* The growth of these individuals was incomplete (see text).



Figure 5. Impacted left canine in upper jaw of skeleton 19G35 J1.

this morphological feature is not, at the present level of understanding, a clear indicator of race.

Stature Estimates

The long bones of 38 individuals were sufficiently complete for length measurements and resultant estimates of stature during life, including 30 males and three females whose long bone growth was complete and five males whose epiphyses were not fully united to the diaphyses. The living stature of each individual (TAB. 3) was calculated from the regression formulae of Trotter and Gleser for white males (1958) or white females (1952) as appropriate. In each instance, the bone or combination of bones yielding the estimate with the smallest standard error was used.

The males ranged in height from 159.49 cm (5'3") to 185.53 cm (6'1") and the females from 148.68 cm (4'10") to 161.17 cm (5'3"). The average height of the 30 fully grown males was 173.29

the semi or trace condition, and 8.6% a distinct shovel shape. It appears that

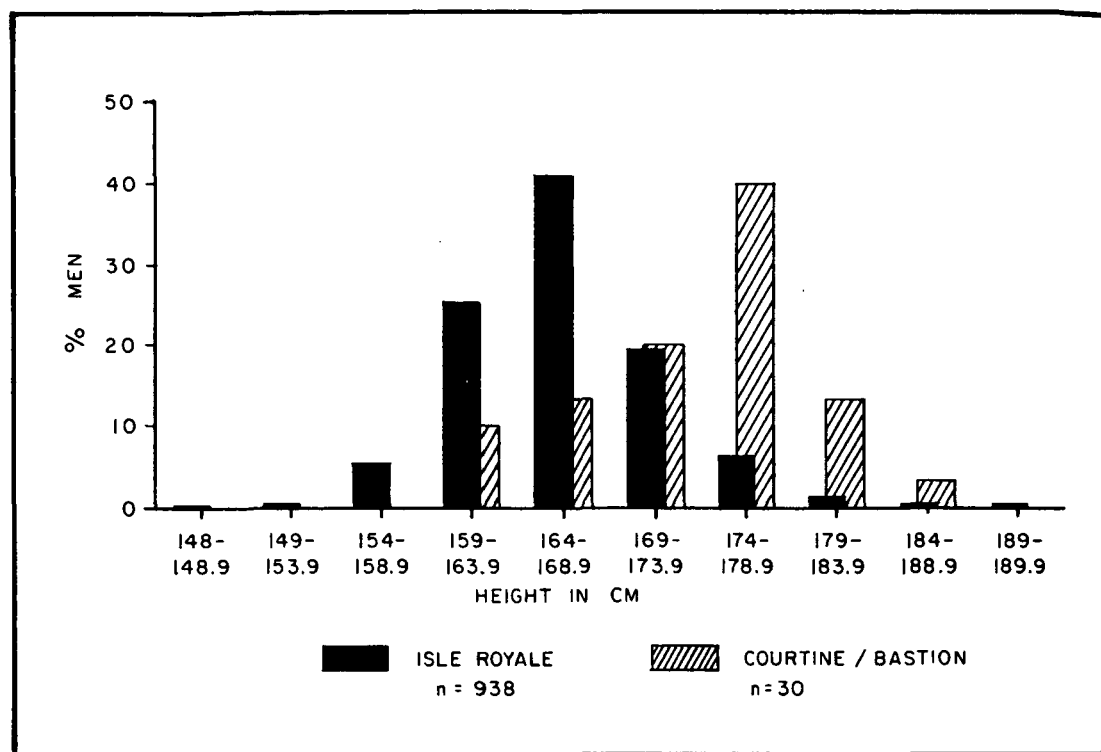


Table 4. Eighteenth-century male statures.

Series	Sample size	Mean (cm)	Standard deviation
French Isle Royale garrison*	938	166.5	5.66
British military in America†:			
foreign born	1647	167.4	6.38
colonial born	1745	171.6	6.45
London, England§		169.0	
U.S. colonials	5	171.9	
Nagel cemetery, New York City**	9	172.8	
Ft. William Henry, New York††	14	177.3	3.93
Louisbourg Fortress§§	12	173.3	4.89
Courtine/Bastion group	30	173.3	6.09

* These are anthropometric data calculated for this study (Québec Diocese, 1752).

†: These are anthropometric data from Steegmann and Haseley (1988).

§ These are osteometric data from Angel (1976).

** The mean was calculated from the average left femur length reported by Shapiro (1930).

†† These are osteometric data from Steegmann (1986).

§§ These data were calculated from individual osteometric statures reported by Anderson 1964 and Jerkic 1974.

cm (5'8"), and the average for the three females was 155.77 cm (5'1").

