Final Osteoarchaeological Report

Dunkellin
(Dunkellin Flood Relief Scheme)
Kilcolgan, Co. Galway

(RMP: -)

Licence No.: 20E0407

by
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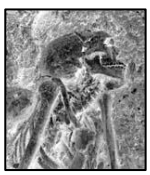

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Abstract

The skeletal remains of sixteen individuals, as well as a small quantity of disarticulated material, were excavated in Dunkellin townland, on the bank of the Dunkellin River near Kilcolgan in Co. Galway, by Dominic Delany & Associates under licence number 20E0407. The cemetery is located close to a number of known archaeological monuments. A single isolated burial had previously been excavated in the vicinity of the cemetery and is broadly contemporary.

Despite poor preservation of the skeletal remains, there were important indicators regarding the life patterns of some of the individuals buried here. In addition, a variety of burial practices were identified including double burials, three crouched inhumations (two being juveniles), and prone burial. Metal finds were also recovered from two of the burials (one being the prone, the other being an individual buried with the head to the west). Post-excavation analysis is ongoing at the time of writing. Radiocarbon dates were obtained for five of the burials, which appeared to be particularly concentrated in the sixteenth century, with at least one burial of a young juvenile dating to the seventeenth century.

List of Figures, Plates, and Tables

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Osteological Terms Used

A number of basic terms are used frequently in osteo-archaeology and these are outlined below. The definitions are taken from White and Folkens (1991, 28-35) and Bass (1995, 319-321).

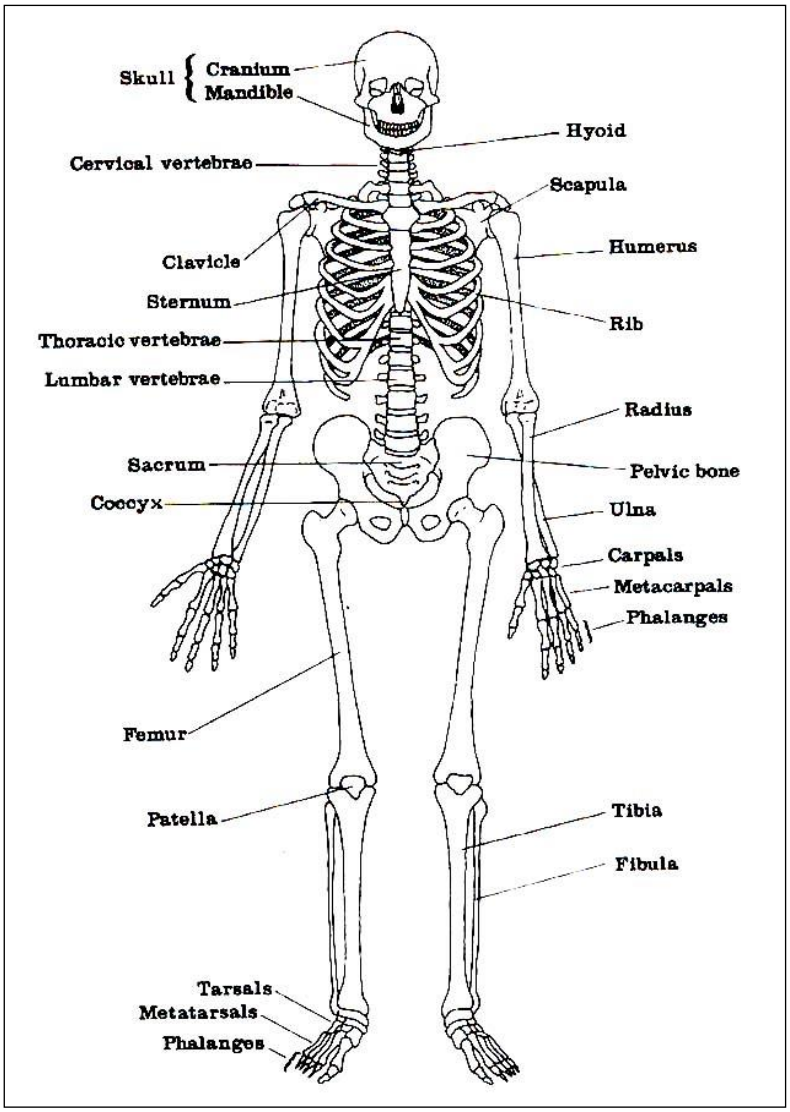


Figure 1. Annotated diagram showing main skeletal elements (after Mays 1998, 2, fig. 1.1)

Directions - General

Superior	toward the head of the body.
Inferior	opposite of superior, body parts away from the head.
Anterior	toward the front of the body.
Posterior	opposite of anterior, toward the back of the individual.
Medial	toward the midline of the body.
Lateral	opposite of medial, away from the midline of the body.
Proximal	nearest the axial skeleton, usually used for long bones.
Distal	opposite of proximal, furthest from the axial skeleton.
Palmar	relating to the hand, the palm side
Plantar	relating to the foot, towards the sole of the foot
Dorsal	relating to the hand/foot, back of the hand, top side of the foot
Endocranial	inner surface of the cranial vault.
Ectocranial	outer surface of the cranial vault.

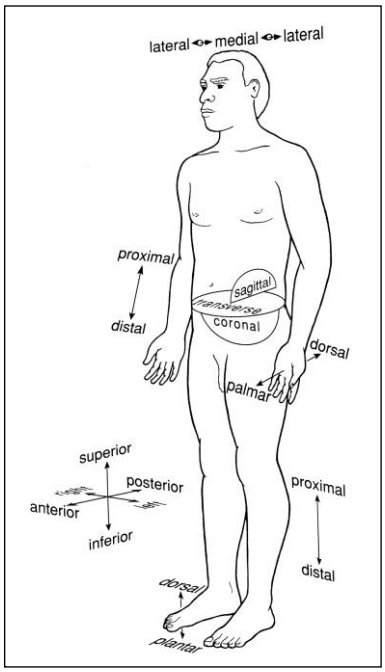


Figure 2. Anatomical directions (from White and Folkens 1991, 29, fig. 3.1)

Directions - Teeth

Mesial	toward the point on the midline where the central incisors meet.
Distal	opposite of mesial.
Lingual -	toward the tongue.
Labial	opposite of lingual, toward the lips.
Buccal	opposite of lingual, toward the cheeks.
Incisal	the biting surface of the tooth.
Occlusal	the chewing surface of the tooth.

General bone features/terms

Process	a bony eminence.
Eminence	a bony projection, usually not as prominent as a process.
Spine	generally a long, thinner, sharper process than an eminence.
Tuberosity	a large, usually roughened eminence of variable shape, often the site of a ligament attachment.
Tubercle	a small, usually roughened eminence, often a site of a ligament attachment.
Trochanters	two large, prominent, blunt, rugose processes found on the distal femur.
Malleolus	a rounded protuberance adjacent to the ankle joint.
Articulation	an area in which adjacent bones are in contact at a joint.
Condyle	a rounded articular process.
Epicondyle	a non-articular projection adjacent to a condyle.
Head	a large, rounded, usually articular end of a bone.
Shaft/diaphysis	the long, straight section between the ends of a long bone.
Epiphysis	end portion of a long bone which is expanded for articulation.
Neck	the section of a bone between the head and the shaft.
Torus -	a bony thickening.
Ridge	a linear bony elevation, often roughened.
Crest	a prominent, usually sharp and thin ridge of bone.
Facet	a small articular surface, or tooth contact.
Metaphysis	a line of junction between epiphysis and diaphysis.
Osteoblastic	process of bone formation
Osteoclastic	process of bone resorption

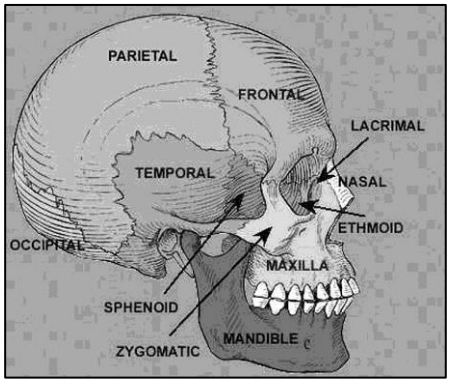


Figure 3. Bones of the skull

Other osteological terms/abbreviations

C1-C7	cervical vertebrae (neck) numbered from 1-7.
CEJ	cemento-enamel junction, junction of crown of tooth and root.
DJD	degenerative joint disease.
T1-T12	thoracic vertebrae (torso) numbered 1-12.
TMJ	tempromandibular joint, joint of lower jaw.
L1-L5	lumbar vertebrae (lower back) numbered 1-5.
S1-S5	sacral vertebrae (in between left and right pelvis) numbered 1-5.
MC-	metacarpal (bones of the palm of the hand).
MT	metatarsal (bones of the arch of the foot).
IAM	Internal Auditory Meatus in temporal bone of cranium.
EAM	External Auditory Meatus in temporal bone of cranium.
MNI	Minimum Number of Individuals.
CPR/TPR	Crude Prevalence Rate/True Prevalence Rate.
SN/s	Schmorl's nodes, depression defects in the vertebral bodies.
AMTL	Ante-Mortem Tooth Loss

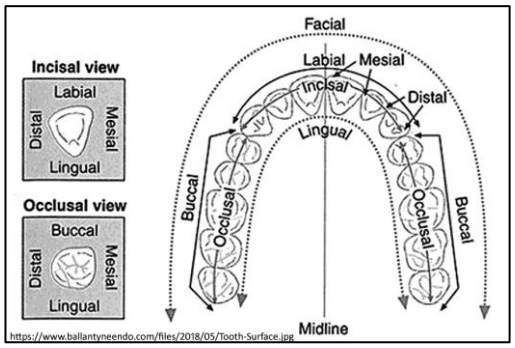


Figure 4. Dental terminology

1. Introduction

1.1 Background to Project

Licenced archaeological excavations were undertaken in July and August 2020 at Dunkellin near Kilcolgan, Co. Galway, following the discovery of human burials during previous archaeological monitoring (16E0481) at the site. The excavations were undertaken by Dominic Delany & Associates under licence 20E0419, who also undertook the monitoring. The archaeological monitoring was in relation to groundworks associated with the Dunkellin River and Aggard Stream Flood Relief Scheme, which was overtaken over a number of years. The writer was present on site for the entirety of the excavation.

The present site is located on the south bank of the Dunkellin River, immediately to the east of Dunkellin Bridge. The cemetery is close to a number of archaeological sites including Dunkellin Castle (**GA103-120002-**) and Dunkellin Church (**GA103-120003-**), both *circa* 200m to the southwest, while a large enclosure (**GA103-102----**) and an inauguration site (**GA103-102001-**) are both located a similar distance away to the northwest. Human remains were previously discovered in the vicinity of the present burials, revealed during earlier monitoring by D. Delany for the same Flood Relief scheme. These comprised the isolated remains of a single young adult male. The writer was also involved in the excavation and osteoarchaeological analysis of that individual. Although somewhat truncated, there was clear evidence that he has suffered from severe scoliosis of the spine, leading to considerable physical deformities (Lynch 2018a). That individual returned a date of between cal AD 1449-1630 (D. Delany, pers. comm.).

Samples from five burials were selected for AMS dating. They were submitted to the ^{14}Chrono Centre in Queen's University Belfast, following the receipt of the necessary licenses for export and alteration from the National Museum of Ireland. The results are summarised in **Table 1**, courtesy of D. Delany**.** The returned dates of four of the burials spanned the latter part of the fifteenth century through to the mid-seventeenth century, with an apparent strong concentration on the 1560s. The youngest juvenile (SK16) returned a later date, with a median probability of 1655.

Table 1. Accelerator Mass Spectrometry (AMS) Results

Lab ID	SK (sex, age-at-death)	Selected Sample Detail	Weight	Radiocarbon Age (BP)	Calibrated Date (95% confidence)1	Median Probability
UBA-48359	SK03 (9-12 yrs)	Fragment of diaphysis of right radius	3.2g	333+/-19	cal AD 1489-1637	1566
UBA-48360	SK04 (?male, 35-39 yrs)	Fragment of the left femoral shaft, from the posterior, just inferior to the area of the lesser trochanter	4.2g	320+/-20	cal AD 1496-1641	1562
UBA-48361	SK08 (?female, adult)	Fragment of the posterior of the distal diaphysis of the left femur	8.8g	341+/-21	cal AD 1477-1635	1565
UBA-48362	SK15 (?, adult)	Two fragments of the right tibia	5.3g	323+/-21	cal AD 1494-1640	1562
UBA-48363	SK16 (2-4 yrs)	Fragment of the midshaft of the left femur	3.2g	247+/-21	cal AD 1539-1950	1655

1.2 Scope of Study

This report details the osteoarchaeological analysis of fifteen *in situ* burials and one *ex situ* individual, as well as a very small quantity of disarticulated human bones, that were recovered during the recent excavations at Dunkellin.

Regarding the osteoarchaeological aspect, there is a brief outline of the materials (that is, the bones) that were examined (**Section 1.3**). The methodology utilised in the study is presented in **Section 1.4**. The results of the osteological analysis are presented in **Section 2**. A summary and discussion of all the results are provided in **Section 3**, while the conclusions of the present study are provided in **Section 4**. The burials are catalogued in **Section 6.1**, while the metrical information is provided in **Section 6.2**. The disarticulated elements are detailed in **Section 6.3**, while the full AMS results are provided in **Section 6.4**.

1.3 Materials

A total of 15 *in situ* burials and the remains of one *ex situ* individuals were identified and excavated at Dunkellin. A very small quantity of disarticulated remains was also recovered. The burials were numbered from 'SK01' through to 'SK16', with the *ex situ* remains also allocated a burial number, as it clearly represented the redeposited remains of a single individual. As such, SK01 will be regarded and assessed as a single individual, along with all of the other burials, throughout this report, rather than as a random collection of disarticulated material.

All of the skeletal remains (including those of the *in situ* burials and disarticulated remains) were processed by the writer in post-excavation following the recommended standards (Buckley *et al.* 1999). The writer was furnished with all on-site recording forms, photographs, and plans prior to the commencement of the osteoarchaeological analysis.

The level of preservation of each individual skeleton was recorded during the excavation as well as in the post-excavation osteoarchaeological analysis. It was apparent from even the initial stages that the level of preservation on the site was poor overall. Despite careful excavation, recovery, and processing, considerable fragmentation was unavoidable. It was possible to measure long bone length

in just two adults (**Section 6.2.2**) and three juveniles (**Section 6.2.3**); two of the latter were young infants, which suggests that smaller bones had a better chance of surviving intact. While erosion of bones was evident, particularly of elements of the torso, fragmentation was significant. Some of the grave fills, for example, that of SK05 (male 15-16 years), contained a high amount of angular stones, which would have impacted the preservation of the skeletal remains and certainly contributed towards at least the fragmentation. In addition, it was apparent during the excavation that any skeletal remains that lay directly on bedrock, had a very poor survival rate. For example, in the case of SK08 (female adult), there almost no bone survived where the body clearly directly overlay the bedrock. Actual truncation of remains was minimal and the quantity of disarticulated human remains was very low (see below). During the initial topsoil stripping of the site, the cranium of burials was frequently the first skeletal element exposed. In those cases, these disturbed fragmented were bagged up, in order to protect them, but were always associated with the original burials rather than being recorded as disarticulated. The remains of SK01 (female 25-30 years) were the exception in comparison to the other burials at the site, which, as mentioned above, suffered significant fragmentation but little truncation. It appears that this burial (SK01) was inadvertently disturbed during the initial site works of the development and was recovered in a disarticulated *ex situ* state. Although incomplete, the bones themselves were actually very well preserved.

During the osteoarchaeological analysis the level of preservation of each skeleton was classed as either ‘very poor’, ‘poor’, ‘good’, or ‘very good’. The first refers to skeletal remains that are either highly incomplete and/or highly fragmented and/or highly eroded. The ‘very good’ refers to a skeleton that is virtually complete and well preserved, with little fragmentation and erosion. The middle two classifications are variations of these two extreme ends. In total, 93.8% of the 16 skeletons from Dunkellin were classed as either ‘poor’ (*n* 8) or ‘very poor’ (*n* 7), in terms of preservation, with just a single skeleton, SK03 (9-12 years) classed as ‘good’. The poor preservation somewhat impacted the osteoarchaeological analysis.

Just three individual collections were recorded as disarticulated remains. These included a surface find, as well as two separate collections of remains gathered during the initial exposure of SK01 and SK02. These remains cannot be confidently linked back with either of those burials and, as such, are considered as general disarticulated human skeletal remains from this burial site.

1.4 Methods

The analysis of human skeletal remains from archaeological contexts can provide information on demography, health, diet, disease, trauma, and possible genetic variations and relations, as well as data on sociological and cultural trends. Standardised methods of assessing the osteological aspects of various skeletal populations allow for comparisons and contrasts to be made across both space and time. When the osteological information is broadened using a bioarchaeological approach, the results of osteoarchaeological analysis can yield detailed and invaluable information. The keys to this approach are firstly the use of standardised methods of analysis, and secondly the size and level of preservation of the skeletal population in question. The assessments of age-at-death, sex, stature (with the latter three often referred to as biological profiling), and dental remains are the primary methods that have been standardised. The methods of biological profiling have generally been formulated using data from known populations.

The ages-at-death of the adult individuals from Dunkellin were determined, where possible, in the basis of the morphology of the auricular surface of the ilium (Lovejoy *et al.* 1985) and on the pubic symphysis (Brook and Suchey 1990). Rates of fusion of secondary epiphyses were used in relation to younger adults (Schaefer *et al.* 2009; Scheuer and Black 2000). The method of assessing the rates of dental attrition to determine age-at-death (Brothwell 1981, 71-2) was not utilised in this study; dental attrition may be affected by a wide variety of factors, such as individual mastication (chewing) traits, dietary preferences, and access to foodstuffs, and the method may only be truly relevant to early populations. As such, it should only be used as an estimate of age-at-death in extreme circumstances. Archaeological adult skeletons cannot be aged very accurately and are assigned into broad age categories. These are ‘young adult’ (18-25 years), ‘middle adult’ (26-44 years), and ‘old adult’ (45+ years). The method used for each individual is provided in the catalogue in **Section 6.1**.

Regarding biological sex, females tend to be slender and small, with marked particular traits in the pelvis for the birthing process, while males tend to be larger and more robust. The biological sex of the adult individuals was determined on the basis of morphological traits in the pelvis and skull (Buikstra and Ubelaker 1994) and on metrical analysis (Bass 1995). The methods used in the determination of the sex of each adult are provided in the catalogue in **Section 6.1**.

The methods used in the determination of the age-at-death of juvenile individuals are more accurate and specific than those used for adult individuals, and are assessed on the basis of the known rates of growth and development of parts of the skeleton and the dentition (Schaefer *et al.* 2009; Scheuer and Black 2000). One of the most reliable methods is to assess the calcification and eruption of teeth (Moorrees *et al.* 1963a; 1963b; Smith 1991). The lengths of the long bones may also be used to determine the age-at-death (Maresh 1970; Scheuer and Black 2000), but diaphyseal length may be highly influenced by nutritional factors. However, long bone length may be a very reliable indicator of age-at-death in very young infants (Scheuer *et al.* 1980). As with young adults, the rates of epiphyseal fusion may also be used in the determination of age-at-death in juveniles (Schaefer *et al.* 2009; Scheuer and Black 2000). Juveniles may be grouped together under the broader age ranges of 'infant' (<1 year), 'juvenile1' (1-6 years), 'juvenile2' (7-12 years), and 'adolescent' (13-17 years). The methods utilised to determine the age-at-death of each individual is provided in **Section 6.1**. It is not possible to accurately determine the sex of juvenile individuals as the sex-specific morphological bone manifestations do not develop clearly until the onset of puberty.

The statures of the adults were estimated following the standards recommended by the British Association for Biological Anthropology and Osteoarchaeology or BABAO (Brothwell and Zakrzewski 2004). The crown-to-heel length of SK09 was estimated using the regression equations of Fazekas and Kośa (1978).