To give some perspective to these data, Figure 6 compares the distribution of male heights in 5-cm increments to that of the 1752 French garrison at Isle Royale, most members of which appear to have been born in the Old World. The latter data were taken from a muster roll held by the Québec Diocese (1752), kindly supplied to me by the *Archives du Séminaire de Québec* via the library of the Canadian Museum of Civilization. The heights were written in the archaic French measurements, "*pie*," "*pouce*," and "*ligne*," and these were changed to centimeters using the conversion factors listed by Ross (1983).

The 30 Courtine/Bastion males were considerably taller as a group than the French soldiers. Other comparative data (see TAB. 4) suggest that these differences might reflect height differences between foreign-born and colonial-born men of military age in the New World in the 18th century (Steedmann and Haseley 1988), an implication that the majority of captives represented by the Courtine/Bastion skeletons were colonial-born.

Paleopathology

Dental disease

Over 90% of 45 people with dentitions had decayed or missing teeth, or alveolar abscesses (FIG. 7). Decayed teeth were recorded in 66.7% of 42 upper jaws and 72.7% of 44 lower jaws with an average number of affected teeth per jaw of 3.3, and 6.3 per person. Of a total 1044 teeth, 27.1%

were carious. None of the carious teeth showed treatment with fillings as reported by Anderson (1964) for the skeletons of two men of nobility buried at the Fortress of Louisbourg in the 1740s. The high incidence of caries, comparable to that of northeast Amerindian agriculturalists (Patterson 1984), suggests a diet rich in carbohydrates (sugars and starches).

Tooth loss, likely a sequel of caries in the Courtine/Bastion group, was recorded in 45.2% of upper jaws and 52.3% of lower jaws with an average number of 1.4 teeth lost per upper jaw, 1.7 per lower jaw, and 2.9 per person. Of 1251 total sites, 10.5% had missing teeth. Abscess lesions, likely also a sequel of caries, were noted in 52.5% of 40 upper jaws, 46.5% of 43 lower jaws, and 65.1% of 43 people taking both jaws into account. The rates of abscessed tooth sites were 1.6 per upper jaw, 1.2 per lower jaw, and 2.7 per person. Of a total 1146 observable alveolar sites, 10.2% were abscessed.

Schmorl's nodes

Another common paleopathological entity in the Courtine/Bastion group was the presence of Schmorl's node scars in the superior and/or inferior surfaces of vertebral bodies (FIG. 8). The scars reflect herniations of intervertebral disc tissue (Saluja et al. 1986). Their occurrences were indicated, either by depressions of varying depth or by elongated channels with clear margins, in the vertebrae of 27 individuals, all males, with an average number of 7.4 vertebrae involved per affected person. The youngest age at which the scars were present was 18–21 years and

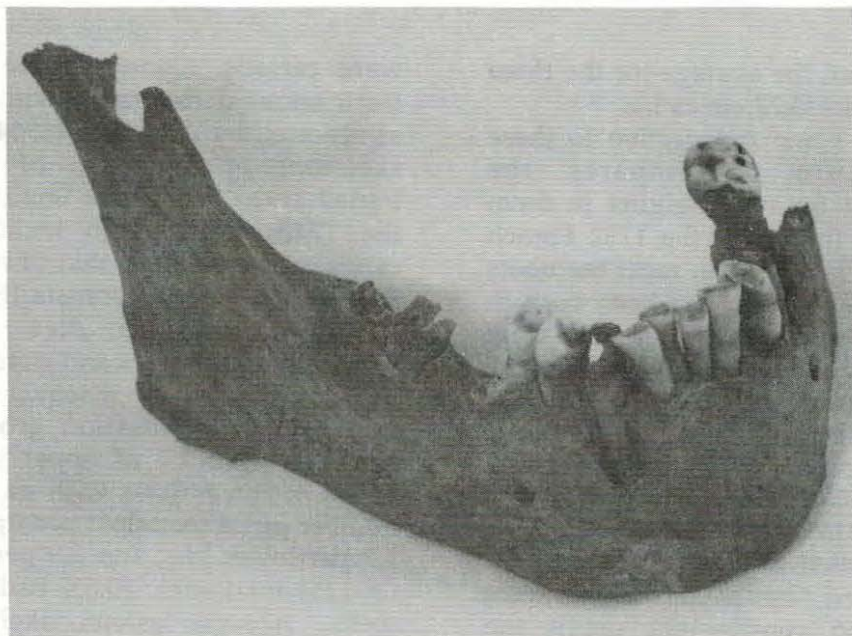


Figure 7. Mandible of skeleton 19G37 F3 showing decayed teeth, ante mortem loss, and an abscess. Note crowding of anterior teeth.

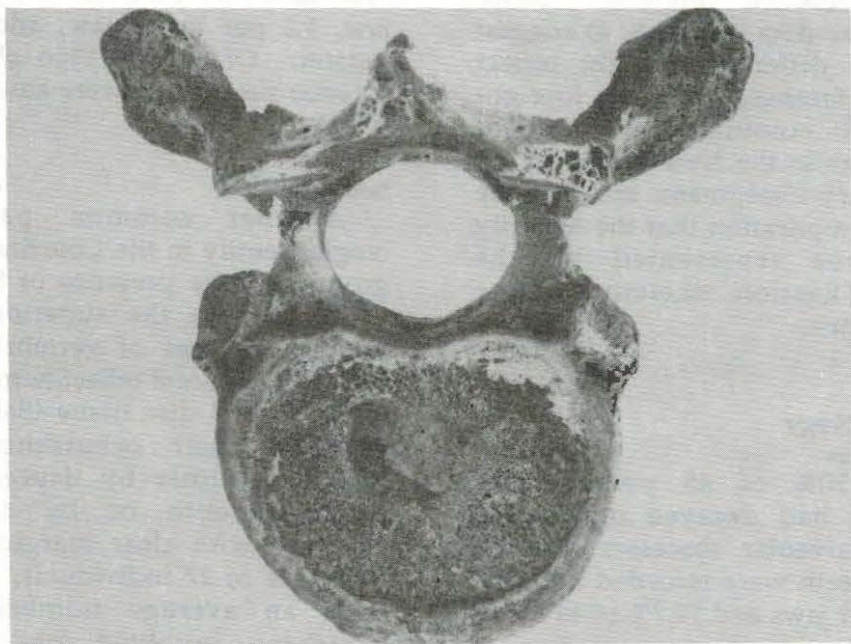


Figure 8. Schmorl's node scar in seventh thoracic vertebra of skeleton 19G37 M1.

the oldest affected person was 65–74 years. The lesions were found as high in the column as the fourth thoracic and as low as the fifth lumbar vertebrae.

The etiology of Schmorl's nodes is not wholly understood, although they have been associated with trauma, growth disorders, advanced arthritis, and other diseases that involve weakening of the bone and/or disruption of the cartilage endplate. Saluja et al. (1986) noted a statistically significant sex difference in the occurrence of Schmorl's node scars in two British series, one from Aberdeen dating from the 13th to 16th centuries and one from London dating from the 18th to 19th centuries. Males were affected much more often than females, and there were no clear differences among the male series. The total incidence for the two male groups was 73.9% based on a sample of 46 men. The Courtine/Bastion male incidence was almost the same, 73% based on a sample of 37. In view of the male prevalence, strenuous activity producing heavy loading on the spine might have been a contributing factor in the production of Schmorl's node scars.

Osteoarthritis

Thirty-six of 45 adult skeletons (those about 18 years of age and older) featured some evidence for osteoarthritis in one or more joint surfaces. The most common site of affliction was the spine with 29 of 38 individuals (76.3%) showing changes in one or more apophyseal joints and 24 of 33 (72.7%) featuring changes in one or more vertebral rib facets. One

or more limb joint surfaces were affected in 20 of 42 skeletons (47.6%).

While some degree of osteoarthritis may be found in any skeletal series because of the normal wear and tear of joints as a consequence of aging, the young age at death profile of the Courtine/Bastion series suggests that other factors might also have been involved. For example, the high incidences for the spine might indicate unusually heavy or repeated loading stresses, perhaps the same conditions that resulted in the high incidence of Schmorl's node scars and a relatively high incidence of spondylolysis reported below in the section on trauma.

Trauma

Traumatic fractures were shown in the skeletons of 10 males. One individual, 19G37 E6, exhibited 16 fractures among 15 bones, including 10 ribs, the right fibula, two metacarpals of the right hand, the sixth thoracic vertebra (fractured spinous process and body compression fracture), and the third lumbar vertebra (compression fracture). Other, possible superficial signs of injury were present in a third right metacarpal, in the right femur, and in the right tibia. Many of the lesions were not fully healed at the time of death, and the skeleton may have been that of a man whom the prisoner diaries report as having died of multiple blows.

Seven other individuals exhibited more than one fractured bone. The skeleton of 19G35 C3 showed two fractured right foot bones, a possible incomplete fracture of the left tibia shaft, and a possible incomplete

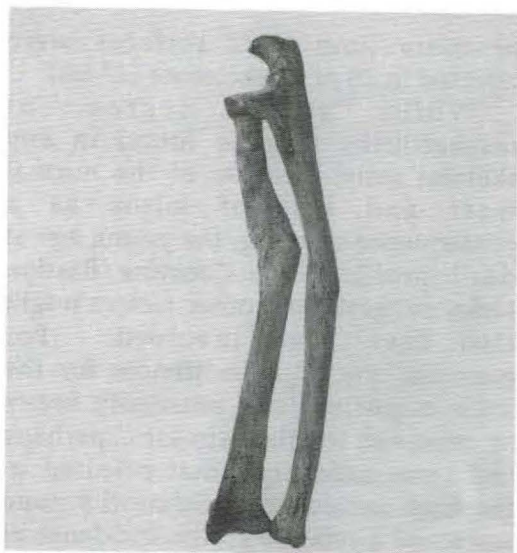


Figure 9. Fractured right forearm bones of skeleton 19G41 C1.

fracture and associated ossified hematoma in a left hand bone.