Permanent teeth were recorded using the following chart:

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

right *left*

The upper row represents the maxilla and the lower row represents the mandible. These are further sub-divided into left and right quadrants. Each permanent tooth (1-8) is prefixed by the number of the quadrant it belongs to (1-4).

Deciduous ('milk') teeth were recorded using the chart below:

55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	72	73	74	75

right *left*

Again, the upper row represents the maxilla while the lower row represents the mandible, and is subdivided into left and right quadrants. Each deciduous tooth (1-5) is prefixed by the number of the quadrant it belongs to (5-8). In some instances, a combination of the two charts was used.

The following symbols can be used to record the teeth:

P - *tooth present*	B - *tooth broken post-mortem*
E - *tooth erupting*	PM - *tooth lost post-mortem*
U - *tooth unerupted*	AM - *tooth lost ante-mortem*
CA - *tooth congenitally absent*	R - *root only*
~~12~~ - *socket absent*	

All incidences of dental diseases such as calculus, caries, abscesses, enamel hypoplastic defects, as well as any other anomalies, were also recorded and are detailed in catalogue (**Section 6.1**) and the relevant areas in **Section 2**.

A number of pathological conditions were observed on the bones, and again, these are detailed in catalogue (**Section 6.1**) and the relevant areas in **Section 2**.

A catalogue of the skeletons from Dunkellin is provided in **Section 6.1** (standardised for all articulated assemblages examined by the writer and with a summary at the start). It details the age-at-death, sex, and stature (including the methods of determination) of each individual, if determined. It also summarises the level of preservation, the *in situ* position, attitude, and orientation of the burial, whether there were any other skeletons directly associated and whether there were any finds. It details what bones and teeth have survived, and the pathological lesions and dental diseases that may have been observed. Any anomalies are noted and any additional comments are also included. A schematic diagram of the surviving skeletal elements of each individual is also provided. Basic metrics are also provided for each individual (**Section 6.2**).

A catalogue of the very small quantity of disarticulated bones recovered is provided in **Section 6.3**. A Microsoft Access database package was used for the catalogue. Most individual bones were given a unique identification number (ID). For example, each tooth and the bone of a mandible are given a unique identification number. This enables total bone counts to be more accurate and helps in matching bone fragments together. There were some exceptions in the cataloguing where, for example, several cranial vault fragments were all allocated a single ID number (for example ID1002 comprises 10 juvenile cranial fragments). In total, 32 entries are listed in the inventory. This represents a total of 137 individual bones, fragments of bone, or teeth, with fragments of the cranium, ribs, vertebrae, and small, unidentified, elements being grouped together.

Thirteen fields were used to compose the database. The 'ID number' is the first field of the database (*n.b.* none of the bones were physically marked during the analysis). This is followed by a field listing the 'Detail' of recovery. Then, each bone, bone fragment, or tooth, is recorded by 'Skeletal Element' and 'Code', (based on Chamberlain and Witkin 2000, see Section 6.3). The 'Side' from which the bones is from is also recorded. The age-at-death is recorded under 'Age1' (Adult 'AA' or Juvenile 'JUV') and 'Age2' ('INF' infant <1 year; 'JUV1' 1-6 years, 'JUV2' 7-12 years; 'ADOL' adolescent 13-17 years; 'YA', young adult 18-25 years; 'MA', middle adult 26-44 years; and 'OA', old adult 45+ years), with the specific age-at-death, if estimated, provided in 'Age3'. The 'Sex' of the individual, if estimated, is recorded. The age-at-death and the sex estimations generally use the same methods as those applied to complete skeletons, although the process is clearly more limited in disarticulated remains. Any 'Skeletal' and 'Dental' conditions are noted. There is a field for further 'Notes', which generally provides some detail on the bone or tooth, as well as noting any possible links with other fragments. The final field lists the number of fragments assigned to each individual ID number, as already described above.

All of the raw osteological data on the human skeletal remains excavated from Dunkellin is housed with the writer. The skeletal remains will be returned to the client and the curation will be determined by the National Museum of Ireland.

2. Analysis

The results of the osteoarchaeological analysis of the 16 burials is presented below divided into relevant sections. A small quantity (137 in total) of disarticulated bones, fragments of bones, and teeth (**Section 6.3**) were also recovered that could not confidently be reassociated with any of the burials. These were primarily recovered during the initial exposure of SK01 and SK02 in particular, as well as a few fragments recovered as general surface finds. While no skeletal pathological lesions were present on any of the disarticulated material, there were dental anomalies, and these are referred to below (**Section 2.3**).

Both adult and juvenile remains were represented in the disarticulated remains. When considered as a whole, a single adult was present, represented primarily by a fragment of a navicular (from the foot) (ID1019) and a number of cranial vault fragments (ID1011), with the latter representing a male individual. Most of the disarticulated remains were juvenile in origin. The teeth indicate at least four juveniles. There is one adolescent individual (ID1020, an upper right permanent molar), one juvenile aged approximately 6-7 years (ID1027, an upper left second deciduous molar, and ID1028, and upper left first permanent molar), and two younger individuals. One of the latter was aged approximately 2 years old (ID1029, an upper right second deciduous molar, and ID1030, an upper right second premolar), while the other was aged between 2-4 years (number teeth, ID1008-1017).

The tooth from the possible adolescent, is likely to be from SK3 (9-12 years). The disarticulated teeth from the 6-7 year old, initially do not seem to tally with the age ranges of any of the burials. However, they are likely to originate from SK02 (9-10 years), whose *in situ* remains not only lacked those teeth, but also exhibited hypoplastic defects as identified in the disarticulated teeth (see **Section 2.3.6**). The two young juveniles are slightly more problematic. In terms of the 2 year old, it is actually just a single tooth (ID1029, an deciduous upper right second molar) which confirms his/her presence. This is

because it is a duplicate of the same tooth identified from the second young juvenile; otherwise the second premolar also attributed to the 2 year old could be classed as being from the 2-4 year old individual represented by most of the disarticulated teeth. Both sets of dental remains of these young juveniles were recovered during the exposure of SK01 and SK02. SK01 is a female aged 25-30 years and so the teeth do not originate from her. SK02 is a 9-10 year old, and certainly the teeth do not come from that individual either. There are two *in situ* individuals who were aged between 2-4 years at the time of death, SK13 and SK16. However, both of these already have the deciduous upper right second molars. SK10 was aged between 3-5 years at the time of death and is missing the deciduous upper right second molar. It is possible that at least one of the disarticulated teeth may be from that individual and that the other set of dentition are from an unidentified burial. At the time of recovery of these disarticulated remains, SK10 had not yet been uncovered. Therefore, if one of the disarticulated teeth did originate from that individual, the truncation happened in antiquity. However, it is also possible that the disarticulated dental evidence of two individuals aged between 2-4 years at the time of death are evidence of two other burials that were previously truncated and for which no *in situ* remains survive.

2.1 Demography

Sixteen burials were excavated at Dunkellin, including the *ex situ* remains of SK01. There were seven adults and nine juveniles. In the adult population, there were four females (includes those identified as 'female' and 'possible female') and two males (includes those identified as 'male' and 'possible male'), while it was not possible to determine the sex of one of the adults (SK15 ?sex adult). It was possible to determine the age-at-death of just five of the adults, three females and two males. One of the females was a young adult, while the two females and the two males were all 'middle adults', that is, aged between 26 and 44 years at the time of death. No older adults (45+ years) were identified (see **Table 2**).

The juveniles presented with a greater range of ages across that cohort. There were two infants, three young juveniles, two older juveniles, and two adolescents. The individuals are detailed in **Table 3**.

Table 2. Age-at-death and sex of Dunkellin adults

Age group	Female	Male	Sex undetermined
Young adult (18-25 yrs)	SK07 (female 18-23 yrs)		
Middle adult (26-44 yrs)	SK11 (?female 3—34 yrs) SK01 (female 25-30 yrs)	SK04 (?male 35-39 yrs) SK12 (male 30-45 yrs)	
Old adult (45+ yrs)	-	-	
Age undetermined	SK08 (female adult)		SK15 (?sex adult)

Table 3. Age-at-death of Dunkellin juveniles

Age group	Individuals
Infant (<1 yr)	SK09 full-term SK14 preterm
Young juvenile (1-6 yrs)	SK10 3-5 years SK13 2-4 years SK16 2-4 years
Older juvenile (7-12 yrs)	SK02 9-10 years SK03 9-12 years
Adolescent (13-17 yrs)	SK05 male 15-16 years SK06 possible male 13-16 years

2.2 Stature

It was possible to determine the statures of just two adult individuals from Dunkellin, both female individuals. The estimated living stature of SK01 (female 25-30 years) was 156.9cm, while the height

of SK07 (female 18-23 years) was 164.0cm, giving an average female stature of 160.5cm. The date of these burials appears to span the latter part of the medieval period, into the post-medieval period. The limited stature evidence from Dunkellin, is shown in **Table 4**, with some other broadly contemporary sites for comparison.

This suggests that the females buried at Dunkellin were relatively tall in comparison to many of the average female statures certainly in the medieval period, and also in the Late and post-medieval periods.

Table 4. Comparative stature estimates from a selection of Medieval and later Irish sites

Site (reference)	Period	Female (cm)	*n*
Dunkellin, Co. Galway	**Late Med./Early Post-med?**	**160.5**	***2***
St Mary's, Kilkenny (Lynch 2018c)	Medieval	150.1	4
St Mary's Lane, Kilkenny (Strid 2003)	Medieval	159.3	1
Boyle Abbey, Co. Roscommon (Lynch 2022)	Medieval	156.5	50
St Mary's Cathedral, Tuam, Co. Galway (Lynch 2005)	Medieval	157.8	9
St Peter's Church, Waterford (Power 1994)	Medieval	160.4	?
St Mary's of the Isle, Cork (Power 1995)	Medieval	157.0	6
Dominican Priory, Drogheda (Halpin and Buckley 1995)	Medieval	155	?
St Mary's, Kilkenny (Lynch 2018c)	Post-medieval	-	-
Athboy, Co. Meath (Shine and Travers 2011)	Late Med./Early Post-Med.	163.4	?
Tintern Abbey (Ó Donnabháin 2010)	Late Medieval	159.8	16
Multiple workhouses (Lynch 2014)	Post-medieval	157.3	16
Multiple middleclass (Lynch 2014)	Post-medieval	160.9	14
St Anne's, Cork City (Lynch 2014)	Post-medieval	157.5	53
St Anne's, Cork City (Lynch 2014)	Post-medieval	157.5	53

It was possible to estimate the crown-to-heel length of SK09 (full-term infant) as 50.8cm.

In addition, it was noted during the analysis that, overall, the measurements taken on the *in situ* femur of SK2 (9-10 years), appeared to be quite short in comparison to the age determined from the dentition. Although of course on-site measurements are not as accurate as those recorded in the laboratory environment; however, it is possible that SK2 was relatively short for her/his age.

2.3 Dental Remains

In the adults, dental remains were recovered with six of the seven adults. The exception was SK15 (?sex adult). The dental remains from SK08 (female adult), were recovered *ex situ* (that is, in the immediate area of SK8, where there were no other adjacent individuals). The six adults with dentitions indicate the potential of 192 teeth (32 permanent teeth/adult), or 224 teeth if all seven adults are considered. In actuality, 125 (including two root fragments from SK08 (female adult), which represent a minimum of one molar tooth) permanent teeth were recorded from the six individuals, while two deciduous teeth were also retained in SK07 (female 18-23 years). The poor preservation highlighted earlier (**Section 1.3**), is starkly indicated in the numbers of observable dental sockets in the adult population; just three individuals (SK04 male 35-39 years, SK07 female 18-23 years, and SK08 female adult) had preserved dental sockets, numbering 17 in total. The alveolar bone, which forms the sockets for the teeth, where either highly fragmented and unidentifiable or was simply not preserved in the remaining adults. This hampered the assessment of factors such as ante- and post-mortem tooth loss, as well as the congenital absence of teeth. In fact, no example of the former was identified, one individual (SK08 female adult), had lost evidence of a tooth lost post-mortem, while a single individual was identified that had a congenitally absent tooth (SK07 female 18-23 years, the lower right third molar). The very poor preservation of the alveolar bone in the adult population also has implications in the identification and recording of certain dental conditions such as periodontal or gum disease and dental abscesses.

In the juvenile population, dental remains were recovered with all except g (pre-term infant). In total, there were 38 erupted and one unerupted deciduous teeth. Regarding the permanent dentition in the juvenile individuals, there were 65 erupted, 12 erupting, and 38 unerupted teeth. As with the adult individuals, the alveolar bone (tooth sockets) was poorly preserved in the juvenile population, but post-mortem tooth loss was identified in at least one individual (SK16, 2-4 years). Similar to SK07 noted

above, SK05 (male 15-16 years) retained the root of the lower right deciduous second molar for longer than normal.

As mentioned at the start of **Section 2**, quite a number of dental remains were recovered in a disarticulated state. In all, 15 teeth were recovered, all representing juvenile individuals. Eleven of the teeth were deciduous, while four permanent teeth were recovered.

2.3.1 Attrition

Rates of attrition, or dental wear, were recorded for every tooth, with the least recorded as '1' and the most excessive, with no enamel remaining, recorded as '8' (based on Smith 1984; referenced in Buikstra and Ubelaker 1994, Fig. 25, 52). This is perhaps most pertinent to molars as wear on the anterior teeth can be related in particular to the actual bite a person may naturally have, such as overbite or underbite. The assessment of rates of attrition is a general indicator as it is impacted by individual traits, access to, and/or preference for, certain foodstuffs, as well as survival of the tooth to analysis stage, amongst other aspects.

Most adults showed some degree of attrition, although the wear on the teeth of the youngest adult SK07 (female 18-23 years) was very mild. No excessive attrition (level 8) was identified, although this may be particularly related to the apparent lack of old adults (45+ years) in the population as well as the rather incomplete nature of the dental remains. The greatest degree of attrition was recorded in SK04 (male 35-39 years), who was also the oldest individual identified in this group.

No excessively abnormal attrition was observed in the juveniles.

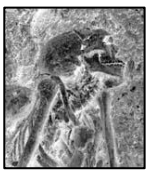
2.3.2 Calculus

Calculus, or calcified plaque, is often the most frequently observed dental disease on archaeological teeth. The deposits can be generally removed through good dental hygiene using for example a small brush or stick, but the deposits may also be inadvertently removed through the consumption of grittier foods. Excessive calculus deposits in a population may suggest both poor oral hygiene and the possible consumption of quite a soft and sucrose-based diet (Roberts and Manchester 1995, 55). The aetiology is multi-causal but its formation is aided by alkaline in the mouth, and is linked with both a high protein

diet and the consumption of a soft, sucrose-based diet (Lieverse 1999; Roberts and Manchester 1995). The deposits are most common on the lingual (tongue) aspect of the lower anterior teeth (the teeth at the front of the mandible) as this is the most alkaline area of the mouth (Waldron 2009, 241). However, the deposits also commonly occur on the lingual aspects of the lower molars. When the deposits occur below the cemento-enamel junction (CEJ) in particular, they are termed as sub-gingival. This is typically indicative of at least some degree of gum resorption and possibly of periodontal or gum disease.

Calculus was identified in the dentitions of five of the six observable adults (83.3%), see **Plate 1** and **Plate 3**. The exception was SK01 (female 25-30 years); however, just a single tooth was recovered from that individual. In terms of the other five individuals, in total 101 teeth were involved, representing 80.8% (101/125) of observable permanent teeth in adult individuals (excluding the deciduous teeth recovered with SK07, female 18-23 years). In general, the lesions varied from slight to moderate in severity. The exception was SK08 (female adult), who exhibited severe deposits on a number of teeth (also see **Section 2.3.3**). Subgingival deposits were identified in all five observable adults.

Plate 1. SK08 (female adult), severe calculus deposits on mandibular teeth



In the eight observable juvenile individuals, calculus deposits were present in the dentitions of four individuals. The youngest was SK13 (2-4 years), while the other three individuals were an older juvenile (SK03, 9-12 years) and both adolescents (SK06, possible male 13-16 years and SK05, male 15-16 years). Mild to moderate deposits were identified in all four individuals.

One of the disarticulated deciduous teeth (ID1027, an upper left second molar), from an individual aged approximately 6-7 years, had slight calculus deposits,

2.3.3 Carious lesions

Carious lesions (cavities in the enamel of the teeth) were recorded in a number of adult dentitions. Bacteria, that is naturally contained in plaque, can metabolise certain carbohydrates into an acidic waste. Over time this can dissolve the enamel of the teeth resulting in cavities (Mays 1998, 148). Sugars are particularly known to the cariogenic, as are refined carbohydrates (Hillson 1986, 293; Woodward and Walker 1994). The frequency of dental caries has increased over time, particularly with the increased consumption of refined foods from the post-medieval period onwards. Carious lesions begin as staining of the enamel and can progress to complete destruction.

Four of the six (66.7%, crude prevalence rate, two females, two males) observable adult individuals had caries. The numbers of teeth involved ranged from one through to seven. In total 10.4% (true prevalence rate, 13/125) of observable permanent teeth were affected. The lesions recorded in most of the adults were small to medium in severity. However, SK08 (female adult) stands out both in the prevalence of teeth affected by caries and by the severity of the lesions (**Plate 2**). At least seven of her teeth were affected, with the crowns of at least two teeth completely lost. This individual was also the only individual to exhibit severe carious lesions (see **Section 2.3.2**). The burials date to the late medieval/early post-medieval period, and the carious prevalence rates are compared with some contemporaries in **Table 5.**

Plate 2. SK08 (female adult), carious lesions, including entire crowns destroyed

Table 5. Comparative data on caries from a selection of broadly contemporary Irish sites

Site	Reference	Period	Caries prev. by individual (%)	Caries prev. by no. of teeth (%)
Dunkellin, Co. Galway	**-**	**Late Med./Post-med.**	**66.7**	**10.4**
Boyle Abbey, Co. Roscommon	(Lynch 2022)	Medieval	39.6	5.7
St Peter's Church, Waterford	(Power 1994)	Medieval	33.1	4.9
St Mary's of the Isle, Cork	(Power 1995)	Medieval	33.6	4.9
Dominican Priory, Drogheda	(Halpin and Buckley 1995)	Medieval	46.7	5.6
Tintern Abbey	(Ó Donnabháin 2010)	Late Medieval	68.8	13.7
Multiple workhouses	(Lynch 2014)	Post-medieval	90	37.4
Multiple middleclass	(Lynch 2014)	Post-medieval	74.2	13.5
St Anne's, Cork City	(Lynch 2014)	Post-medieval	73.5	17.7

It is clear that the prevalence rates in the Dunkellin individuals are certainly greater than the average prevalence rates in a number of Irish medieval populations. However, neither do they mimic the very high prevalence rates present in post-medieval populations. The prevalence rates of caries in the Dunkellin adults, mimics very much the radiocarbon results, and are reflective of a diet beginning to exhibit a much higher degree of processed carbohydrates than in the previous medieval diet. Indeed, the only two adults *without* carious lesions were SK01 (female 25-30 years), represented by a single tooth, and SK07 (female 18-23 years); in both instances any lack of caries is understandable, either because of the highly incomplete nature of the dentition or the youth of the individual. This suggests that the prevalence rates may actually be a little under the lower than the reality.

Carious lesions were observed in the dentition of a single juvenile; two deciduous teeth in SK03 (9-12 years) has small lesions.

2.3.4 Periodontal Disease

Periodontitis occurs when the gums become inflamed (gingivitis) and may transfer to the underlying alveolar bone (periodontitis) (Roberts and Manchester 1995, 56). The bone may resorb significantly and can ultimately lead to tooth loss. The inflammation is caused by pathogenic bacteria in dental plaque (Waldron 2009, 239). However, deposits of calculus, in particular, can aggravate the problem. It is most typically identified through observing the degree of resorption in the alveolar bone. As mentioned above however, the alveolar bone was very poorly preserved in almost all individuals in this population, with dental sockets only surviving in two adults. However, it was noted (**Section 2.2.1**) that all observable adults had at least some degree of subgingival deposits of calculus, which suggests that there was at least some gum resorption. However, this cannot be assessed in detail.