A well-healed depressed fracture, 35 mm × 30 mm in diameter, was apparent in the posterior skull vault of 19G35 D1. The damage involved only the outer table. Elsewhere in the skeleton, an injury to the left hand may have been responsible for slight structural differences between the shaft ends of the right and left third metacarpals, the latter also possessing an irregular spur-like growth.

Two well-healed depressed fractures, also affecting only the outer table, were apparent in the skull of 19G41 C1. One of the lesions was a shallow, circular, dish-like depression, 18 mm in diameter, in the front of the vault. The second lesion was a small funnel-like depression, 10 mm in diameter, in the posterior vault. Also in this skeleton, both right forearm bones had been broken and healed with gross distortions of the shafts (FIG. 9).

The ulna and radius had also been fractured in the right forearm of 19G37 F2. Remodeling had occurred but with nonunion of the broken ends, a finding not unusual in modern medical practice, especially with fractures involving the forearm (Stewart 1974).

Five right ribs had been fractured in the skeleton of 19G35 K12 but were virtually healed by the time of death. Multiple fractures were apparent in the left hand of 19G35 J1 including the fourth, third, and second proximal phalanges. The first bone displayed a distinct deformity of the shaft indicating healed overlap of the broken ends. In the bones of the third and second digits, there were only slight distortions in the shafts.

The seventh individual with more than one bone probably fractured was 19G41 D1. In this skeleton, the left clavicle was broken with healed overlap of the separated parts. Distortions in the shaft and distal articular surface suggest that a phalange in the right foot may also have been fractured.

Compression fractures in vertebral bodies were visible in three individuals including the sixth thoracic and third lumbar of 19G37 E6, the eighth thoracic of 19G35 K1, and the first lumbar of 19G37 M4. As noted above, the damage to the bones of 19G37 E6 may have resulted from violence; of interest from this perspective is that the sixth thoracic vertebra also suffered a fractured spinous process.

In 19G37 F4, there may have been an avulsion fracture of the medial epicondyle of the right humerus (the area of the elbow) in which the prominence was displaced distally. In

19G35 K1, changes in the distal right femur suggested traumatic myositis ossificans, or ossification of muscle tissue that can result from deep trauma to the lower thigh; there is a cluster of thick, sinuous exostoses at the most distal insertion site of the adductor magnus muscle.

Possible indicators of traumatic arthritis were apparent in four skeletons. One of them was 19G35 C3 which had a possibly fractured fourth proximal phalange and three arthritic carpal bones in the left hand. The other five wrist bones of that hand and all eight right carpal bones were normal.

Sternoclavicular joints in 19G35 K12 and 19G37 F3 may also have suffered trauma. In the first case, the right joint featured enlarged and irregular surfaces that suggested displacement. There were no arthritic changes in the left joint and, as reported above, five right ribs had been fractured. The joint changes may have been related to the rib fractures in a single episode of trauma. In 19G37 F3, the clavicular surface of the left sternoclavicular joint was enlarged and featured much more advanced arthritic changes than evident in the right joint.

The fourth person with possible traumatic arthritis was 19G41 D2. In this skeleton, the distal articular surface of the left fifth metatarsal was distorted and arthritic, while all 19 other metatarsal ends were normal. The distal end of the third proximal phalange in the right foot was flared and otherwise distorted, suggesting another possible instance of traumatic arthritis.

Possible fatigue fractures in feet, known as "march foot" because of its

occurrence in modern military recruits after long marches (Juhl 1981: 135-136), were indicated for two individuals. The changes included elongated ivory-like plaques of bone (ossified hematomata or ossified callus) along one side of a metatarsal shaft, possibly the sequel of a hairline fracture in one side of the bone. In 19G35 H1, both third metatarsals and the left fifth metatarsal were involved, and in 19G35 K14, the right third metatarsal was affected.

Other possible fatigue or stress fractures were indicated by spondylolysis of lumbar vertebrae (FIG. 10). This condition entails separation of a neural arch between the superior and inferior articular processes (*pars interarticularis*), the pedicle, or the lamina (Merbs 1983: 35-42). The etiology is poorly understood but some studies have shown a familial predisposition for the separation that apparently results from heavy loading stresses on the lower back.