No periodontal disease was observed in the juvenile population.

2.3.5 Dental Abscesses

Dental abscesses can occur through attrition or wear of the enamel, through caries, or through trauma. The exposed pulp cavity may then become infected by bacteria. The pus resulting from the infection extrudes from the area of the root out through the alveolar bone via a sinus drain. The abscess can occur externally on the maxilla or mandible, or it may drain inwards, particularly into the

maxillary sinuses, and can cause a variety of other physiological problems. Dental abscesses are particularly linked with the development of caries in modern populations, rather than attrition, due to the change to a softer diet in recent centuries.

No instances of dental abscesses were recorded in any individual from Dunkellin; this may be entirely down to poor preservation of alveolar bone, which may be the only way to identify dental abscesses in skeletal remains.

2.3.6 Dental Enamel Hypoplastic Defects

These lesions manifest as a depressed line, or series of lines, or pits, on the surface of the enamel of the tooth. They occur as a result of a disturbance to the growth of the organic matrix, which is later mineralised to form enamel. Crucially, they are typically only visible if an individual has survived the physiological stress and the enamel begins to growth again. The teeth develop in the juvenile years; therefore, the defects are an indication of childhood stresses. It is possible to estimate the timing of the stress based on the location on the tooth. The cessation in enamel development can occur as a result of a number of diseases and/or nutritional deficiencies including diarrhoea, parasitic infestations of the gut, scurvy, rickets, allergic reactions, and general malnutrition, as well as being associated with birth trauma (Hillson 1986; Mays 1998, 158; Waldron 2009, 244).

Hypoplastic defects were observed on a single adult individual, SK07 (female 18-23 years), where lesions on three teeth indicated she endured some physiological stress between the ages of approximately 2.5 and 3.5 years. This is a prevalence of 20% (1/5) of observable adults.

In contrast, the dental defects were present in 37.5% (3/8) of observable juveniles. SK02 (9-10 years) suffered stress during the first year of life, with a possibly associated disarticulated tooth (see below) suggesting stress in the second year of life also. The other two individuals provided more substantive evidence of repeated stresses. SK03 (9-12 years) appears to have had two distinct episodes between the ages of approximately 3.5 and 4.5 years, while SK05 (male 15-16), underwent stresses in the second and fourth years of life.

Two disarticulated teeth also exhibited hypoplastic defects. A permanent upper left first molar (ID1028), tentatively identified as a 6-7 year old, but possibly actually originating from SK02 (9-10

years), had a hypoplastic pitting, indicating stress at approximately 1.5 years. Severe hypoplastic defects were present in the developing crown of a permanent upper right canine (ID1017), from an individual aged between 2-4 years at the time of death. The defects suggested repeated stresses from approximately 1.5 to the time of death.

2.3.7 Dental Anomalies

As mentioned earlier (**Section 2.3**) one adult, SK07 (female 18-23 years), had retained both lower deciduous second molars (**Plate 3**), so that the second premolars had not erupted at the time of death (assuming these teeth were actually present to begin with). In addition, SK05 (male 15-16 years) had retained part of the root of the lower right deciduous second molar (**Plate 4**). Neither of these anomalies would have had an impact on the lives of these individuals.

Plate 3. SK07 (female 18-23 years), right mandible, calculus and retention of deciduous 2nd molar,

Plate 4. SK05 (male 15-16 years), right mandible, retention of root of deciduous 2nd molar

Chipping was observed in the surviving dentitions of a number of adult individuals. SK04 (male 35-39 years) had five teeth affected, primarily in in posterior teeth (molars), three of the anterior teeth of SK07 (female 18-23 years) were chipped, while a mixture of 11 teeth (anterior and posterior) of SK12 (male 30-45 years) were involved. The significance, or not, of dental chipping being present in both observable male adults (2/2, 100%), in comparison to a third of observable females (1/3, 33.3%), cannot be assessed on the low number of individuals involved. However, that variation is quite a common finding in archaeological populations (Scott and Winn 2011). Dental chipping can occur accidentally; however, it may also be linked to the occupational use of teeth and therefore possible differences in work practices between females and males. Chipping may also be related to diet; there was a decrease in the prevalence of chipping from medieval to post-medieval times in a European sample, which was linked to a softening of the diet (Scott and Winn 2011).

Finally, a tiny enamel pearl was observed on the distal aspect of the root of the upper left third molar of SK08 (female adult) (**Plate 5**). These are normal, and benign, variants.

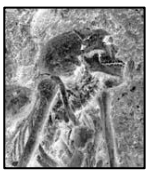
Plate 5. SK08 (female adult), enamel pearl on distal aspect of upper left third molar

2.4 Skeletal Pathological Lesions

A limited number of skeletal pathological lesions were identified in the Dunkellin assemblage. This is likely related particularly to the poor preservation of the remains. In the adult individuals, pathological lesions were observed on four individuals: SK04 (possible male 35-39 years), SK07 (female 18-23 years), SK08 (female adult), and SK12 (male 30-45 years). The numbers of individuals involved, combined with the poor level of preservation make quantifying prevalence rates problematic and, essentially, unfeasible. Two of the juveniles, both adolescent, exhibited pathological lesions.

2.4.1 Degenerative Joint Disease

Degenerative joint disease or DJD is one of the most commonly observed skeletal pathological lesions in archaeological skeletal remains. Its onset tends to be age-related and it primarily occurs as a result of repeated 'wear and tear' on the joints through degeneration of the articular cartilage (Ortner and Putschar 1981, 419-20). It may be accelerated by occupational activities and/or trauma. In skeletal remains the disease manifests as porosity or pitting of the joint surface and/or additional bone



growths or osteophytes, often around the margins. In more advanced cases, eburnation (polishing of the bone) can occur as the bones of the joint rub off each other. Its presence is pathognomonic of osteoarthritis (Rogers and Waldron 1995).

Three of the adults (3/7 or 42.9%) presented with evidence of DJD. As mentioned above, it is not possible to properly assess the prevalence rates, either by age-at-death, sex, and/or individual joint. In the case of all three individuals (SK04, possible male 35-39 years, SK08, female adult, SK12 male 30-45 years), the vertebral column was involved. This is a common location for joint degenerative, still today as a result of the strains on the spine from an upright gait and the consequences of normal activity. In addition, the right temporomandibular joint (the jaw) of the first individual, the right hip of the second individual, and the left knee of the last individual were also affected. The lesions were slight to moderate in severity; no eburnation or excessive joint degeneration was observed. Interestingly, in the experience of the writer, this is one of the few sites containing multiple individuals, where there was no evidence of a condition known as Schmorl's nodes in the spinal elements. Schmorl's nodes are essentially skeletal evidence of herniation in the vertebral disks and are commonly observed in archaeological populations. It is very likely that the poor preservation of the bones of the torso in this population was a significantly biasing factor.

A possible male adolescent (SK06, 13-16 years), had defects on the left inferior apophyseal facet of T11 and on the left superior facet of T12. There appears to be very slight pitting of the surface, with some marginal osteophytic growth, both suggestive of DJD. This would be very unusual in an individual of this age profile. However, it was observed that the linea aspera on the right femur was very prominent (see **Section 2.4.7**). The change in the latter suggests intensive strenuous movements which may have also brought about early degeneration of the spine.

Another young male (SK05, 15-16 years) had unusual lytic lesions around at the distal ends of both first metatarsals (base of the big toe), on the plantar aspect (underside of foot) (**Plate 6**). There is post-mortem damage to both bones, but there is clear lytic destruction of the joint surfaces, particularly in the dorsal aspect. The exposed trabecular bone has been remodelled. In an adult individual, the bilateral and lytic nature of the lesions would be suggestive of rheumatoid arthritis (after Waldron 2009, 70). The age of this individual is a major factor. Chronic arthritis in juveniles is generally classed under the heading juvenile idiopathic arthritis (JIA), which may be subdivided into oligoarticular JIA,

polyarticular JIA, or systemic JIA. (Borchers *et al.* 2006, 280; Waldron 2009, 66). Rheumatoid factor-positive (RF+) polyarticular JIA, which involves symmetrical lesions, is the juvenile equivalent of adult rheumatoid arthritis (RA) (ibid.). However, a considerable range of other lesions would need to be present to even attempt a diagnosis (see Rothschild *et al.* 1997), with at five or more large or small joints affected at onset (Borchers *et al.* 2006). No such evidence was evident in the skeletal remains of SK05, although again, it needs to be stressed, that preservation was poor and the remains suffered significant fragmentation. It appears that this young individual did suffer from some form of erosive arthropathy, at least symmetrically affecting the first metatarsophalangeal joints, and from which the individual had apparently recovered somewhat.

Plate 6. SK05 (male 15-16 years), lytic erosions on margins of the distal epiphyses of the left and right first metatarsals, plantar view

2.4.2 Metabolic Disease

The evidence of metabolic disease was limited in this population. A single adult, SK04 (possible male 35-39 years) exhibited porosity in the left eye orbit. The right was unobservable. This represents a crude prevalence of 25%, or 1/4 of all adults with one or both orbits observable. These distinct lesions are known as cribra orbitalia. The porosity occurs when the middle layer (the diploë) of the bone

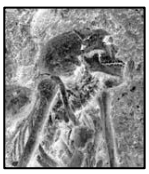
expands with a corresponding thinning of the outer surface of the bone, resulting in the diagnostic appearance of small holes or foramina on the external surface; when the lesions occur in the eye orbits they are termed cribra orbitalia and when on the external surface of the cranium they are referred to as porotic hyperostosis. This condition is traditionally associated with the body increasing its output of iron (Mays 1998, 142). Older studies typically linked the lesions with iron-deficiency anaemia. However, most present studies link the condition to general physiological stress; when a body is under stress from an invading organism (such as a parasitic infestation of the gut), the system increases its output of iron in order to counteract the stress. Thus this pathological lesions may actually be a sign of a healthy defence system (Roberts and Manchester 1995, 166-7; Stuart-Macadam 1991, 105). Recording a variation of this premise, a recent study on iron deficiency in Kenyan children found that iron-deficiency was a nutritional adaptation against endemic infectious disease; essentially the attacking pathogen is less successful as a result of the lack of iron (Wander *et al.* 2009). Another study specifically linked the lesions with a diet deficient of vitamin B_{12}, which may be derived from foods of animal origin (Walker *et al.* 2009). However, at present, and regarding the current report, the lesions are interpreted as the body reacting to general physiological stress.

One juvenile individual had evidence of cribra orbitalia, where it was observed in the right orbit of SK06 (possible male, 13-16 years). The left was unobservable.

2.4.3 Trauma

Two adult individuals exhibited evidence of trauma, indicating a crude prevalence rate of 14.3% (1/7). In the first individual the trauma was perhaps in the more traditional sense of actual broken bones, while in the second individual, congenital weakness is likely a factor in the trauma.

SK04 (possible male 35-39 years) had two healed fractures, one to an unidentified right rib and one to the right ulna. The latter was located approximately at the midshaft, with anterior displacement of the distal end of the bone. There was no evidence of trauma to the right radius; however, the bones were quite fragmented. The cause of the fracture is unknown; it may have occurred accidentally or through a violent assault. It is not possible to determine if the fractures occurred at the same time, although it is certainly a likelihood given that both are to the right side and are well healed. This same bone had evidence of active periosteal lesions (see **Section 2.4.4**), although these are unlikely to relate to the well-healed bone fracture.



Another adult, SK07 (female 18-23) exhibited what may be termed a stress fracture in the fourth and fifth lumbar vertebrae, that is, the lower back (**Plate 7**). In L4, there is a fracture at the left pars interarticularis, while the right is unobservable (as a result of poor preservation). A similar defect is present in L5 but is bilateral (L5 also exhibited a developmental anomaly where the posterior process is cleft, see **Section 2.4.6**). The fractures at the pars interarticularis in L4 and L5 in SK07 are ante-mortem and the location of the fractures indicate a condition known as spondylolysis. A mechanical stress fracture, spondylolysis involves the separation of elements of a vertebra; typically the vertebral body, the pedicles, and transverse and superior articular processes are separated from the laminae, spinous process, and inferior articular processes (Aufderheide and Rodríguez-Martín 1998, 63) (**Figure 5**). It occurs as a result of repeated stress, although congenital weakness may be 'an important factor in the expression of this abnormality' (Ortner 2003, 147-148). Indeed, given the presence of a congenital defect in L5 (see **Section 2.4.6**), is seems likely that congenital weakness may have been a influencing factor in the development of spondylolysis in SK07. The lumbar vertebrae, and specifically the fifth, are most typically affected in cases of spondylolysis (see, for example, Fibiger and Knüsel 2005; Lessa 2011). The typical age of onset is between 10 and 15 years and it is more common in males than females (Bergmann *et al.* 2002; Waldron 2009, 153). In modern European populations the prevalence is 5-6% (Fibiger and Knüsel 2005). It is not unknown for more than one vertebrae to be affected; more than one in five individuals with spondylolysis in one study had fractures in two vertebrae (Lessa 2011). Spondylolysis may go largely undetected in the living individual. However, when it gets to the stage of slippage (spondylolisthesis), considerable pain may be experienced in the lower back and the legs (Bergmann *et al* 2002). Unfortunately, the poor preservation of the skeletal elements in SK07 do not allow for the assessment for the presence or absence of spondylolisthesis.

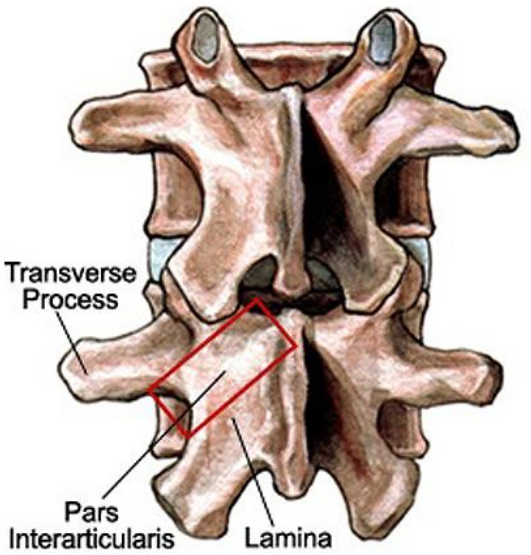


Figure 5. Schematised image of location of break in spondylolysis

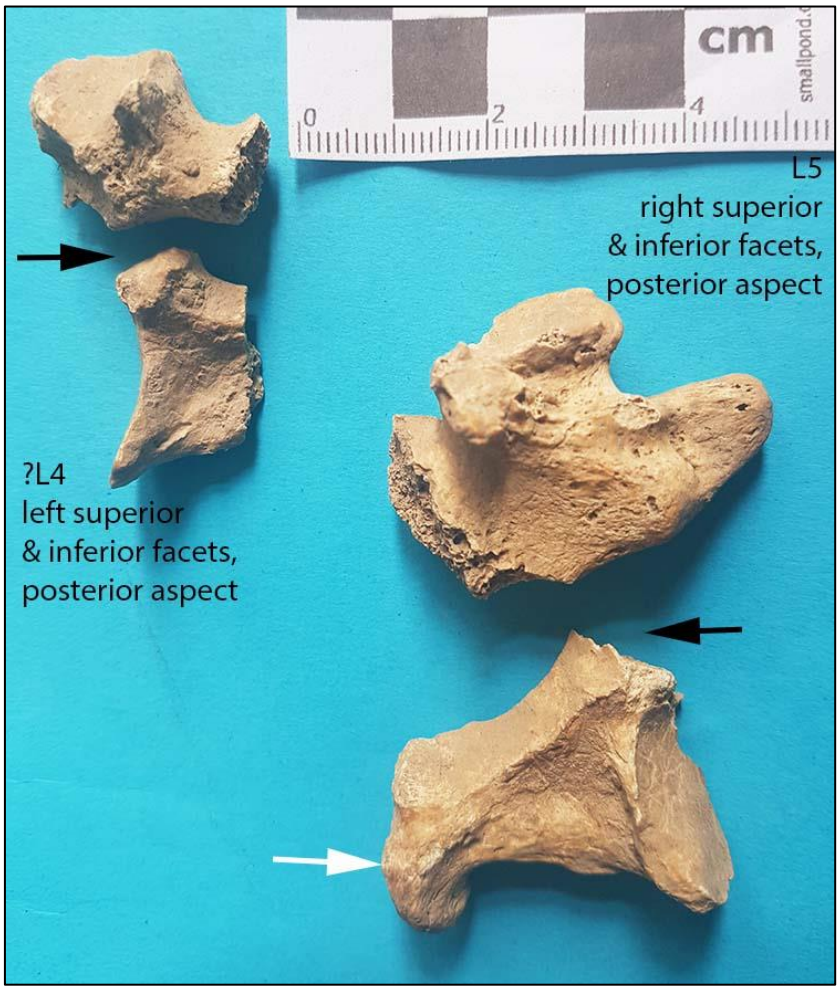


Plate 7. SK07 (female 18-23), arches of probably L4 and L5, posterior view. Black arrows indicate spondylolysis in left arch of ?L4 and right arch of L5. White arrow indicates non-union or cleft posterior process of L5.

2.4.4 Non-specific Infection

Evidence of non-specific infection was present in three adults from Dunkellin. Infectious disease has been the primary killer of humans for a considerable period. Unfortunately, the skeletal manifestations only occur in some circumstances and are rarely identifiable as to a specific infectious disease. Acute infections rarely leave any trace on skeletal remains. In contrast, chronic, long-term infections, where an individual may be strong enough to survive for a long enough period for the disease to manifest on the bone, are often identified in archaeological populations. In most instances the bone lesions are non-specific, although specific infections may occasionally be identified, such as

leprosy and tuberculosis. The bone lesion most attributed to infection, because of its association with the process of inflammation, is fibre bone or periostitis. Periostitis occurs when the fibrous layer, the periosteum, directly overlying the bone becomes inflamed. The process of inflammation, with the accumulation of pus and infected matter, forces the periosteum to rise and a new layer of bone may form underneath. When the lesions are active the layer of bone may be grey in colour and may be porous, striated, or disorganised. With time the new layer of bone can heal and be remodelled into lamellar bone, the normal surface of the bone. Periostitis is confined to the surface of the bone. However, it may penetrate into the bone marrow resulting in a considerably more serious condition known as osteomyelitis (there are other causative factors for the latter that are not described here). The occurrence of periosteal lesions at multiple sites on the skeleton are often taken to be indicative of a systemic infection, while isolated lesions may occur as a result of a number of factors (Larsen 1997, 83). Tibiae are frequently the most common location for evidence of infection to appear (Larsen 1997, 85; Roberts and Manchester 1995, 129-130). While periosteal lesions on the visceral surfaces on the ribs may linked with tuberculosis (Roberts *et al.* 1994), in reality they may be associated with any pulmonary infection (Mays *et al.* 2002).

In Dunkellin, in SK04 (possible male 35-39 years), there were extensive and widespread periosteal lesions, in a variety of stages of development or healing. Active bone was recorded near the right elbow (the right ulna had a well-healed fracture – the two pathological processes are unlikely to be related), partly remodelled and healed lesions were present on the diaphysis of the left fifth metatarsal (foot), while extensive, thickened, healed, circumferential deposits, were present in both the tibiae and the fibulae, with layering of deposits in the left tibia (see **Plate 8**, **Plate 9**, **Plate 10**). Of course, there may be different causes for some or all of these bones exhibiting periosteal bone, particularly given the evidence of different stages of healing. The lesions in the lower leg bones at least, are indicative of a systemic infection; the other lesions may relate to this or may have resulted from something as simple as a hard strike to the right elbow and/or left foot, resulting in inflammation.