Five males were affected for a total male incidence of 18.5% based on presence in the column of a fifth lumbar vertebra, the most commonly affected bone. In all instances, separation was through the *pars interarticularis* rather than the pedicle or lamina. Burials 19G35 H2, 19G35 K12, and 19G37 M2 featured complete bilateral separation in the fifth lumbar vertebra, and 19G37 M2 also exhibited a unilateral right separation in the second lumbar. Burial 19G37 N1 showed a separation of the right *pars* but the left side of the vertebra was damaged post-mortem and could not be observed. The fifth individual featured an affected sixth lumbar vertebra but the fifth was normal. The

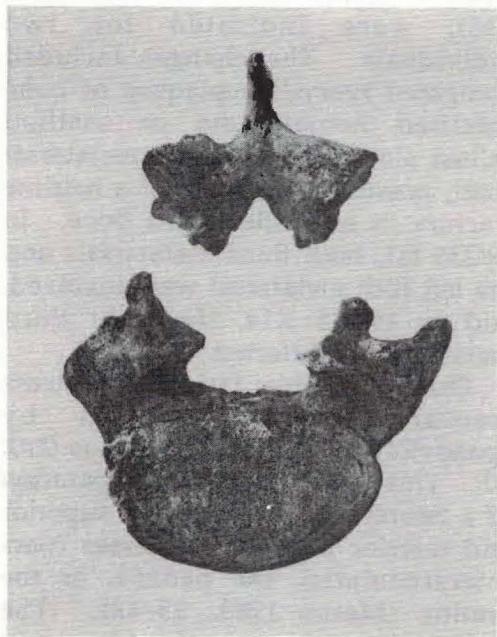


Figure 10. Spondylolysis of fifth lumbar vertebra of skeleton 19G35 H2.

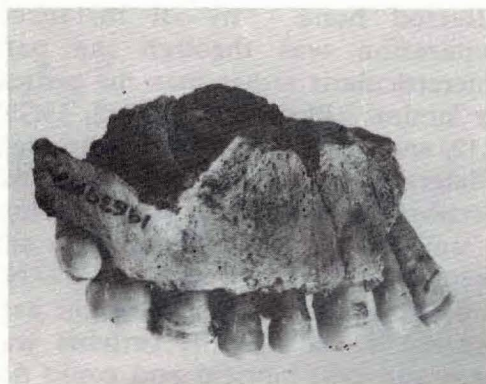


Figure 11. Dental enamel hypoplasia in central incisor (marked) and canine (slight) of skeleton 19G37 M2. Note the impacted third molar.

separation in the sixth unit was unilateral right.

Childhood metabolic stresses

Defects in the enamel of tooth crowns (enamel hypoplasia) were recorded in 31 of 43 dentitions for a total Courtine/Bastion incidence of 72.1%. They usually took the form of horizontal constrictions or lines on anterior teeth (FIG. 11) but occasionally were represented by mottling or pitting of the enamel. In most cases, the lines were barely perceptible or slight, but in ten instances were distinct. Such defects are usually attributable to periods of metabolic stress, such as illness or nutritional deficiency, on the individual during tooth formation in early childhood (Larsen 1987).

Cribrra orbitalia, a porousness in the roof of the eye socket (FIG. 12), is another presumed indicator of childhood illness or nutritional deficiency, in this case resulting in episodes of anemia (Stuart-Macadam 1985, 1987). The lesion was observed in nine of 37 Courtine/Bastion individuals, the youngest at 14–16 years and the oldest at 45–54 years. In all cases, the lesion was healed (or remodeled), indicating an osseous response that took place long before death, likely during infancy or childhood.

Maxillary sinus inclusions

Maxillary sinus inclusions are spicules of bone attached to the floor or walls of the maxillary sinus. They probably indicate chronic sinusitis (Wells 1977; Juhl 1981: 1139–1140), a low-grade infection in which

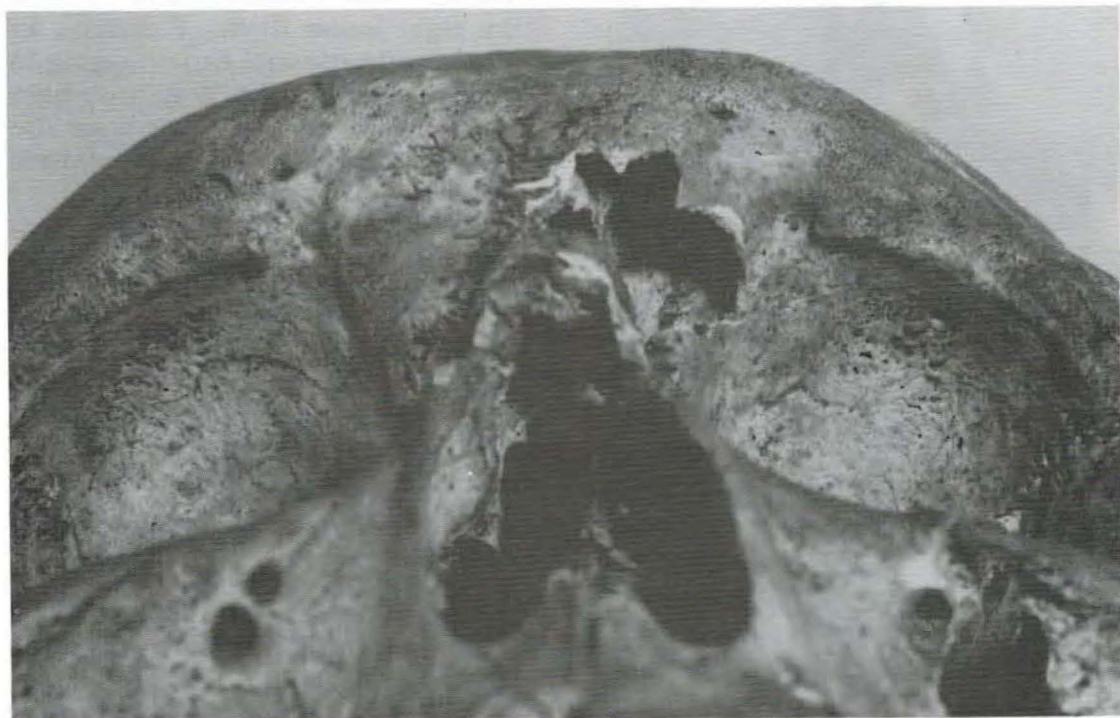


Figure 12. Pitting and porousness (cribra orbitalia) in orbit roofs of skeleton 19G35 C3.

thickening of the walls and other condensations of bone have been radiographically demonstrated in living patients. The spicules were noted in the sinuses of nine individuals, five bilaterally and four unilaterally. In one, the anterior wall of the sinus also appeared thickened. In 22 individuals, both sinuses were normal, and in 5, one sinus was normal while the other could not be observed. Hence, 25% of the observable Courtine/Bastion series featured maxillary sinus inclusions.

Inflamed leg bones

Eight males exhibited a similar type of inflammation in lower limb long bones. This appeared as a superficial

accretion, marked by a deposition of finely textured bone that, in many instances, was darkly stained in contrast to unaffected parts (FIG. 13). In some cases, the change appeared active at the time of death while in others it appeared to be resorbing or remodeled. The change may represent calcification of subperiosteal hemorrhaging that, in the absence of other changes, may indicate vitamin C deficiency or scurvy (Saul 1972: 56-66).

In total, eight femurs were involved among six people, six tibiae among five people, and two fibulae from one person. Since not all leg bones were consistently represented in the Courtine/Bastion series, it is difficult to know whether there might have been any differential

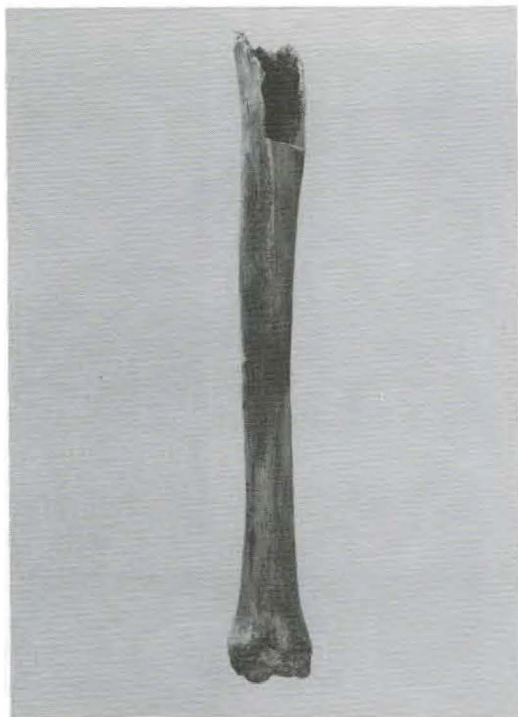


Figure 13. Inflamed left tibia (roughened surface) of skeleton 19G35 D1.

involvement. In skeleton 19G35 D1, both tibiae and both fibulae were affected, but there were no evident changes in the two femora. In 19G37 E5, both femora and the right tibia were involved, but the left tibia and each of the two fibulae were not affected.

There were two other affected people with all six bones present. In 19G35 H1, the left femur alone was involved. In 19G37 E6, the right femur and right tibia were affected. The changes here need not have been caused by vitamin C deficiency but possibly by trauma. As noted in the previous section, this person suffered multiple bone fractures, including a fractured right fibula. The supposed hemorrhaging in this instance might

have been the consequence of blows to the right lower limb. Similarly, an area of subperiosteal hemorrhaging in the right femur of 19G35 K1 may have resulted from trauma. This bone also featured probable traumatic myositis ossificans.