Plate 8. SK04 (possible male 35-39 years), right ulna, proximal end, active periosteal lesions

Plate 9. SK04 (possible male 35-39 years), diaphysis of left MC5, evidence of partly remodelled and healed periosteal lesions

Plate 10. SK04 (possible male 35-39 years), left tibia, distal end, healing periosteal lesions, with clear layering over normal bone

A single bone in SK07 (female 18-23 years) exhibited periosteal lesions; faint healed striated bone was present on the right fifth metatarsal of the foot. The cause of this is undetermined; she also had stress fractures and a developmental defect in the lower spine, but none of these may be related. In any case, she had essentially recovered fully from whatever had caused the inflammation, and possible infection, in the right foot.

Finally, SK12 (male 30-45 years), had an unusual lesions on the internal surface of one of the left ribs. Essentially there was an oval lytic erosion through the normal bone surface into the trabecular bone, but which had completely healed. Apart from some DJD (see above) and a minor developmental anomaly (see below), no other pathological lesions were observed on the skeletal remains of this individual. Although (as with periosteal lesions in the ribs), lytic foci in the ribs may traditionally be associated with tuberculosis, this is certainly not always the case (Fysh and Taylor 2002). Indeed, the apparent lack of any other pathological processes in this individual ensure that the healed lytic lesion in the rib may only be considered as a possible indicator of some form of intrathoracic infection (after ibid.).

2.4.5 Developmental Abnormalities

A number of relatively minor developmental abnormalities were observed on the skeletal remains of some of the Dunkellin individuals. In SK07 (female 18-23 years), accessory sacral facets were observed to the posterior of the right sacroiliac joint. None were identified in the rather incomplete left elements. These facets provide for biomechanical enhancement (Vleeming *et al.* 2012, 545). They are a relatively common finding; one study identified them in 13% of 100 CT scans and in 16% of 56 dried skeletons (Ehara *et al.* 1988). This individual also had a cleft posterior process in the fifth lumbar vertebra (**Plate 7**). This cleft is essentially the most minor manifestation of a condition known as spina bifida occulta, which in itself is a significantly less severe manifestation of the classic, and potentially fatal, spina bifida. The bones of the vertebrae, in their normal state, act as a protective channel for the spinal cord. However, in some individuals the laminae of the neural arches of the vertebra can fail to fuse completely, and the spinal cord may be exposed. In the case of spina bifida the cord may be exposed on the surface of the back and cause significant problems, and indeed may be fatal. In the case of spina bifida occulta the cord is still maintained within the normal space; the vertebrae have simply failed to fuse completely. In the lumbar spine, the posterior process of L5 (as in SK07) should be complete by the age of 5 years (Schaefer *et al.* 2009, 114). Spina bifida occulta typically occurs in the lumbosacral region and can be asymptomatic (Scheuer and Black 2000, 189; Waldron 2009, 219). However, in other instances, the defect has been linked with other issues such as recurrent and continuous lower back pain or functional disorders of the lower urinary tract (Kumar and Tubbs 2011). A small tuft of hair, a dimple, or pigmented skin may mark the site of the defect in the living individual (ibid.). Developmental spinal defects are sometimes multiple in nature (Oh and Eun 2008): clinical cases reveal cervical spina bifida occulta along with other defects in the spines of a number of patients (Song *et al.* 2010). In the case of SK07, the unfused gap was very small and likely had little, if any, impact on the individual. This individual has already been noted above (see **Section 2.4.3**) in relation to the stress fractures of spondylolysis that were identified in the fourth and fifth lumbar vertebrae; it is possible that the presence of the cleft posterior process in L5 points to an inherent congenital weakness in these spinal elements which may have been a contributory factor to the development of the stress fractures.

Finally, in SK12 (male 30-45 years) it was observed that the right fifth intermediate and distal foot phalanges had fused together. Ankylosis or fusion of a joint can occur as a result of a variety, or combination, of conditions including developmental abnormalities, trauma, joint disease, and infectious disease, among others. Fusion between the intermediate and distal foot phalanges, known as symphalangism, is one of the most commonly occurring joint ankylosis. A study found the condition was present in 72.5% of fifth toes and 11.9% of fourth toes, with no prevalence to side or sex (Nakashima *et al.* 1995; referenced in Mann and Hunt 2005, 181)

2.4.6 Miscellaneous (including observed specific entheseal changes)

Two individuals, an adult male (SK12, male 30-45 years) and an adolescent male (SK05, male 15-16 years), exhibited distinct anomalies in both the left and right humeri (**Plate 11**). At the point of insertion of the latissimus dorsi muscle there is a fossa. Each muscle attach to a bone at two sites (the entheses), the insertion and the origin. The former tends to be more moveable during contraction, while the latter is more stable. Muscles connect to the bone at the enthesis via either a ligament or a tendon. The enthesis may be fibrous (attaching directly to the bone) or fibrocartilaginous (a more complex attachment) (Nikita 2017, 269-276). The insertion of the latissimus dorsi is a fibrous enthesis. Morphological changes to enthesis can occur, often as a result of an increase in the mechanical load during muscle activity. These changes may involve bone formation, bone resorption (as in the individuals from Dunkellin), or a combination of the two. While traditionally interpreted as direct evidence of actual activity, the aetiology is more complex and interplays with 'mechanical loading, age, body size, sex, diet, and metabolic, genetic, and pathological factors' (Nikita 2017, 274). The low number of individuals, combined with the very poor preservation of skeletal remains at this site ensure that further analysis is somewhat hindered. However, the fact that both of these individuals are males may be of significance. Interestingly, although many other indicators were also used, in a study of possible bone changes associated with individuals buried with weapons (and therefore more likely to have endured physical training as warriors) from a tenth century site in Hungary, this particularly enthesis was noted as often exhibiting changes (Tihanyi *et al.* 2020). In modern contexts, this muscle is specifically associated with the crawl stroke in swimming (Stone and Stone 1997). It is possible that these distinct lesions, in two males from this small population, may indicate gender-specific activities, possibly from an early age.

Plate 11. SK05 (male 15-16 years), fossae at point of insertion of the latissimus dorsi muscle on both humeri

It was also observed that the costal tuberosity in both the left and right clavicles of SK07 (female 18-23 years) were rather raised, but flattened, almost like a platform. The costal tuberosity is the point of attachment for the strong costoclavicular ligament, at the medial end of the inferior aspect of the clavicle. It, along with the coracoclavicular ligament at the lateral end, bind the clavicle tightly. Fractures of the clavicle, which is the most frequently broken bone in the human body, tend to occur at the weakest point on the midshaft. The costal tuberosity may sometimes be impacted quite significantly by mechanical pressure, resulting in a deep depression called a rhomboid fossa (Scheuer and Black 2000, 246-7). The actual presence of a rhomboid fossa may be taken as an indicator of the male sex and, as mentioned, its development appears to be associated with strenuous activity

(Anderson 1998; Rogers *et al.* 2000; Mann and Hunt 2005, 118-119). In the case of SK07, the point of attachment is flattened rather that a depression. In any case, it suggests possible excessive use of the shoulder muscles in general, above what may normally be expected in an individual of this age.

It was noted earlier (**Section 2.4.1**) that a possible male adolescent, SK06 (13-16 years), had subtle evidence of degeneration of the spine, which would be particularly unusual in an individual of this age. However, an anomaly was observed in the surviving right femur (left unobservable), which suggests this individual may have been involved in habitually physically exertive tasks. The linea aspera, located on the posterior of the diaphysis of femur, is particularly pronounced in this individual. It is the site of attachment for a variety of muscles, particularly the adductor muscles, including the adductor brevis, adductor magnus, and the adductor longus. These adduct the thigh and assist in medial rotation (Stone and Stone 1997). Adduction, in the case of the thigh, involves returning the leg, from a position outstretched to the lateral, to being parallel (vertically) with the other leg. The pilasteric index, using measurements of the medial/lateral and anterior/posterior, is used to specifically record the shape of the midshaft of the femur. In the case of SK06, the pilasteric index of the right femur was 133.2. A high pilasteric index has been associated with mechanically-stressed populations. One large study recorded averages of between 100.8 and 116.5 in Late Chalcolithic female and male adults buried at Tell Brak, in Syria (Sołtysiak 2010). Another study recorded averages of between 98.36 and 113.33 (Pomeroy and Zakrzewski 2009). These suggest that the pilasteric index in SK06, whose bones were still immature at the time of death, was very high. This may suggest that this young male was routinely engaged in a physically demanding activity, which led to alterations to the normal shape of the femora, as well as premature possible degeneration of the spine.

Finally, at a post-mortem break in the right distal tibia of SK01 (female 25-30 years), a faint dense line of bone was visible. This is known as a Harris line or ‘growth arrest lines’. They may be more readily identified in complete bones through the routine use of radiograph. They are believed to occur due to an accumulation of osseous deposition as a result of the stunting of growth (Mann and Hunt 2005, 147). While traditionally taken as an indicator of (survival of) physiological stress in childhood, the aetiology is complex: the defects have been recorded in individuals who never suffered serious childhood ailments while they can be absent in individuals who are known to have suffered stresses. Evidence of the defects may also obliterate over time (ibid.; Mays 1998, 175-7; Aufderheide and Rodríguez-Martín 1998, 422-423). A recent study considers the lines to be a result of normal growth

and growth spurts (Papageorgopoulou *et al.* 2011). While this may be the case, an exceptionally high prevalence (93.6%) of the lines were in juveniles from the nineteenth-century Poor Law Union cemetery associated with Kilkenny workhouse (Geber 2014). It is possible that the lesion in SK01 is indicative of a period of physiological stress that they endured during childhood.

3. Synthesis

3.1 Summary of Analysis

Excavations at Dunkellin in 2020 (licence number 20E0407) revealed 15 *in situ* burials and the remains of one other individual whose burial was likely extensively disturbed during the groundworks of the proposed development (a flood relief scheme for the Dunkellin River). The burials had suffered little from truncation but the preservation of the skeletal elements was largely poor, with the skeletal remains impacted in particular by fragmentation but also by erosion. The bones of the torso – the vertebrae, ribs, and pelvic bones in particular – were very poorly preserved in most of the burials.

The 16 individuals comprised seven adults and nine juveniles. Within the adults whose sex could be determined, there were four females and two males (including a possible female and male respectively). One of the females was a young adult, while both males and two females were all classed as 'middle adults', that is, aged between 26-44 years at the time of death. No older adults (45+ years) were identified. In the juvenile group, there were two infants (one a pre-term infant and one a full-term infant), three young juveniles (1-6 years category), two older juveniles (7-12 years category), and two adolescents (13-17 years).

A very small quantity of disarticulated material was recovered, representing an adult and four juveniles. While the remains of the adult and at least two of the juveniles, likely originate from the 16 identified burials at Dunkellin, dental remains from two juveniles aged between 2-4 years appear to represent at least one, and possible two, other burials in the area which were not identified during the excavation.

Due to poor preservation, it was only possible to estimate the living stature of two adult individuals, both females. The average stature was 160.5cm. This cemetery dates to the late medieval/early post-medieval period, and the females appear to have been quite tall in comparison to some of their contemporaries. In one juvenile, aged between 9-10 years at the time of death, it was noted that the length of the femur appeared short when compared with the age estimate from the dentition. The crown-to-heel length of the full-term infant was estimated at 50.8cm.

Dental remains were recovered from six adults and eight juveniles (in the latter group, the exception was the preterm infant). The adults comprised 125 permanent teeth and two retained deciduous teeth, while in the juvenile individuals there were 38 erupted and 1 unerupted deciduous teeth and 65 erupted, 12 erupting, and 38 unerupted permanent teeth. In both the adult and juvenile individuals, the alveolar bone (which anchors the teeth) was very poorly preserved. The dental diseases and conditions which was present on the adult teeth are those that are normally seen in many archaeological populations. Attrition, or dental wear, was not significant, although this may be linked with the small sample size as well as the apparent lack of older adults. Calculus, or calcified plaque, was present on 83.3% of observable adults, or 80.8% of observable teeth. The deposits were generally slight to moderate in severity, although severe deposits were present in one individual. The calculus was subgingival in all individuals, indicating probably periodontal disease (important evidence, given the general lack of alveolar bone). Carious lesions (decaying teeth), were present in 66.7% of adult (10.4% of observable teeth), and were generally small to medium in size. One individual exhibited severe carious lesions. The prevalence rates were potentially a little underestimated, and certainly reflect a late medieval/early post-medieval diet, with an increasing level of refined carbyhydrates. The lack of alveolar bone is likely a significant bias in the fact that no evidence of dental abscesses was identified in this population. Evidence of dental enamel hypoplastic defects (indicative of childhood physiological stress) were identified in 20% of adults. Chipping of dental enamel was recorded in three adults, which represented all observable males in comparison to just one-third of observable females. Calculus was recorded in 50% of the juvenile population, with the youngest individual aged just 2-3 years. One juvenile has caries while no evidence of periodontal disease was observed in the juveniles. Hypoplastic defects were identified in 37.5% of juveniles, with all affected apparently enduring multiple repeated episodes. In terms of anomalies, it was noted that one adult individual had retained their lower second deciduous molars and one adolescent also retained part of

the root of a deciduous molar. One adult had an enamel pearl on a tooth root. Fifteen teeth, both permanent and deciduous, were also recovered in a disarticulated state and all juvenile in origin.

Evidence of pathological lesions was relatively scarce and is likely significantly impacted by poor preservation of skeletal material, which has affected the diagnoses of some of the skeletal changes that were recorded. As is the case in most skeletal archaeological populations, degenerative joint disease was common, being observed in 42.9% of all adults. The spine was the most common location, but the disease was also present in the temporomandibular, hip, and knee joints. The lesions were slight to moderate in severity, with no eburnation or fusion identified. DJD was also apparent in two adolescent individuals. One possible male had very mild spinal degeneration, with other bone changes suggesting that he may have been involved in abnormally strenuous work, which must indeed have been severe to impact the bones of this young person. Another male adolescent had partially remodelled erosive lesions in both the left and right first metatarsophalangeal joint (actual diagnosis not possible).

Cribra orbitalia, indicative of a metabolic condition, was the only skeletal lesion present in this population in that category. It was identified in a possible male adult and adolescent. A Harris line, suggestive of stunted growth, was also present in one adult female. Evidence of classic trauma, in the form of bone fractures, were identified in a single possible male adult, who had well-healed fractures to the lower part of the right arm and to a right rib (this individual also had extensive evidence of non-specific infection), while stress fractures (spondylolysis) were present in the two of the lower vertebrae of a female young adult (who appeared to also have other evidence of congenital weakness in this area of the spine).

Evidence of non-specific infection was recorded in a third of adults. Widespread periosteal lesions, in various stages ranging from healed through to active, were identified in the remains of one possible male adult (who also had evidence of cribra orbitalia, as well as two healed bone fractures). Isolated lesions were also present on a foot bone of a female young adult and on a rib of a male adult. As with some of the other pathological lesions, there may have been a bias towards males in terms of the evidence of inflammation/infection.

The developmental abnormalities that were identified were in a one female and one male adult. The former, as well as having accessory sacral facets, also had a cleft posterior process in a lower lumbar vertebra (she also had stress fractures, spondylolysis, in at least two of these vertebrae). Two of the bones of the right fifth toe of the latter individual were fused (symphalangism).

Finally, a number of anomalous lesions were observed which likely are indicative of physical exertions. Two males, an adult and an adolescent, had evidence the bones of the upper arm, of bilateral excessive use of the muscles of the shoulders. A female young adult also had some evidence of excessive bilateral muscle use (involving the clavicles) in the shoulders, though possibly of a different nature to that in the male individuals. In addition, as noted earlier in relation to DJD in the spine of a possible male adolescent, this same individual had evidence of changes to the normal morphology of at least the right femur, indicating excessive use of the adductor muscles.

3.2 Discussion

This small cemetery, containing at least 16 burials, was discovered during archaeological monitoring by Dominic Delany and Associates, in association with a flood relief scheme. A single burial had previously been identified in 2017, during the same scheme, and was analysed by the writer (Lynch 2018a). This burial was located further to the west of the present cemetery. During the excavation, it was surmised by the writer, that this cemetery dated to the Early Medieval period, primarily on the basis of the burial practices. However, radiocarbon dating firmly put the date of the site in the late medieval/early post-medieval period. The size of the skeletal sample from this site is small, at just 16 individuals. This ensures that the interpretation of any osteological observations is limited. In addition, the preservation of the skeletal remains was significantly compromised in most cases, with fragmentation being a particular issue. The latter is likely very much linked with significant evidence of land reclamation in this area in the past (D. Delany, pers. comm.). Despite this, the osteoarchaeological analysis has provided some fascinating insights into this previously unrecorded cemetery. In addition, there are very interesting and revealing individual stories hidden within this site, which may be further enhanced with an examination of burial practices (see below).

The general distribution of juvenile to adult individuals, combined with the broad ranges age-at-deaths (apart from a lack of older adults), suggests that this is a communal burial ground, not particularly

reserved for any one cohort of society. Less than half of the population (43.8%) were adult, compared with 56.3% juveniles. Another young juvenile, and possibly two, are represented in the disarticulated assemblage. In cemeteries, the numbers of juveniles compared to adults may differ across both time and space and, of course, other biases must be considered, such as differential preservation, area excavated, *etcetera*. Research has indicated that, in Early Medieval Irish cemeteries, anywhere between 33% and 50% of the individuals may be made up of juveniles (Buckley 2010, 45). However, this appears to change in the medieval and post-medieval period, typically with progressively less juveniles being represented in the general burial record. Juvenile are poorly represented in a number of large medieval cemeteries associated with monasteries, including Boyle, Co. Roscommon with 27.5% juveniles (Lynch 2022, 293), the Dominican Priory in Drogheda with 18% (Halpin and Buckley 1995, 195), St Mary's of the Isle Dominican Priory in Cork with 24.1% (52/216) (Power 1995), St Thomas the Martyr in Dublin with 22% juveniles (Buckley 2003), and quite a high 31.1% juvenile in the the assemblage excavated from Tintern Abbey in Co. Wexford (Ó Donnabháin 2010). While the monastery association may incur a bias, or number of biases, in terms of juvenile burials, in reality, they are not particularly well represented in medieval secular cemeteries either, For example, 32.9% were juveniles in the large medieval cemetery at Ballyhanna in Co. Donegal (McKenzie 2015, 86), while 28% were juveniles in St Peter's Church in Dublin (Coughlan 2003). In a late medieval/post-medieval cemetery excavated in Kildare in 2014, just 17.9% of the 28 excavated burials were less than 18 years at the time of death (Lynch 2015), although this cemetery had a number of deviant burials and may be more unusual than the typical secular cemetery. In a large post-medieval parish cemetery in St Anne's in Cork, just 17.5% were juveniles (Lynch 2018d). This contrasts sharply with the 41.5% juveniles recorded in nineteenth century Irish workhouses (ibid.), a system in which children were extremely vulnerable. The high prevalence of children in *cillíní*, or so-called 'children's burial grounds', is a well-known phenomenon. When taken in the context of general medieval cemeteries, both monastic and secular, and post-medieval populations, the 56.3% of juveniles at Dunkellin is a high quantity. It has been suggested that higher (>50%) quantities of juveniles in an Irish cemetery population may indeed indicate a *cillín* (Buckley 2010). Could this possibly be the case at Dunkellin? It is important to remember than *cillíní* do not necessarily comprise infant individuals who were unbaptised; any individual up to 7 years of age could have been routinely interred in those sites (see Lynch 2018d), while any adults who were perceived to have transgressed societal norms would also have been interred there. Perhaps so. Indeed, at least one of the burials (SK15 (? adult) may be considered deviant (see below), effectively suggesting an individual who could have been denied

consecrated burial. However, such interments certainly occur in consecrated burials grounds also. Essentially, there is nothing else, apart from the high numbers of juveniles, to confirm that this is indeed a *cillín* in the traditional sense. The variety of burial practices at Dunkellin is noted below, and it was this which suggested to the writer that the burials were Early Medieval in date. However, radiocarbon dating proved otherwise (see **Table 1**). The variety in burial, along with the high numbers of juveniles, is certainly unusual for a cemetery of this date.

The age-at-death profiles of both the adult and juvenile groups are also interesting, as well as the sex profile of the adults. Firstly, in the adults, there were no indications of older adults (45+ years). It is not possible to gauge the significance, if any, of this as it was only possible to determine ages-at-death of five adults. Perhaps some of the adults, whose age could not be assessed, are actually older adults, perhaps the older adults were buried elsewhere, or perhaps this community did not experience longevity. Similarly, the fact that the only young adult (17-25 years) was a female cannot be interpreted in any meaningful manner. The sex of the adults however, although based on just six individuals, suggests that females (66.7%) were more frequently buried here than male individuals (33.3%). Whether this was a deliberate, orchestrated, burial practice cannot be determined. In the juveniles, there were two infants (<1 year), three young juveniles (1-6 years category), two older juveniles (7-12 years category), and two adolescents (13-17 years), with at least one, and possibly two, more young juveniles being identified in the disarticulated material. Traditionally, it is the youngest cohorts of juveniles who would have had the highest mortality, and the general profile from the present site largely mirrors that expectation, with five of the nine juveniles (of the *in situ* burials) being 6 years or less at the time of death.

The actual health profile of the population is difficult to assess due to the small sample size and the fragmentary nature of the remains. One of the most basic indicators of health status may be the assessment of final attained stature. Essentially, in simplistic terms, a population who were perhaps nutritionally and/or physiologically challenged in childhood may not attain full stature in adulthood. In archaeological populations, this may be assessed by comparing statures across various contemporary populations. In reality, human growth is more complex, but the assessment of final stature can be a useful indicator of health. However, in the case of Dunkellin, it was only possible to estimate the living stature of two female adults. Their average stature was taller in comparison to

many of their contemporaries, which may suggest that the females at least experienced a relativity healthy childhood. But what can other health indicators from the Dunkellin individuals reveal?

The dentition can offer one of the most immediate and clear indicators of general health status in the form of dental enamel hypoplastic defects; defects, due to physiological issues in childhood, which can preserve in the enamel of the developing tooth. It should be remembered that the very fact that the lesions are identified indicates that the individual actually recovered from that particular issue. In the case of Dunkellin, these lesions were scarce and were identified in just a single adult (a young female) and three juveniles. Interestingly, this represents just 20% of adults, compared with 37.5% of juveniles. There is the possibility that that those who suffered physiological stress in childhood, and recovered, were then left with a reduced life expectancy. Those who appear not to have suffered significant stresses may have had a longer life expectancy. Indeed, it was noted in the that the juveniles in particular appear to have suffered from repeated bouts of stress, which would seem to confirm an ultimate impact on their life expectancies. Interesting, the long bones of one of the juveniles indicated that they were quite small for the age-at-death as estimated from the more reliable dentition, suggesting that the growth rate of this child had been compromised; s/he also had enamel hypoplastic defects. Whether there was a bias in terms of who may have suffered those stresses, based on social status and/or particularly based on gender, is at least partially examined in relation to gender and health below.

Following on from the likelihood that some sections of the community may have had significantly different experiences in terms of childhood health, which ultimately may have impacted their life expectancies, other skeletal markers are also revealing. For example, cribra orbitalia was only identified in male (or possible male) individuals; this suggests that some males at least may have been under greater physiological stresses than their female counterparts. This possibility is further compounded by the evidence of non-specific infection. Both male adults presented with evidence of inflammation (clear evidence of a chronic systemic infection in one individual, while the other had a pulmonary infection), while just a single female adult was affected (a single bone in the foot). That is a crude prevalence of 100% of adult males and just 25% of adult females. This again suggests a different life experience in terms of gender, although it should be noted that the actual manifestation of evidence of infection is also evidence of an actual ability to survive. Weaker individual may have died quickly from infections without their bones ever being impacted and so they are effectively

invisible in the record of infectious disease. However, the evidence is contradictory. One female adult exhibited evidence of a Harris line, another indication of physiological stress during childhood, while the aforementioned single adult with hypoplastic defects was also a female. While the limited stature evidence, might suggest that at least females had an advantage during youth, perhaps this was not actually the case and that both sexes were impacted by physiological stresses, though perhaps in varying degrees of severity.

There does appear to be more definitive evidence of variation between the sexes in relation to occupational activities and the impact these may have had on the skeleton. DJD was common and recorded in almost 43% of adults; in reality, a higher prevalence may be expected, and it is likely that both poor preservation and a lack of older adults has considerably impacted the identification of this disease. Interestingly, joint disease was present in both adult males but just one adult female, despite the higher numbers of females. This represents crude prevalence rates of 100% of male adults, in comparison to just 25% of female adults. In addition, an adolescent possible male had, very unusually, evidence of mild spinal degeneration, with alterations also to the normal profile of the femora (thigh bones) suggestive of intense strenuous muscle use. Furthermore, two males (an adult and an adolescent, the former had general DJD the latter did not and was not the same adolescent male as previously referred to) had clear evidence of bilateral excessive use of the muscles of the shoulders. This all suggests that males were habitually engaged in heavy strenuous tasks, probably from a young age. There are exceptions of course; a young adult female also had bilateral changes in the clavicles (collarbones) which also indicates excessive shoulder use. Overall, however, work practices appear to have had significant impacts on the males. This may potentially be linked with compromised nutrition, which led to males being more prone to infectious diseases as well. The only evidence of classic bone fractures in this population was also in an adult male (to a right rib and the right arm); of course, it is not possible to surmise how he received these fractures. However, given the apparent physical exertions that the males appear to have been under in this population, perhaps it relates to an occupational hazard/s. The stress fractures (spondylolysis) in the lower spine of the young adult female, may have a much stronger link with congenital weakness in this particular individual, as opposed to repeated strain, as there was evidence of a developmental abnormality (a cleft posterior process) in one of the affected vertebra, suggesting a predisposition existed. Finally, chipped enamel (whether related to diet and/or occupational activity) was identified in all observable male adults but just one-third of female adults. While, realistically, this translates as just two adult males and one adult

female, it is at least suggestive of gender variations in life experiences, be it related to diet and/or occupation.

In relation to diet, the teeth broadly reflect what may be expected of a expected of an Irish population of this date. Calculus deposits are common, reflecting both the diet and limited oral hygiene practices. Gum disease was a problem and likely related to the calculus deposits. The prevalence rates of carious lesions, or rotting teeth, appear to reflect a population beginning to consume more refined carbyhydrates than their medieval counterparts; refined carbohydrates had a detrimental impact on the teeth of all social cohorts in the later post-medieval period. Attrition, or dental wear, in this population is also relatively mild, again reflecting the consumption of softer foodstuffs which became a feature in the post-medieval period, and continues into the present day. However, the attrition evidence may be slightly skewed, given that no older adults were identified in the sample.

Finally, regarding the osteological evidence itself, it is noted that the radiocarbon dates appear to particularly focus in the 1560s. It is tempting, particularly perhaps given the unusually high number of juveniles, to suggest that many burials in this cemetery may represent victims of a single tragic event, such as a disease epidemic (there is no evidence of widespread violence). Acute infections, those that kill quickly and often indiscriminately, typically leave no trace on the bones. Indeed, the double burials clearly indicate that at least some multiple deaths were occurring in the community. However, the radiocarbon dating, while providing tantalising evidence, is not conclusive; while the median dates for are in the 1560s, in reality, the date ranges span from the late fifteenth century through to the mid-seventeenth century. In addition, the date from one of the young juveniles (SK16, 2-4 years) suggest burial occurred later at this site also. It is possible that at least some represent burials of those dying during some disease epidemic, but there is no clear evidence. And clear care was afforded in the burials of many, though not all (see below), individuals, which does not indicate a desire for rapid disposal of diseased individuals. In addition, the variety in modes of the burials at the site, as well as the broad spatial spread of the burials, suggest a passage of time, perhaps greater than that indicated by the radiocarbon dates.

There was quite a diverse range of burial positions recorded in this small cemetery (see below), which is the factor which suggested to the writer that this was an Irish Early Medieval cemetery. The traditional Christian burial mode, still common today, was to be laid supine and extended, orientated

with the head broadly to the west. The positions of the arms, particularly the lower parts, could vary, being either extended by the sides or crossed, in a wide variety of patterns, over any area of the torso. There could be significant variations in burial positions in the Early Medieval period, with some likely relating to fading pagan beliefs. Legs in particular may be flexed, being bent slightly to the left or right, and/or the individual may lie slightly on the side. In more extreme cases, individuals could be buried in a crouched or foetal position, with the knees drawn up tightly against the chest and the body resting on the side. Prone burials (buried face down) are also known and are likely deviant in origin (see below). In the Early Medieval period, most individuals were likely uncoffined, with shrouds and/or winding sheets primarily used to contain bodies. Most burials were in simple, earth-dug pits, though there may be surrounds of small stone boulders or slabs, or perhaps stones around the head area. Some may be contained entirely within stone cists, while some grave linings have also been identified. Burials may also comprise single or multiple individuals (O'Sullivan *et al.* 2013, 287; Buckley 2010, 43; O'Brien 2020). In the context of Early Medieval cemeteries, variation was common; hence the initial belief by the writer that Dunkellin dated to that period. However, radiocarbon dating suggest sixteenth/seventeenth century dates, with a particular concentration on the 1560s.

Most of the burials in Dunkellin were supine and extended, and most were orientated with the head to the westsouthwest. The exception was a female adult (SK08), with the head towards the east. In addition, three individuals were buried in crouched positions while a prone burial was also identified. All of the graves were in simple pits, with no evidence of artificial demarcation of grave edges. Gravedigging ceased once bedrock was uncovered. The bases of many of the graves were not flat, but undulated as the bedrock appeared. Some graves were also quite compact. It is a combination of the laying of remains directly on bedrock, along with the extensive later land reclamation in the area, which resulted in the often extreme fragmentation of the skeletal remains. Artefacts were recovered from two burials: a ferrous metal object was recovered from the below the central pelvic area of SK15 (?sex adult), while three copper alloy rings (not finger rings) were recovered from the right side of the torso of SK08 (female adult). Analysis of these objects is continuing at the time of writing.

Regarding the orientation of SK08 (**Plate 12**), such orientations are sometimes interpreted as being the burial of a possible cleric (see Sprague 2005, 107). This is based on the premise that, on the Day of Judgement, when all the dead (buried with the head to the west) would rise to face God in the east (the rising sun), clerics (buried with the head to the east) would rise to face their congregation. While

there may certainly be some credence to this (that is, that burials were orientated to reflect the cleric/non-cleric status of an individual), it is unlikely to be universally true (see Gilchrist and Sloane 2005, 153). SK08 was a female individual and is unlikely to have been a cleric in the traditional sense (a similar instance was recently identified in an Early Medieval cemetery examined by the writer (Lynch 2019)). SK08 warrants further mention however, as there were some other aspects which set her apart from other individuals at this site. As mentioned above, three copper alloy rings (not finger rings) were recovered on her right side, between her rib cage and her arm. These are particularly intriguing and unexpected. They are not what would be expected in a typical shrouded burial and suggest some form of decorative clothing or attachment to the body. The post-excavation analysis of these will hopefully reveal what they may represent. In addition, in osteological terms, her teeth suggested she had a diet that differed to many of the others that were buried in Dunkellin. She was the only individual that exhibited both severe deposits of calculus as well as multiple carious lesions, some resulting in the destruction of entire crowns of teeth. Carious lesions are typically linked with the ingestion of refined carbohydrates, and the general prevalence rates at Dunkellin reflect a population on the cusp of the significant dietary changes going into the post-medieval period. However, the minimum of seven teeth which exhibit carious lesions in this individual account for more than half of all of the teeth from this site impacted by caries. The severity of the dental decay and the calculus deposits suggest a different diet to her contemporaries, while both the inclusion of the intriguing copper rings with the burial and the orientation of the individual in the grave, suggests she was regarded as ‘different’ to the majority of individuals in the community.

Plate 12. SK08 (female adult)

The three crouched burials comprised a full-term infant (SK09), loosely crouched, and buried on her/his right side (**Plate 13**), a 2-4 year old (SK13) lying on the right side (**Plate 16**), curled over the left lower leg of SK12 (male 30-45 years), and a tightly flexed possible male adult (SK04), buried on his left side (**Plate 14**). While both SK09 and SK13 may simply reflect an intuitive action of how one may lay a uncoffined deceased infant and young child in a shallow grave, the adult burial is clearly deliberate. Some research has previously indicated that crouched burials span from the second/first century BC to the first half of the third century AD (McGarry 2010, 175). However, they certainly occur after the latter date; a crouched burial in Rathoath, Co. Meath was dated to AD 420-620 (Fibiger 2010, 117) and crouched burials at Mount Gamble, Co. Dublin were dated to the earliest phase of the sixth to twelfth century cemetery (O'Donovan and Geber 2010). One crouched individual and one prone and crouched individual was dated to AD 850-1300 in the large cemetery of Parknahown 5, Co. Laois (O'Neill 2010, 258), and the prone nature of that latter burial suggest deviancy. An unusual crouched burial at Inishbarnóg Island in Co. Donegal was dated to AD 887-1036 (Crumlish 2015; Lynch 2018b). This distinct burial from Dunkellin returned a median date cal AD 1496-1641, with a medial probability of

1562. While certainly more common in earlier times, crouched burials are not unknown from medieval cemeteries in Ireland however. Three crouched adults, all female, were excavated from the large medieval cemetery at Ballyhanna in Co. Donegal, with dating to cal AD 1225-1276 (Macdonald and Carver 2015, 79)

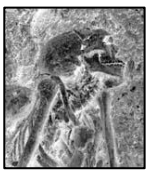
Plate 13. SK09 (full-term infant)

There may have been a diversity of reasons why someone may have been buried in a crouched position, and this may have varied both across time and space. As mentioned, the crouched position of the young infant in particular at Dunkellin essentially mimics the natural pose of an individual of that age. It is possible that, in some instances, an adult buried in this 'foetal position' may have connotations of interlinking birth, death, and perhaps rebirth. In other instances, debilitating disease has been suggested as a cause for the burying of individuals in crouched positions (Buckley 2010, 44-45, 48; Ó Néill and Coughlan 2010, 249). In Owenbristy, Co. Galway (O'Brien 2011, 97), and also at Faughart, Co. Louth (Buckley and Conway 2010, 54), crouched burials have been interpreted as representing individuals who may have been transported some distance for burial, with the crouched

position of the skeleton mirroring the binding of the body for transportation to the burial site. Indeed, in the former site, the crouched remains of an adult not only had a rather unique ornamental neck ring, but analysis of strontium and oxygen isotopes indicated that he may not have been local (Evans and Chenery 2009; quoted in O'Brien 2011, 97). The processes of decomposition must also be a consideration in terms of these contorted burials; it would not be possible to manipulate a body in a state of rigor mortis into the crouched position but waiting until the rigor mortis has gone might coincide with natural bloating of the body, which could also hamper manipulation of the body. Potentially, the positioning of the body may have been very soon after death.

Plate 14. SK04 (possible male 35-39 years)

The crouched possible male adult (SK04) warrants a closer examination. Despite the relatively poor preservation, it was possible to determine that his body was manipulated into the position at the time of burial, rather than prior to placement in the grave. He was laid on his left side into the grave (which presumably was not particularly deep). The arms were bent up first and positioned so that the hands were curled up, palmside against palmside, in front of the face. The legs were then bent into position, with the left knee overlying the right elbow. The left leg, being the lowermost of the two, was snug against the bedrock, with the foot in a 'tip-toe' or relevé position. In contrast, the right leg was a little



more 'relaxed'. His skeletal and dental remains, despite being poorly preserved, had greater evidence of pathological diseases and conditions than most of the other individuals, and revealed tantalising hints as to his life-course. He had quite extensive deposits of calcified plaque, suffered periodontal or gum disease, had at least two decaying teeth, had significant dental attrition, and had chipping of a number of teeth. The latter may be linked to diet and/or occupational use of the teeth. He suffered from degenerative joint disease in at least the jaw and the spine. He had mild cribra orbitalia in the left eye orbit (right unobservable), indicative of at least some physiological stress in the past. He also had two bone fractures - one to an unidentified right rib and one to the right ulna (lower part of arm) - both of which were well-healed at the time of death. He also had extensive evidence of a chronic systemic infection. As is common, no manner of death could be determined for this individual. Clearly his life experience had a considerable impact on both his bones and teeth. But crucially, he also survived with these various ailments for a considerable period. Indeed, at an estimated age-at-death of between 35-39 years, he was potentially one of the oldest individuals interred here. The fact that his remains has preserved evidence of these various physical challenges indicates that he may, paradoxically, have been relatively healthy. Again, however, the returned radiocarbon date of cal AD 1494-1641 for this individual was quite unexpected, as it may typically be considered a medieval, or likely earlier, practice.

There was also one prone burial. The positioning of this individual was not recognised during excavation, as the remains were extremely poorly preserved, and was only realised in post-excavation during the osteoarchaeological analysis. SK15 (?sex adult), cal AD 1494-1640, was buried face down, possibly with at least the left hand behind the back (**Plate 15**). A ferrous metal object was located in the pelvic area and analysis is ongoing at the time of writing. The 'face down' term does not refer to the actual face itself, rather that the individual was lying on their stomach rather than their back; in reality, just a single cranial fragment survived, and the actual position of the head is unknown. The positioning of at least the left hand raises the possibility that the hands were bound. The identification of the ferrous metal object may assist further in the interpretation of this burial. In many societies, the prone position is anathema to the concept of a respectful burial. The very act of placing a body face down essentially obliterates the person's identity. However, it has been noted that it may symbolise an act of penitence, for either the deceased or family members (Gilchrist and Sloane 2005, 154, referenced in Macdonald and Carver 2015, 79), with the position mimicking the prostration pose in the living. Even if that is the case, the position is widely considered deviant. A deviant burial is one

that is 'different from the normative burial ritual of the respective period, region and/or cemetery' (Aspöck 2008, 17). While a crouched burial may, in a traditional Christian context, be classed as deviant, in reality it is not (Cherryson 2008; Reynolds 2009; Tsaliki 2008). It is simply a variant and does not necessarily have negative connotations. In contrast, a prone is a classic deviant burial, an interment designed to punish the deceased for some real or imagined crime or transgression/s against the norms of society. It ensures that the individual is confined, both physically and spiritually (O'Brien 2020, 153). The possibility that the hands of this individual may have been bound would indicate further negative implications regarding the actual death of this individual – could he potentially have been executed? Unfortunately, his skeletal remains are very poorly preserved and there is no evidence of any peri-mortem traumas. The location of this burial was also physically isolated from the main cohort of burials; even though these were quite dispersed, they were all contained with relatively discrete area. In contrast, SK15 lay some distance from the nearest burial. This may indicate a liminal location, away from the main cemetery. However, deviant burial and actual physical liminality are not necessarily linked; prone burials have been located within Irish Early Medieval cemeteries, along with apparently 'normal' burials (see Corlett and Potterton 2010). Indeed, six prone burials were recorded spread throughout the medieval burial ground of Ballyhanna in Co. Donegal (Macdonald and Carver 2015, 79). It appears the burial position itself may often have been punishment enough; it was not always necessary to reflect the deviancy in the actual burial location, although this may be the case in Dunkellin. Finally, it was noted earlier (**Section 1.1**), that an isolated burial was previously excavated in the adjacent townland of Castlegar, also by D. Delaney. The remains of the young male adult indicated that he suffered from scoliosis, or a lateral curvature of the spine. This may have impacted his life, such as through compromised respiration, and it appears he used his upper limbs more considerably that his lower limbs (Lynch 2018a). It is tempting to surmise that his disability led to him also being isolated in burial, like SK15 at Dunkellin apparently was. However, there is no substantive evidence to support this premise. It is interesting to see this isolated burial however, which appears to have occurred at a similar time to the interments at Dunkellin.