Pipemaker Tooth Wear

Twelve individuals, all male, exhibited peculiar wear patterns in the teeth that almost certainly resulted from holding a tobacco pipe that was worked back and forth through the teeth over a period of months or years. When viewed from the front, the occlusal surfaces of adjacent teeth were worn scallop-like and where upper and lower jaws could be articulated the worn teeth produced rounded openings (FIG. 14).

Where available for study, the teeth in both sides of the jaw were worn more often than not, but the right usually more prominently than the left. In the upper jaw, the wear patterns affected in varying degree and incidence the first premolars, canines, lateral incisors, and central incisors, while in the lower jaw, the wear patterns extended to include the second premolars. The youngest affected individual was 19G37 L1 at 18–21 years, and the oldest was 19G35 K12 at 65–74 years. Twenty-nine males did not exhibit the wear patterns, nor did three females for which teeth were available.

Other Changes

Along with the usual skeletal elements, the remains of three individuals included small bony elements that resembled half-casts of

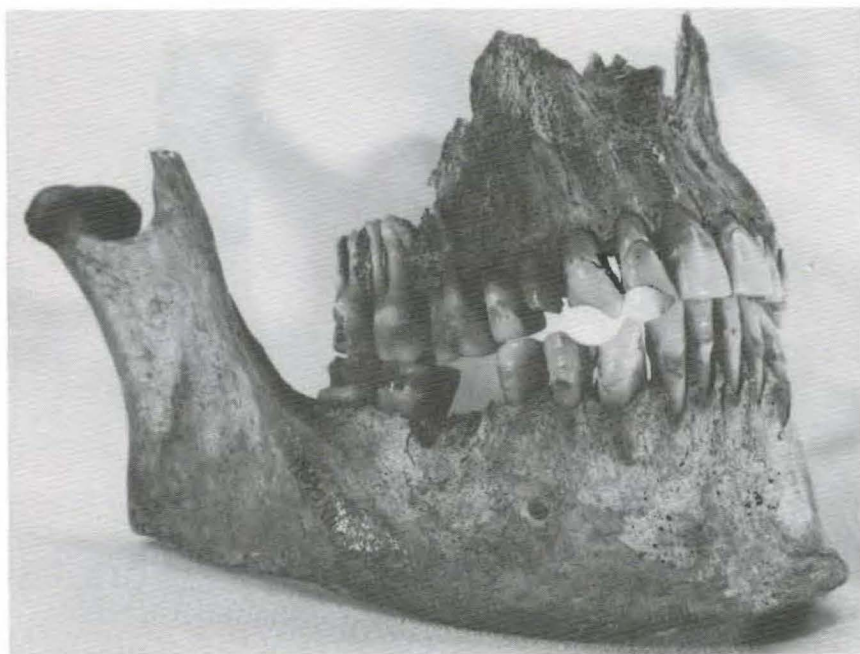


Figure 14. Pipe-smoker wear in teeth of skeleton 19G35 K11.

the tertiary bronchi (cf. Gray 1973: 1132). Three elements were with 19G35 K12, the oldest individual in the series (FIG. 15), one with 19G37 F2, aged 55–64 years, and one with 19G37 E5, 40–49 years. The elements varied from 25 mm to 34 mm long and from 3 mm to 6 mm in diameter. The significance of this finding is unknown. In life, the walls of the tertiary bronchi, those segments within the lungs, are supported with spirals, rings, and plaques of hyaline cartilage, the same type of cartilage that is an embryonic precursor to the development of most bones of the skeleton.

Two individuals featured unusually curved and short left ulnae. In 19G35 H3, the expected normal

curvature in the upper part of the shaft was exaggerated in the left bone when compared with the right, and the whole bone was 7 mm shorter. There were severe arthritic changes in the left elbow that may have been related, possibly an indication of injury, though the ulna itself did not appear broken. In skeleton 19G35 K1, the left ulna was markedly bowed laterally and 15 mm shorter than its right counterpart. In this case, there was no arthritis in the elbow.

In skeleton 19G35 H1, the right humerus and clavicle had unusual prominences suggesting anomalous development of the upper chest and shoulder muscles. The humerus featured a large, prominent, smooth-surface tubercle at the distal end of the