Plate 15. SK15 (?sex adult)

Despite the negativity which would appear to surround SK15, there are also poignant caring factors evident at Dunkellin in the main concentration of burials. Reference has already been made about the high numbers of juveniles in this cemetery sample; they appear to have been deemed an integral part of the community, certainly in terms of burial rights. The two infants (SK09 and SK14) are particularly interesting in relation to burial practices. The full-term infant (SK09) appears to have been accorded a burial in its own right, lying crouched on its right side, in a foetal position. The pre-term infant (SK14) may have been born, possibly a still birth or, if a live-birth, dying very close to the time of birth, or may have cut from the pregnant woman after her death; in any case, s/he was afforded a normal and careful burial. The pre-term infant was buried immediately next to the right hip of a possible female adult (SK11 possible female 30-34 years). While it may be assumed that the burials of these latter two individuals are contemporary, it should not be taken for granted that they are mother and child; there may be no familial, or at least genetic, link whatsoever between the two. The estimated crown-to-

heel length of SK09 was 50.8cm, which falls within the expected range of 48-53cm for full-term foetuses (Williams and Bannister 1995, 345). The preterm infant is more likely to have been a still-birth, although not necessarily. If born alive, at between 33-35 foetal weeks old, the infant would not have survived long without modern medical intervention. But again, that individual was accorded careful burial next to a female adult. Although a little older, the careful placement of SK13 (2-4 years) on the lower left leg of SK12 (male 30-45 years) (**Plate 16**), again evokes a certain poignancy. As with SK11 and SK14, there may be no biological link between SK12 and SK13, but the careful interment of both of these individuals, one a prime male adult, the other a hope for the next generation, speaks volumes as to the fragility of life.

Plate 16. SK12 (male 30-45 years) and SK13 (2-4 years)

4. Conclusions

The remains of 16 individuals were identified in this previously unrecorded cemetery, with the remains of at least another young juvenile (and possibly a second) represented in the small quantity of disarticulated material. The often-significant fragmentation of bones somewhat hampered the osteoarchaeological analysis. However, the remains, in osteological terms, largely present with evidence which may be expected from any later medieval/early post-medieval Irish population. In addition, there were interesting indications of variations in life experiences for different individuals within the community, at least some of which appeared to be linked with gender. It is the modes of burial which particularly stand out at this site. The diverse range of burial practices including double burials (adults and children), three crouched burials, and a prone burial, with the latter possibly having her/his hands tied behind the back, along with a high proportion of juveniles, suggested to the writer a possible Early Medieval date. However, radiocarbon dates indicate these are a late medieval/early post-medieval population. A number of burials were distinct. These include a female adult with copper alloy rings recovered beside the torso, whose burial was also unusually orientated, and also had the macroscopic evidence of a diet different to her contemporaries, and a male adult, possible one of the most elderly interred at the site, with dental and skeletal evidence of compromised health, buried in tightly crouched position, distinctly unusual for the period. In addition, the prone adult, possibly with bound hands, buried with a metal object between the thighs, is particularly perplexing. The unexpected late date for this cemetery makes it even more intriguing and the amalgamation of all of the post-excavation analyses will be particularly interesting.

5. Project References

Anderson, T. 1998. An Overlooked Anatomical Variant: The Clavicular Rhomboid Fossa. *Journal of Paleopathology,* 10**,** 59-62.

Aspöck, E. 2008. What Actually is a 'Deviant Burial'? Comparing German-Language and Anglophone Research on 'Deviant Burials', *in* Murphy, E. M. (ed.) *Deviant Burial in the Archaeological Record***,** 17-34. Oxford: Oxbow Books.

Aufderheide, A. C. & Rodríguez-Martín, C. 1998. *The Cambridge Encyclopedia of Human Paleopathology,* Cambridge, Cambridge University Press.

Bass, W. M. 1995. *Human Osteology: A Laboratory and Field Manual,* Columbia, Miss., Missouri Archaeological Society.

Bergmann, T. F., Hyde, T. E. & Yochum, T. R. 2002. Active or Inactive Spondylolysis and/or Spondylolisthesis. *Journal of the Neuromusculoskeletal System,* 10**,** 70-78.

Borchers, A. T., Selmi, C., Cheema, G., Keen, C. L., Shoenfeld, Y. & Gershwin, M. E. 2006. Juvenile Idiopathic Arthritis. *Autoimmunity Reviews,* 5**,** 279-298.

Brook, S. T. & Suchey, J. M. 1990. Skeletal Age Determination Based on the Os Pubis: A Comparison of the Acsádi-Nemeskéri and Suchey-Brooks Methods. *Human Evolution,* 5**,** 227-238.

Brothwell, D. & Zakrzewski, S. 2004. Metric and Non-metric Studies of Archaeological Human Bone, *in* Brickley, M. & Mckinley, J. I. (eds.) *Guidelines to the Standards for Recording Human Remains***,** 27-33. Institute of Field Archaeologists Paper No. 7.

Brothwell, D. R. 1981. *Digging Up Bones: The Excavation, Treatment and Study of Human Skeletal Remains,* London, British Museum (Natural History).

Buckley, L. 2003. Health Status in Medieval Dublin: Analysis of the Skeletal Remains from Abbey of St Thomas the Martyr, *in* Duffy, S. (ed.) *Medieval Dublin IV***,** 98-126. Dublin: Four Courts Press.

Buckley, L. 2010. Ninch, Laytown, Co. Meath, within the Context of North Leinster Early Medieval Cemeteries, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in the Light of Recent Archaeological Excavations***,** 43-48. Dublin: Wordwell Ltd.

Buckley, L. & Conway, C. 2010. Early Medieval Settlement and Burial Ground at Faughart Lower, Co. Louth, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in the Light of Recent Archaeological Excavations***,** 49-60. Dublin: Wordwell Ltd.

Buckley, L., Murphy, E. & Ó Donnabháin, B. 1999. *The Treatment of Human Remains: Technical Paper for Archaeologists,* Dublin, Republished by Institute of Archaeologists of Ireland 2004.

Buikstra, J. E. & Ubelaker, D. H. 1994. *Standards for Data Collection from Human Skeletal Remains: Proceedings of a Seminar at the Field Museum of Natural History, organized by Jonathan Haas,* Fayetteville, Arkansas Archeological Survey.

Chamberlain, A. T. & Witkin, A. 2000. Human Skeletal Remains from Cloghermore Cave, County Kerry, Ireland. Unpublished Report for Client.

Cherryson, A. K. 2008. Normal, Deviant and Atypical: Burial Deviation in Late Saxon Wessex, AD 700-1100, *in* Murphy, E. M. (ed.) *Deviant Burial in the Archaeological Record***,** 115-130. Oxford: Oxbow Books.

Coyne, F. & Lynch, L. G. 2010. Corbally, Co. Kildare: The Results of the 2003-4 Excavations of a Secular Cemetery, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in the Light of Recent Archaeological Excavations***,** 77-90. Dublin: Wordwell Ltd.

Coughlan, T. 2003. Excavations at the Medieval Cemetery of St Peter's Church, Dublin, *in* Duffy, S. (ed.) *Medieval Dublin IV***,** 11-39. Dublin: Four Courts Press.

Crumlish, R. 2015 2015:361 Inishbarnog, Donegal. *Excavations.ie Database of Irish Excavation Reports* [Online]. Available: https://excavations.ie/report/2015/Donegal/0025006/ [Accessed 21 June 2021].

Ehara, S., El-Khoury, G. Y. & Bergman, R. A. 1988. The Accessory Sacroiliac Joint: A Common Anatomic Variant. *American Journal of Roentgenology,* 150**,** 857-859.

Evans, J. A. & Chenery, C. A. 2009. Strontium and Oxygen Isotope Analysis fo Tooth Enamel from Five Individuals from the Owenbristy Site, Ireland. Unpublished Report to Eachtra Archaeological Projects: NERC Isotope Geosciences Laboratory.

Fazekas, I. G. & Kośa, F. 1978. *Forensic Foetal Osteology,* Budapest, Akadémiai Kaidó.

Fibiger, L. 2010. The Human Skeletal Remains from Ratoath, Co. Meath, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in the Light of Recent Archaeological Excavations***,** 117-137. Dublin: Wordwell Ltd.

Fibiger, L. & Knüsel, C. 2005. Prevalence Rates of Spondylolysis in British Skeletal Populations. *International Journal of Osteoarchaeology,* 15**,** 164-174.

Fysh, E. & Taylor, G. M. 2002. Investigation of the Link Between Visceral Surface Rib Lesions and Tubersulosis in a Medieval Skeletal Series from England Using Ancient DNA. *American Journal of Physical Anthropology,* 119**,** 27-36.

Geber, J. 2010. Appendix 6 Osteological Report. *In:* Lehane, J. & Delaney, F. (eds.) *Final Archaeological Excavation Report Owenbristy, Co. Galway. Cashel and Burial Ground.* Unpublished Report: Eachtra Archaeological Projects.

Geber, J. 2011. Human Remains from Owenbristy, *in* Delaney, F. & Tierney, J. (eds.) *In the Lowlands of South Galway. Archaeological Excavations on the N18 Oranmore to Gort National Road Scheme***,** 86-94. Dublin: National Roads Authority.

Geber, J. 2014. Skeletal Manifestations of Stress in Child Victims of the Great Irish Famine (1845–1852): Prevalence of Enamel Hypoplasia, Harris Lines, and Growth Retardation. *American Journal of Physical Anthropology,* 155**,** 149-161.

Gilchrist, R. & Sloane, B. 2005. *Requiem: The Medieval Monastic Cemetery in Britain,* London, Museum of London Archaeology Service.

Halpin, A. & Buckley, L. 1995. Archaeological Excavations at the Dominican Priory, Drogheda, Co. Louth. *Proceedings of the Royal Irish Academy. Section C.,* 95C**,** 175-253.

Hillson, S. 1986. *Teeth,* Cambridge, Cambridge U.P.

Hurl, D. P., Sandes, C. & Buckley, L. 2002. The Excavation of an Early Christian Cemetery at Solar, County Antrim, 1993. *Ulster Journal of Archaeology,* 61**,** 37-82.

Kumar, A. & Tubbs, R. S. 2011. Spina Bifida: A Diagnostic Dilemma in Paleopathology. *Clinical Anatomy,* 24**,** 19-33.

Larsen, C. S. 1997. *Bioarchaeology: Interpreting Behavior from the Human Skeleton,* New York, Cambridge University Press.

Lessa, A. 2011. Spondylolysis and Lifestyle Among Prehistoric Coastal Groups from Brazil. *International Journal of Osteoarchaeology,* 21**,** 660-668.

Lieverse, A. R. 1999. Diet and Aetiology of Dental Calculus. *International Journal of Osteoarchaeology,* 9**,** 219-232.

Lovejoy, C. O., Meindl, R. S., Pryzbeck, T. R. & Mensforth, R. P. 1985. Chronological Metamorphysis of the Auricular Surface of the Ilium: A New Method for the Determination of the Adult Skeletal Age at Death. *American Journal of Physical Anthropology,* 68**,** 15-28.

Lynch, L. G. 2005. Osteoarchaeological Report on Human Skeletal Remains Excavated at St Mary's Cathedral, Tuam, Co. Galway. Licence No. 86E0336. Unpublished Report for Client: Aegis Archaeology Limited.

Lynch, L. G. 2006. Osteo-Archaeological Report on Human Skeletal Remains Excavated at Corbally, Co. Kildare. Excavation Licence Number: 03E1752ext. Unpublished Report for Client: Aegis Archaeology Ltd.

Lynch, L. G. 2014. An Assessment of Health in Post-Medieval Ireland: 'One Vast Lazar House Filled with Famine, Disease, and Death'. PhD Thesis submitted to University College Cork.

Lynch, L. G. 2015. Osteoarchaeological Report on Human Skeletal Remains Excavated at Old Hospital Road, Kildare. Licence No. 14E0398. Unpublished Report for Client: L. G. Lynch.

Lynch, L. G. 2018a. Osteoarchaeological Report on Human Skeletal Remains Excavated at Castlegar (Dunkellin Flood Relief Scheme), Co. Galway. Excavation No.: 16E0481. Unpublished Report for Client: L. G. Lynch.

Lynch, L. G. 2018b. Osteoarchaeological Report on Human Skeletal Remains Excavated at Inishbarnóg Island, Co. Donegal (DG073-046---- 'Burial'), Licence No. 03E1072ext. Unpublished Report for Client: L. G. Lynch.

Lynch, L. G. 2018c. Osteoarchaeological Report on Human Skeletal Remains Excavated at St Mary's Church and Graveyard, Kilkenny City (KK019-026115- Church, KK019-026156- Graveyard). Licence No. 12E1314. Unpublished Report for Client: L. G. Lynch.

Lynch, L. G. 2018d. The Osteoarchaeology of Exclusion: Child Burials in Post-medieval Ireland, *in* Hatfield, M., Kruse, J. & Nic Congáil, R. (eds.) *Historical Perspectives on Parenthood and Childhood in Ireland***,** 177-199. Galway: Arlen House.

Lynch, L. G. 2019. Osteoarchaeological Report on the Human Skeletal Remains Excavated at Attirory, Carrick-on-Shannon, Co. Leitrim. (RMP: LE031-039--- 'church site'). Licence No.: 15E0453. Unpublished Report for Client: L. G. Lynch.

Lynch, L. G. 2022. 'Human Remains: Summary of Osteoarchaeological Findings from Excavations 2006-12, Boyle Abbey', in F. Moore and G. Stout (eds), '*Boyle Abbey, Co. roscommon. Conservation, Architecture and Archaeological Excavations 1982-2018*', 292-298. Dublin: the Stationery Office.

Macdonald, P. & Carver, N 2015 'Archaeological Excavations at Ballyhanne Graveyard - Chronology, DEvelopment and Context', in Mckenzie, C. J., Murphy, E. M. & Donnelly, C. J. (eds.) *The Science of a Lost Medieval Gaelic Graveyard. The Ballyhanna Research Project***,** 47-84. Dublin: Transport Infrastructure Ireland.

Mann, R. W. & Hunt, D. R. 2005. *Photographic Regional Atlas of Bone Disease. A Guide to Pathological and Normal Variation in the Human Skeleton,* Springfield, Charles C. Thomas.

Maresh, M. M. 1970. Measurements from Roentgenograms, *in* Mccammon, R. W. (ed.) *Human Growth and Development***,** 157-200. Springfield: C. C. Thomas.

Mays, S. 1998. *The Archaeology of Human Bones,* London, Routledge.

Mays, S., Fysh, E. & Taylor, G. M. 2002. Investigation of the Link Between Visceral Surface Rib Lesions and Tuberculosis in a Medieval Skeletal Series from England Using Ancient DNA. *American Journal of Physical Anthropology,* 119**,** 27-36.

Mcgarry, T. 2010. Late Pagan and Early Christian Burials in Ireland: Some Issues and Potential Explanations, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in the Light of Recent Archaeological Excavations***,** 173-185. Dublin: Wordwell.

Mckenzie, C. J. 2015. Life in Medieval Ballyhanna - Insights from the Osteological and Palaeopathological Analysis of the Adult Skeletons, *in* Mckenzie, C. J., Murphy, E. M. & Donnelly, C. J. (eds.) *The Science of a Lost Medieval Gaelic Graveyard. The Ballyhanna Research Project***,** 85-102. Dublin: Transport Infrastructure Ireland.

Mitchell, P. D. & Brickley, M. 2018. *Updated Guidelines to the Standards for Recording Human Remains*, Chartered Institute for Archaeologists.

Moorrees, C. F. A., Fanning, E. A. & Hunt Jr, E. E. 1963a. Age Variation of Formation Stages for Ten Permanent Teeth. *Journal of Dental Research,* 42**,** 1490-1502.

Moorrees, C. F. A., Fanning, E. A. & Hunt Jr, E. E. 1963b. Formation and Resorption of Three Deciduous Teeth in Children. *American Journal of Physical Anthropology,* 21**,** 205-213.

Nakashima, T., Hojo, T., Suzuki, K. & Ijichi, M. 1995. Symphalangism (Two Phalanges) in the Digits of the Japanese Foot. *Annals of Anatomy,* 177**,** 275-278.

Nikita, E. 2017. *Osteoarchaeology. A Guide to the Macroscopic Study of Human Skeletal Remains,* London, Academic Press.

O'brien, E. 2011. The Context and Content of the Cemetery, *in* Delaney, F. & Tierney, J. (eds.) *In the Lowlands of South Galway. Archaeological Excavations on the N18 Oranmore to Gort National Road Scheme***,** 94-98. Dublin: National Roads Authority.

O'brien, E. 2020. *Mapping Death. Burial in Late Iron Age and Early Medieval Ireland,* Dublin, Four Courts Press.

O'donovan, E. & Geber, J. 2010. Excavations on Mount Gamble Hill, Swords, Co. Dublin, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in Light of Recent Archaeological Excavations***,** 227-238. Dublin: Wordwell Ltd.

O'neill, T. 2010. The Changing Character of Early Medieval Burial at Parknahown 5, Co. Laois, AD 400-1200, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in the Light of Recent Archaeological Excavations***,** 251-260. Dublin: Wordwell Ltd.

Ó Donnabháin, B. 2010. The Human Remains, *in* Lynch, A. (ed.) *Tintern Abbey, Co. Wexford: Cistercians and Colcloughs. Excavations 1982-2007. Archaeological Monograph Series: 5***,** 105-125. The Stationery Office: Dublin.

Ó Néill, J. & Coughlan, J. 2010. An Enclosed Early Medieval Cemetery at Cherrywood, Co. Dublin, *in* Corlett, C. & Potterton, M. (eds.) *Death and Burial in Early Medieval Ireland in the Light of Recent Archaeological Excavations***,** 239-250. Dublin: Wordwell Ltd.

Oh, Y.-M. & Eun, J.-P. 2008. Congenital Absence of a Cervical Spine Pedicle: Report of Two Cases and Review of the Literature. *Journal of the Korean Neurosurgical Society,* 44**,** 389-391.

Ortner, D. 2003. *Identification of Pathological Conditions in Human Skeletal Remains,* Amsterdam, Academic Press.

Ortner, D. J. & Putschar, W. G. J. 1981. *Identification of Pathological Conditions in Human Skeletal Remains,* Washington, Smithsonian Institution Press.

Papageorgopoulou, C., Suter, S. K., Rühli, F. J. & Siegmund, F. 2011. Harris Lines Revisited: Prevalence, Comobidities, and Possible Etiologies. *American Journal of Human Biology,* 23**,** 381-391.

Pomeroy, E. & Zakrzewski, S. R. 2009. Sexual Dimporphism in Diaphyseal Cross-Sectional Shape in the Medieval Muslim Population of Écija, Spain, and Anglo-Saxon Great Chesterford, UK. *International Journal of Osteoarchaeology,* 19**,** 50-65.

Power, C. 1994. A Demographic Study of Human Skeletal Populations from Historic Munster. *Ulster Journal of Archaeology,* 57**,** 95-118.

Power, C. 1995. A Medieval Demographic Sample, *in* Hurley, M. & Sheehan, C. (eds.) *Excavations at the Dominican Priory, St Mary's of the Isle, Crosse's Green, Cork***,** 66-83. Cork: Cork Corporation.

Reynolds, A. 2009. *Anglo-Saxon Deviant Burial Customs,* Oxford, Oxford University Press.

Roberts, C., Lucy, D. & Manchester, K. 1994. Inflammatory Lesions of the Ribs: An Analysis of the Terry Collection. *American Journal of Physical Anthropology,* 95**,** 169-182.

Roberts, C. A. & Manchester, K. 1995. *The Archaeology of Disease,* Ithaca, N.Y., Cornell University Press.

Rogers, J. & Waldron, T. 1995. *A Field Guide to Joint Disease in Archaeology,* Chichester, Wiley.

Rogers, N. L., Flournoy, L. E. & Mccormick, W., F. 2000. The Rhomboid Fossa of the Clavicle as a Sex and Age Estimator. *Journal of Forensic Science,* 45**,** 61-67.

Rothschild, B. M., Hershkovitz, I., Bedford, L., Latimer, B., Dutour, O., Rothschild, C. & Jellema, L. M. 1997. Identification of Childhood Arthritis in Archaeological Material: Juvenile Rheumatoid Arthritis Versus Juvenile Spondyloarthropathy. *American Journal of Physical Anthropology,* 102**,** 249-264.

Schaefer, M., Black, S. & Scheuer, L. 2009. *Juvenile Osteology. A Laboratory and Field Manual,* Amsterdam, Elsevier.

Scheuer, J. L., Musgrave, J. H. & Evans, S. P. 1980. The Estimation of Late Fetal and Perinatal Age from Limb Bone Length by Linear and Logarithmic Regression. *Annals of Human Biology,* 7**,** 257-265.

Scheuer, L. & Black, S. 2000. *Developmental Juvenile Osteology,* San Diego, CA, Academic Press.

Scott, G. R. & Winn, J. R. 2011. Dental Chipping: Contrasting Patterns of Microtrauma in Inuit and European Populations. *International Journal of Osteoarchaeology,* 21**,** 723-731.

Shine, D. & Travers, C. 2011. Excavations in Athboy, Co. Meath. *Archaeology Ireland,* 25**,** 19-22.

Smith, B. H. 1984. Patterns of Molar Wear in Hunter-Gatherers and Agriculturalists. *American Journal of Physical Anthropology,* 63**,** 39-56.

Smith, B. H. 1991. Standards of Human Tooth Formation and Dental Age Assessment, *in* Kelley, M. A. & Larsen, C. S. (eds.) *Advances in Dental Anthropology***,** 142-168. New York: Wiley-Liss.

Sołtysiak, A. 2010. *Death and Decay at the Dawn of the City. Interpretation of the Human Bone Deposits at Tell Majnuna,* Warsaw.

Song, K.-C., Cho, K.-S. & Lee, S.-B. 2010. Congenital Defect of the Posterior Arch of Cervical Spine: Report of Three Cases and Review of the Current Literature. *Journal of the Korean Neurosurg Society,* 48**,** 294-297.

Sprague, R. 2005. *Burial Terminology. A Guide for Researchers,* Lanham, AltaMira Press.

Stone, R. J. & Stone, J. A. 1997. *Atlas of Skeletal Muscles,* Dubuque, Wm. C. Brown Publishers.

Strid, L. 2003. 'Appendix A. The Human Remains from Excavations in St Mary's Lane, Kilkenny City', 18-46, in I. Doyle, 'Archaeological Monitoring and Excavation of a Medieval Cemetery at St Mary's

Lane, Kilkenny City. Licence No. 03E0572'. Unpublished Report for Client: Margaret Gowen & Co. Ltd.

Stuart-Macadam, P. 1991. Anaemia in Roman Britain: Poundbury Camp, *in* Bush, H. & Zvelebil, M. (eds.) *Health in Past Societies. Biocultural Interpretations of Human Skeletal Remains in Archaeological Contexts***,** 101-113. Oxford: BAR British Series 567.

Tihanyi, B., Berthon, W., Kis, L., Váradi, O. A., Dutour, O., Révész, L. & Pálfi, G. 2020. "Brothers in Arms": Activity-related Skeletal Changes Observed on the Humerus of Individuals Buried with and without Weapons from the 10th-century CE Carpathian Basin. *International Journal of Osteoarchaeology,* 30**,** 798-810.

Tsaliki, A. 2008. Unusual Burials and Necrophobia: An Insight into the Burial Archaeology of Fear, *in* Murphy, E. M. (ed.) *Deviant Burial in the Archaeological Record***,** 1-16. Oxford: Oxbow Books.

Ubelaker, D. H. 1989. *Human Skeletal Remains: Excavation, Analysis, Interpretation,* Washington, Taraxacum.

Vleeming, A., Schuenke, M. D., Masi, A. T., Carreiro, J. E., Danneels, L. & Willard, F. H. 2012. The Sacroiliac Joint: An Overview of its Anatomy, Function and Potential Clinical Implications. *Journal of Anatomy,* 221**,** 537-567.

Waldron, T. 2009. *Palaeopathology,* Cambridge, Cambridge University Press.

Walker, P. L., Bathurst, R. R., Richman, R., Gjerdrum, T. & Andrushko, V. A. 2009. The Causes of Porotic Hyperostosis and Cribra Orbitalia: A Reappraisal of the Iron-Deficiency Anemia Hypothesis. *American Journal of Physical Anthropology* 139**,** 109-125.

Wander, K., Shell-Duncan, B. & Mcdade, T. W. 2009. Evaluation of Iron Deficiency as a Nutritional Adaptation to Infectious Disease: An Evoluntionary Medicine Perspective. *American Journal of Human Biology,* 21**,** 172-179.

White, T. D. & Folkens, P. A. 1991. *Human Osteology,* San Diego, Academic Press.

Williams, P. L. & Bannister, L. H. (eds.) 1995. *Gray's Anatomy. The Anatomical Basis of Medicine and Surgery,* New York: Churchill Livingstone.

Woodward, M. & Walker, A. R. P. 1994. Sugar Consumption and Dental Caries: Evidence from 90 Countries. *British Dental Journal,* 176**,** 297-302.

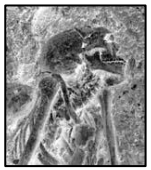
6. Appendices

6.1 Catalogue of *In Situ* Human Skeletal Remains

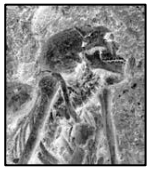
A summary of the *in situ* skeletons from Beresford is provided in **Table 6**.

Table 6. Summary of osteoarchaeological analysis of *in situ* skeletons

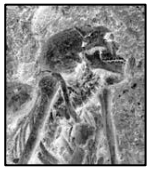
Burial	Sex	Age-at-death	Stature (cm)	Preservation	Orientation	Skeletal Pathology	Dental Pathology	Finds?	Assoc. Burial	Other
SK01	Female	25-30 yrs	156.9	Good	Disarticulated	Other – Harris line in distal right tibia.	1 perm. tooth Attrition - minimal	-	-	
SK02	-	9-10 yrs	-	Poor	WSW/ENE Supine, extended		1 erupted & 1 unerupted perm. tooth Hypoplastic Defects – stress 0-1 yrs	-	-	Long bones appear short for the dental age-at-death



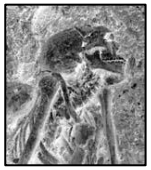
SK03	-	9-12 yrs	-	Good	WSW/ENE Supine, extended		30 perm. teeth (21 erupted, 4 erupting, 5 unerupted) & 5 deciduous teeth Calculus – 11 perm. teeth (slight to moderate), 2/5 decid. teeth (slight to moderate). Caries – 2 decid. teeth, small lesions. Hypoplastic Defects – 6 perm teeth, at least 2 periods of stress 3.5-4.5 yrs	-	-	Selected for AMS dating
SK04	Poss. Male	35-39 yrs	-	Poor	WSW/ENE Tightly crouched on left side	DJD – mild right TMJ & cervical and thoracic vertebrae. Metabolic – mild cribra orbitalia left orbit (right unob.). Trauma –healed midshaft fracture in an unidentified right rib.	28 perm. teeth Calculus – 27/28, slight to moderate, subgingival on many. Caries – 2/28, small to medium at CEJ.	-	-	Selected for AMS dating



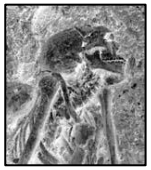
						Healed fracture in the right ulna (also has active periostitis). Non-specific Infection – multiple bones affected: Right ulna (active); fifth left metacarpal (partly remodelled and healed); left tibia (thick healed circumferential deposits, with layering); left fibula (thick healed circumferential deposits); right tibia – similar to left; right fibula – same as right.	Attrition – max. on molars level 6. Chipping – 5/28.			
SK05	Male	15-16 yrs	-	Poor	WSW/ENE	DJD – ante-mortem lytic erosions at margins of	28 perm. teeth, plus 4 erupting	-	-	-



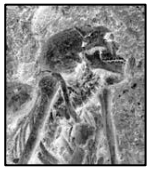
					Supine, extended	distal joints of left and right MT1. Other –fossae at site of insertion of latissimus dorsi (fibrous entheses) in both humeri.	Calculus – 26/28, slight to moderate. Hypoplastic Defects – 8 teeth, at least two periods of stress, 1-2 yrs and 3-4 yrs. Anomalies – the root of the lower right second deciduous molar retained.			
SK06	Poss. male	13-16 yrs	-	Very poor	WSW/ENE Supine, extended, but legs slightly to right lateral	Metabolic – mild cribra orbitalia in right orbit (left unob.). Anomalies – defect in apophyseal facets of T11 and T12 that resemble DJD. - linea aspera in the right femur (left unob.) is very prominent.	15 perm. teeth, plus 4 erupting Calculus – 10 teeth, slight to moderate.	-	-	-



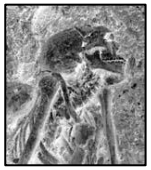
SK07	Female	18-23 yrs	164.0	Poor	WSW/ENE Supine, extended	Trauma – spondylolysis L4 & L5. Non-specific Infection – subtle healed striated bone on right MT5. Developmental – accessary sacral facet on the right ilium (none on left); - cleft post. process in L5. Other – flattened facet at costal tuberosity.	25 perm. teeth plus 1 erupting & 2 decid. teeth Calculus – 23 perm., slight to moderate, subgingival. - 2 decid., slight to moderate, subgingival. Hypoplastic Defects – 3 teeth, stress between 2.5-3.5 years. Chipping – 3 perm. Attrition – max. on molars level 2. Anomalies – lower second deciduous molars retained.	-	-	-
SK08	Female	Adult	-	Very poor	E/W Supine, extended	DJD – mild right hip and thoracic spine	22 perm. + two root fragments (MNI 1 tooth)	3 copper alloy rings (not finger	-	Selected for AMS dating



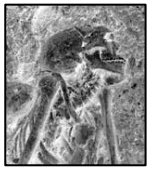
							Calculus – 19/23 teeth, slight to severe, many subgingival. Caries –7/23, small to severe. Attrition – max. on molars level 5. Other – enamel pearl on root of 28.	rings) at right torso		
SK09	-	Full-term infant	50.8	Very poor	WSW/ENE Flexed on right side	-	1 unerupted decid. tooth	-	-	-
SK10	-	3-5 yrs	-	Poor	WSW/ENE Supine, extended	-	5 unerupted perm teeth & 7 erupted decid teeth	-	-	On-site long bone measurements suggested a younger ind.
SK11	Poss. female	30-34 yrs	-	Poor	WSW/ENE Supine, extended	-	18 perm. teeth Calculus – 13/18, slight to moderate deposits, subgingival.	Oyster shells. Periwinkle shell at left wrist	SK14 immediately beside right hip	



							Caries – 3/18, small lesions, CEJ. Attrition – max. level 3 on molars.			
SK12	Male	30-45 yrs	-	Poor	WSW/ENE Supine, extended	DJD – mild C1 and C2, left patella. Infection – healed oval lytic lesion on internal surface of unidentified left rib shaft. Developmental - symphalangism of right fifth intermediate and distal foot phalanges. Other – fossae at site of insertion of latissimus dorsi (fibrous entheses) in both humeri.	29 perm. teeth Calculus – 29/29, slight to moderate, subgingival. Caries – 1/29, small. Attrition – max. level 4 on molars. Chipping – 11 teeth.		SK13 lying crouched on lower left leg & foot	Bones quite robust. Sternum visible during the excavation but did not survive
SK13	-	2-4 yrs	-	Poor	WSW/ENE	-	17 unerupted perm. teeth, plus unidentified enamel	-	Lay crouched on lower left	-



					Crouched on right side		fragment & 20 erupted deciduous teeth <u>Calculus</u> – 14/20 deciduous teeth, slight to moderate.		leg and foot of SK12	
SK14	-	Preterm infant	-	Very poor	WSW/ENE Supine, left leg at least may be flexed to left lateral	-	-	-	Buried beside right hip of SK11	-
SK15	-	Adult	-	Very poor	WSW/ENE prone, with at least the left hand behind the back	-	-	Ferrous metal object at pelvis	-	Two fragments of right tibia selected for AMS dating
SK16	-	2-4 yrs	-	Very poor	WSW/ENE Supine, extended	-	3 unerupted perm. & 6 unerupted decid. teeth	-	-	Fragment of left femur selected for AMS dating

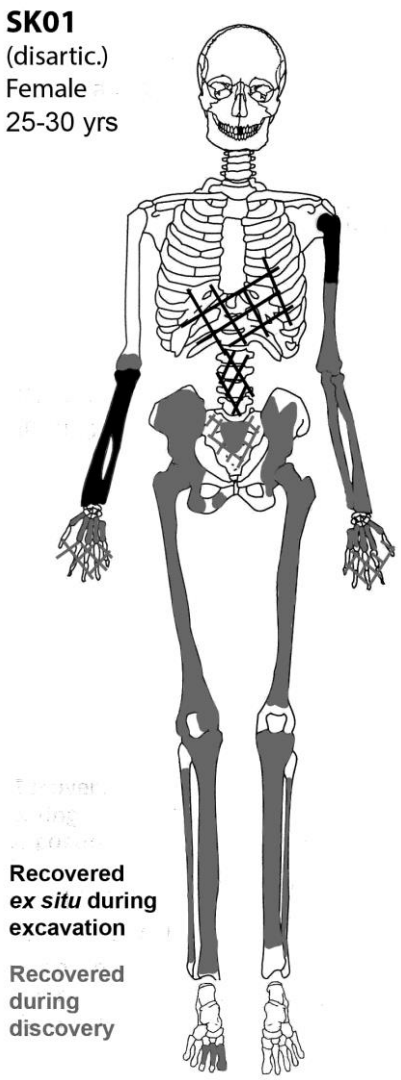


SK01 (disarticulated)

Age: Middle Adult 25-30 years (secondary epiphyseal fusion, auricular ilium)
Sex: Female
Stature: 156.9=/-3.72cm (right femur)

Skeletal Preservation: All of the remains of this individual were in a disarticulated state, due likely to the nature of discovery. Good. Bones relatively well preserved. Some were recovered during the initial exposure of the burial ground (grey in diagram), while others were recovered in a disarticulated state during the excavation (black in diagram).
Skeletal Position: Disarticulated/*ex situ.*
Skeletal Attitude: Disarticulated/*ex situ.*
Orientation: Disarticulated/*ex situ.*
Associated Skeleton/s: -
Associated Finds: -

Bones Present: A tooth. Left humerus, distal end of right humerus, radi, ulnae, one left carpal, complete left and right metacarpals, incomplete left and right hand phalanges. Minute quantity of thoracic and lumbar vertebrae, and shafts of ribs. Ilia, ischia, fragment of right pubis. Femora, fragment of right patella, tibiae, fibulae, incomplete right metatarsals.



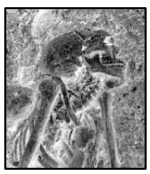
Dental Inventory:

								P							
~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~

1 permanent teeth

Dental Pathology: Minimal attrition on surviving tooth.
Skeletal Pathology:
Metabolic – at least one Harris line is visible in the post-mortem break at the distal right tibia.

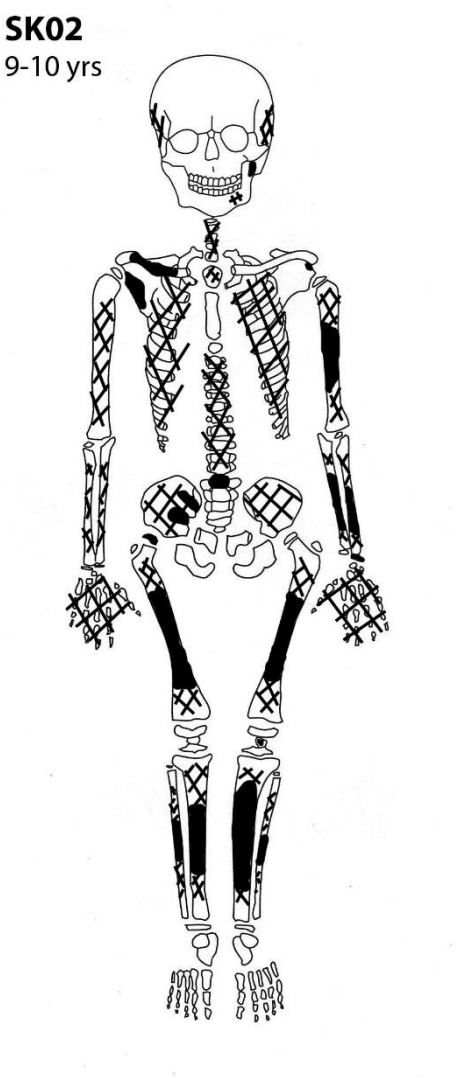
Anomalies: -
Comments: -



SK02

Age: Older juvenile 9-10 years (dentition)
Sex: -
Stature: -

Skeletal Preservation: Poor. Fairly complete but there is significant fragmentation. The extremely fragmented cranium was disturbed during initial exposure and was lifted prior to the excavation and recovery of the complete remains.
Skeletal Position: Supine.
Skeletal Attitude: Extended. Both lower arms were bent with the hands resting together, palm down, on the right pelvis. The ankles were approximately 4cm apart.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: -



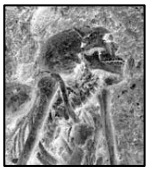
Bones Present: *Most, or all, of the remains are highly fragmented*. Highly incomplete cranium and mandible. Fragments of the right clavicle, scapulae, humeri, radi, ulnae, incomplete left and right carpals, metacarpals, and hand phalanges. Minimum eight left and five right ribs, fragments of the cervical, thoracic, lumbar, and sacral vertebrae, fragments of the ilia. Fragments of the femora (including right proximal epiphysis), left patella, tibiae, fibulae.
Dental Inventory:

~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~
	P	U													

2 permanent teeth (1 erupted, 1 unerupted)

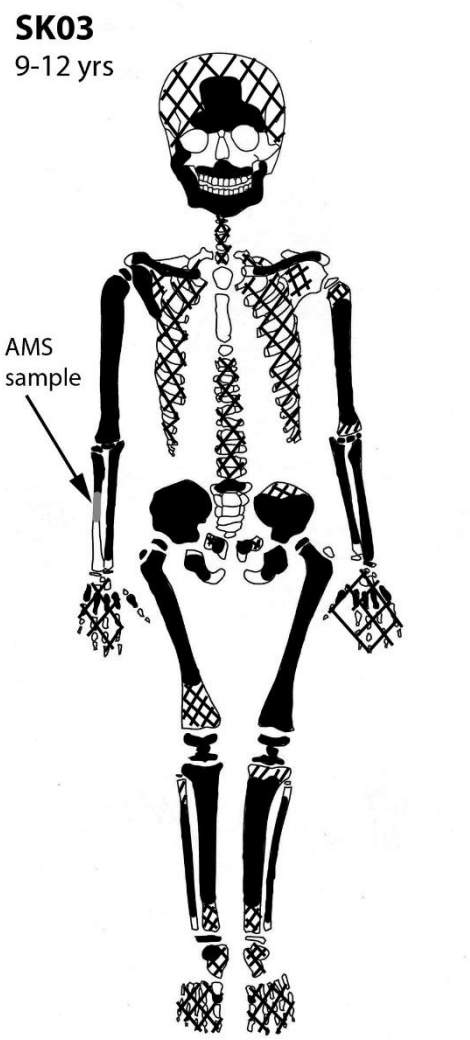
Dental Pathology:
Hypoplastic Defects – tips/cusps of 46 are hypoplastic, indicating stress in first year of life.
Skeletal Pathology:

Anomalies: The right femur was measured prior to lifting and was approximately 250mm in length. This suggests an age-at-death of possibly between 5.5-7.5 years (based on Ubelaker 1989).



Comments: The left and right ribs have collapsed differently; the left ribs have collapsed downwards, or inferiorly, as expected, but the right ribs have collapsed outwards to the lateral aspect.