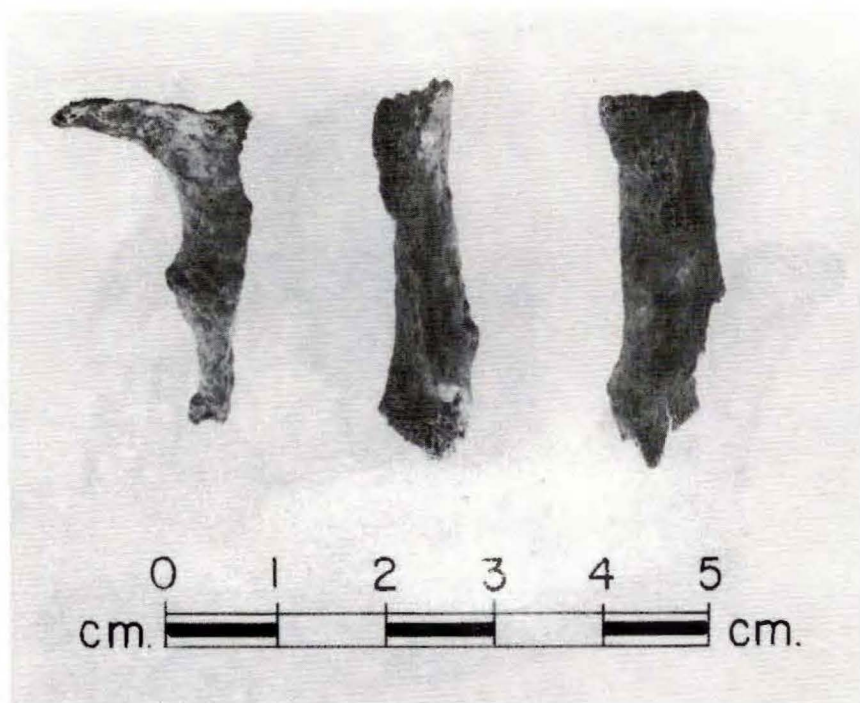


Figure 15. Suspected bronchial half-casts in skeleton 19G35 K12. Note the branching of one element and the nodular or segmental nature of the external surfaces.

crest of the lesser tuberosity, the usual location of the *teres major* muscle insertion, while the inferior border of the sternal half of the clavicle, the usual site of origin for the *pectoralis major* muscle, was greatly extended and wedge-shaped.

In skeleton 19G35 K7, aged 14–16 years, the right tibia diaphysis was stunted in its development. The bone was 11 mm smaller than the left in its anteroposterior diameter at the nutrient foramen, the shaft was notably more round with a cnemic index of 95.8 (as opposed to 71.4 for the left bone), and the length was 18 mm shorter. The fibulae could not adequately be compared for possibly related size and shape differences as

the left consisted only of fragments. All other bones in this individual appeared normal with respect to size and shape.

The left innominate bone of 19G41 C1 featured an unusual bony growth. Possibly an osteochondroma, a benign bone tumor, this was a thick, somewhat flat spur with a triangular cap emanating superiorly from the uppermost part of the iliac fossa and adjacent iliac crest.

Conclusions

It was not possible to determine the causes of death from the skeletons. The diaries revealed that most of the prisoners died of unspecified fevers,

consumption (possibly tuberculosis), dysentery, and scurvy. One person may have died of gangrene and another of hemorrhage. Many became ill on the journey to Québec from their sites of capture and subsequently died in prison. Crowded and unsanitary conditions contributed to the spread of disease, but French authorities seem to have taken some pains to minimize epidemics. A diary entry dated January 12, 1747 (Pote 1976), mentions that a prison hospital was provided, and another states that the prison rooms were whitewashed, presumably as a means of disinfection. In April, 1747, a fire broke out in the prison and the captives were housed in tents until more substantial quarters could be rebuilt. Exposure to wet, rainy weather caused many to become ill and die during this period.

The journals indicate that the prisoners were given daily rations of bread, beef, peas, and water. Occasionally, they received claret or brandy and mutton pies. Visitors often came with presents of clothes, brandy, sugar, and tobacco. Lack of vitamin C was obviously a problem, judging from the number of cases of scurvy.

Study of the skeletons has provided additional insight into the lives of these people. Estimates of age at death, sex, and race resemble a population profile intimated in the diaries. Statures were tall, comparable to that of other North American colonials. Details of the bones and teeth reflect poor dental health, perhaps occupation-related stresses on the spines of most men, traumatic injuries, possible scurvy, chronic sinus infection, and metabolic stresses during childhood. It is difficult to

know the extent to which some of these changes occurred while the people were prisoners. Some of the lesions were still active at the time of death and probably were incurred in prison (e.g., some cases of bone fracture, possible scurvy, and dental disease), while others appear to have resulted from chronic long-term stresses (e.g., Schmorl's node scars, arthritis, other cases of dental disease). Future studies of other skeletal series from this period may help to resolve these issues and would certainly provide broader insight into patterns of injury, disease, and other forms of stress that affected 18th-century populations of northeastern North America.

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earlier draft of this paper. An abbreviated version was presented at the 1988 annual meeting of the Council for Northeast Historical Archaeology, Québec City. The remains are currently housed in the collections of the Canadian Museum of Civilization and available for further research on request.

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