SK03



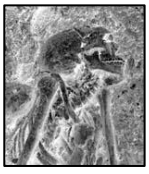
Age: Older juvenile 9-12 years (dentition and long bones)
Sex: -
Stature: -

Skeletal Preservation: Good. Complete, but with significant fragmentation.
Skeletal Position: Supine.
Skeletal Attitude: Extended. Arms parallel to torso, left hand palm down, right right palm up. Ankles 5cm apart. Feet and head slightly higher than the remainder of the skeleton. Upper torso/shoulders lie tightly inbetween a gap in the bedrock.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: -

Bones Present: *Most, or all, of the remains are quite fragmented*. Fragmented cranium and mandible. Incomplete clavicles, scapulae, humeri (including proximal left epiphysis and both distal epiphyses), radi (including proximal and distal epiphyses), ulnae, incomplete left and right carpals and hand phalanges, complete left and right metacarpals but with erosion of many epiphyses. Minimum seven left and nine right ribs, fragments of most vertebrae from C1 through to S1. Fragments of the ilia, ischia, and pubes. Femora (including epiphyses), tibiae (including proximal epiphyses), fibulae, incomplete left and right tarsals, metatarsals, foot phalanges.
Dental Inventory:

	P	P	P	P	P	P	P	P	P	E	E	U	P	P	U
~~18~~	~~17~~	16	~~15~~	~~14~~	~~13~~	12	11	21	22	23	24	25	~~26~~	~~27~~	~~28~~
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
U	P	P	U	P	P	P	P	P	P	E	E		P	P	U

30 permanent teeth (21 present, 4 erupting, 5 unerupted

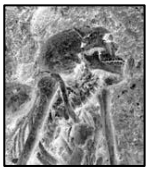


							P	P	P
~~55~~	~~54~~	~~53~~	~~52~~	~~51~~	~~61~~	~~62~~	~~63~~	~~64~~	~~65~~
~~85~~	~~84~~	~~83~~	~~82~~	~~81~~	~~71~~	~~72~~	~~73~~	~~74~~	~~75~~
P									P

5 deciduous teeth

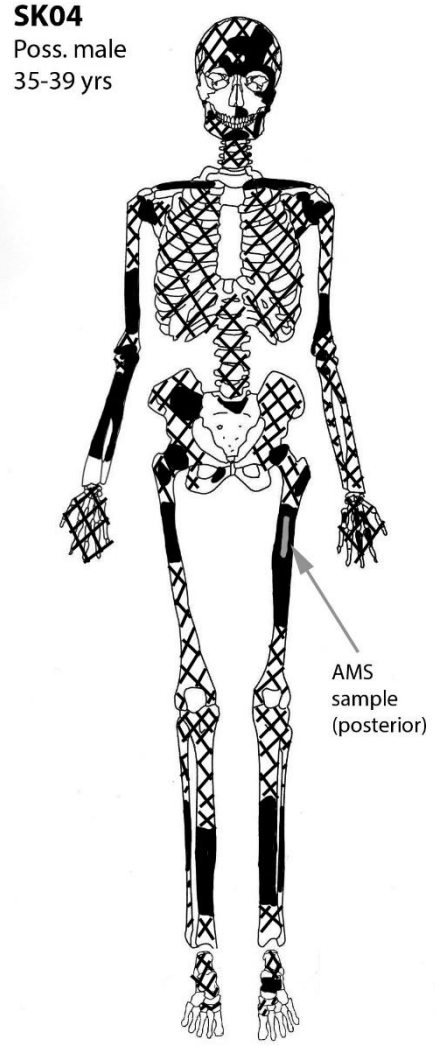
Dental Pathology:
Calculus – 2/5 deciduous teeth, slight to moderate on 85 and 75; 11 permanent teeth, slight to moderate on 16,12, 26, 46, 42-33, 36.
Caries – 2 deciduous teeth, small lesions at the CEJ on 64 and 65.
Hypoplastic Defects – 6 permanent teeth, 14, 13, 23, 24, 43, and 33, at least one line on each, at *c.* Cr3/4. Likely at least two periods of stress between 3.5-4.5 years.
Skeletal Pathology: -

Anomalies: -
Comments: A 3.2g sample of the diaphysis of the right radius was selected for AMS dating. It returned a date of cal AD 1489-1637, with a median probability of 1566 (UBA-48359).



SK04

Age: Middle Adult 35-39 years (auricular ilium)
Sex: Possible Male (skull is slightly more male, metrics are female, pelvis appeared male during excavation)
Stature: -

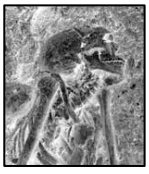


Skeletal Preservation: Poor. Complete but highly fragmented.
Skeletal Position & Attitude: Crouched on left side. Both upper arms are to the front of the torso, at *c.* 45° to the spine, with both lower arms extended, parallel to the spine, upwards towards the face. The left hand (lowermost in terms of the arms within the grave) is curled, palm side up, under the right lower arm. The right hand is curled, palm side down, in front of the face. The legs are tightly flexed. The left leg (the lower of the two) is tightly flexed, with the femur at almost 180° to the spine. The left knee is on the right elbow. The lower left leg is tightly flexed against the femur, with the anterior tibia and foot tightly abutting the bedrock; the left foot is actually extended distally, in a relevé or 'tip-toe' position, due to the bedrock. The right leg is not as tightly flexed as the left, with the femur at *c*. 45° to the spine. The right lower leg is flexed over the left lower leg, though in a more relaxed position, with the right foot in a natural position.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s:
Associated Finds: -

Bones Present: *Most, or all, of the remains are highly fragmented*. Incomplete cranium and mandible. Incomplete clavicles, scapulae, humeri, radi, ulnae, incomplete left and right carpals, metacarpals, and hand phalanges. Minimum eight left and two right ribs, fragments of C1-T1, S1, and the vertebrae in between. Fragments of the ilia and right pubis. Incomplete femora, tibiae, fibulae, incomplete left and right tarsals.
Dental Inventory:

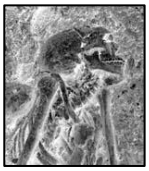
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	21	22	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	32	33	~~34~~	~~35~~	~~36~~	37	38
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	

28 permanent teeth

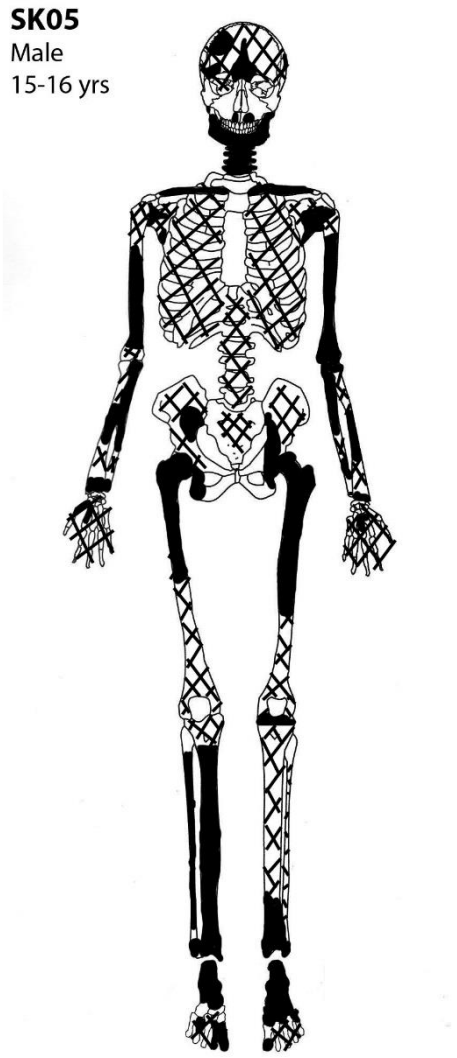


Dental Pathology:
Calculus – 27/28, slight to moderate deposits on all except 37. Subgingival on all teeth except 47,43, and 34.
Caries – 2/28, small to medium lesions at CEJ of 47 and 37.
Attrition – maximum wear on molars is level 6.
Chipping – chipping evident on five teeth: buccal cusp of 24; lingual/distal corner of 47; mesial and lingual edge of 46; distal margin of 36; mesial, distal, lingual edges of 37.
Skeletal Pathology:
Degenerative Joint Disease – mild in right temporomandibular, and in cervical and thoracic vertebrae.
Metabolic – mild cribra orbitalia in left orbit, right unobservable.
Trauma – there is a healed midshaft fracture in an unidentified right rib. Healed fracture also present in the right ulna, 95mm inferior to the ulna tuberosity, the shaft is displaced anteriorly. This bone also has active periostitis (see below).
Non-specific Infection – multiple bones affected.
Right ulna – there is post-mortem erosion around the olecranon process. However, there is clear active dense but porous grey bone on the medial and posterior aspects of the head, from the inferior edge of the ulna tuberosity extending superiorly. Bone also exhibits an old healed fracture (see above).
Fifth left metacarpal – the proximal and distal ends are damaged post-mortem. However, on the dorsal aspect of the shaft there is partly remodelled porous bone, at least 6.7mm proximal/distal by 3.06mm. There are also faint traces of healed periosteal lesions at the distal end of the palmar aspect. Finally, there is a slight smooth rise or bump on the medial aspect of the shaft, measuring 9.32mm proximal/distal by 4.13mm, and measuring 1.01mm in height. This may be healed periosteal bone.
Left tibia – only the diaphysis survives. There are thickened healed deposits, comprising at least two separate layers. These start at the inferior margin of the popliteal line and extend distally, getting progressively more severe. The lesions are circumferential.
Left fibula – only the diaphysis survives. There are circumferential healed periosteal deposits.
Right tibia – same as on left, but less evidence of layers.
Right fibula – same as on right.

Anomalies: -
Comments: A fragment (4.2g) of the left femoral shaft, from the posterior, just inferior to the area of the lesser trochanter, was selected for AMS dating. It returned a date of cal AD 1496-1641, with a median probability of 1562 (UBA-48360).



SK05



Age: Adolescent 15-16 years (epiphyseal fusion)
Sex: Male (pelvis, skull)
Stature: -

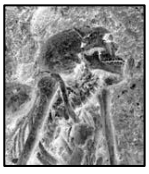
Skeletal Preservation: Poor. Most elements are present but there is significant fragmentation. There was a high amount of angular stones in the fill, which appear to have substantially contributed toward the fragmentation.
Skeletal Position: Supine.
Skeletal Attitude: Extended. The head appears to be largely upright. The upper arms are parallel to the torso. The left elbow is bent at 90°, with the hand extended, palm down, over the right elbow. The right elbow is bent at *c.* 45°, with the hand extended over the pubic area. The feet appear to have been close together. The torso and arms appear quite loose, that is, not tightly constricted.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: -

Bones Present: *Most, or all, of the remains are highly fragmented*. Incomplete cranium and mandible. Slight incomplete clavicles, incomplete scapulae, humeri, radi, ulnae, incomplete left and right carpals, metacarpals, and hand phalanges. Minimum 11 left and eight right ribs, vertebrae include C1-T2 and unidentified thoracic, lumbar, and sacral fragments. Incomplete ilia and ischia. Incomplete femora, tibiae, fibulae, incomplete left and right tarsals, metatarsals, foot phalanges.
Dental Inventory:

E	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E
~~18~~	~~17~~	~~16~~	~~15~~	14	13	12	11	21	22	23	24	25	26	~~27~~	~~28~~
48	47	46	45	44	43	~~42~~	~~41~~	~~31~~	32	33	34	35	36	37	38
E	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E

28 permanent teeth plus 4 erupting

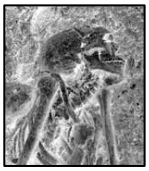
Dental Pathology:
Calculus – 26 teeth, all except 27, 28, 48, 35, 37, 38, slight to moderate deposits.
Hypoplastic Defects – 8 teeth, single lines on each of 13, 11, 21, 23, 44, 43, 33, 34, indicating at least two periods of stress at 1-2 years and 3-4 years.



Anomalies – the root of the lower right second deciduous molar is still present in the alveolar bone.

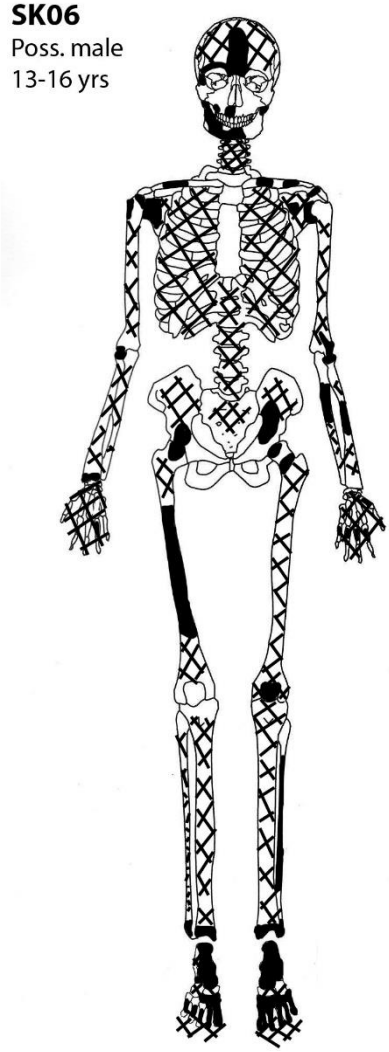
Skeletal Pathology:
Degenerative Joint Disease – Remodelled lytic erosions to distal epiphyses of both left and right first metatarsals, plantar aspect. There is post-mortem damage to both bones. In the left first metatarsal there is a clear lytic erosion to and including the joint margin, on the planter aspect. The trabecular bone was exposed but is remodelled. This lesion measures 15.3mm proximal/distal by at least 6.62mm, and extends at least 2.92mm below the normal joint surface. At the distal end of the erosion are two very small more focused lytic lesions. A similar erosion is present in the right first metatarsal in the same location, although there is greater post-mortem damage. This measures at least 12.96mm proximal/distal by 6.57mm and is at least 2.87mm below the normal joint surface. A distinct lytic focus, measuring 2.46mm in approximate diameter, is located just to the lateral of the main area of erosion. Further lytic destruction is present on the medial aspect of the margin of the joint, involving destruction of the normal bone, exposure of the trabecular bone, and remodelling.
Other – entheseal change: there are fossae at site of insertion of latissimus dorsi (fibrous entheses) in both humeri.

Anomalies: -
Comments: -



SK06

Age: Adolescent 13-16 years (epiphyseal fusion)
Sex: Possible male (based on incomplete cranium)
Stature: -

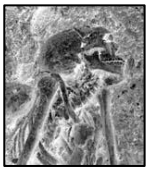


Skeletal Preservation: Very poor. Most elements are present but the bones are extremely fragmented.
Skeletal Position: Supine.
Skeletal Attitude: Extended, but with legs flexed slightly to right lateral. The left upper arm is tight against the torso, with the lower arm bent at 90° over the abdomen, with the left hand extended, palm down, towards the right lower arm. The right upper arm is slightly splayed out from the torso and the entire arm is extended parallel to the torso. The right lower arm is lying prone, with the hand lying extended and palm-side-up. The lower body was slightly turned on its right side. The femora extend at *c*. 45° to the right of the line of the spine, with the lower legs bent back again. Appears to have been laid into the grave from one side only (the left side of the body), so the body was slightly turned/orientated on its right side. The right knee is the highest part of the skeleton, resting against the tight gravecut. The right hand is also tightly against the gravecut.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: -

Bones Present: *Most, or all, of the remains are highly fragmented*. Incomplete cranium and mandible. Incomplete clavicles, scapulae, humeri. radi, ulnae, incomplete left and right carpals, metacarpals, and hand phalanges. Minimum seven left and five right ribs, incomplete cervical through to sacral vertebrae. Fragments of the ilia. Incomplete femora, left patella, incomplete tibiae, fibulae, complete (but fragmented) left and right tarsals and metatarsals, incomplete left and right foot phalanges.
Dental Inventory:

E	P	P	P	P	P	P	PM	P							E
18	17	16	15	14	13	12	11	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
48	47	46	45	44	43	42	41	31	32	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~
E	P	P	P	P	P	P	P	PM	PM					P	E

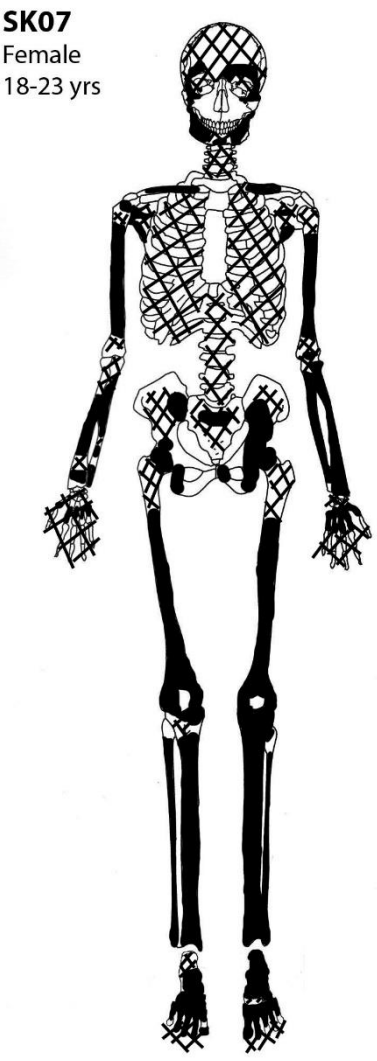
15 permanent teeth, plus 4 erupting



Dental Pathology:
Calculus – 10 teeth, slight to moderate deposits on 16-12, 21, 47, 46, 42, 41.
Skeletal Pathology:
Metabolic – mild cribra orbitalia in right orbit, left unobservable.
Anomalies – the left superior facet of T11 and the left superior facet of T12 appear unusual, given the age-at-death of this individual. There is very slight, apparently ante-mortem, pitting of the surfaces of the joints, as well as very slight marginal lipping. May be an indication of some form of instability in the spine rather that DJD per se?
- in addition, the linea aspera on the right femur (left is extremely fragmented) is very prominent. At approximately the midshaft, it measures 25.7mm anterior/posterior by 19.3mm

Anomalies:
Comments: -

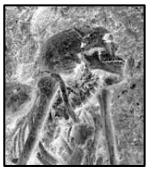
SK07



Age: Young Adult 18-23 years (epiphyseal fusion)
Sex: Female (pelvis. Skull and metrics are a little ambiguous)
Stature: 164.0+/-4.24cm (left radius, see 'Comments')

Skeletal Preservation: Poor. Quite complete but there is some fragmentation.
Skeletal Position: Supine.
Skeletal Attitude: Extended. The grave cut appears to have been both too narrow and too short. The upper left arm is much higher in the grave than the spine (up against the edge of the gravecut). The left elbow is bent at 45° with the hand on the left pelvis. The upper right arm is slightly splayed out from body, but the lower arm is tightly flexed up towards the head so that the right hand is in an extended position, overlying the throat area. Although the ankles are approximately 3cm apart, the right foot slightly overlies the left, while the foot phalanges are upright against the gravecut.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: -

Bones Present: *Most, or all, of the remains are quite fragmented*. Incomplete cranium and mandible. Fragments of the clavicles and scapulae, humeri, radi, and ulna are quite intact but eroded at proximal and distal



ends, incomplete left and right carpals, right metacarpals, and left and right hand phalanges, complete left metacarpals. Minimum seven left and eight right ribs, vertebrae include C1-C2, fragments of L1 to L5, and unidentified cervical, thoracic, lumbar and sacral vertebral fragments. Fragments of the ilia, ischia, and left pubis. Slightly incomplete femora, patella, tibiae, fibular, mostly complete left and right tarsals and metatarsals, incomplete left and right foot phalanges (one sesamoid with right foot).

Dental Inventory:

	P	P	P	P	P	P	P	P		P	P	P	P	P	
~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
48	47	46		44	43	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	34		36	37	38
CA	P	P		P	P	P	P	P	P	P	P		P	P	E

25 permanent teeth plus one erupting

55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	72	73	74	75
P									P

2 deciduous teeth retained

Dental Pathology:

Calculus – 23 permanent teeth (excepting 17,11, 38), slight to moderate deposits, subgingival in 16, 26;

- 2 deciduous teeth, slight to moderate deposits on both surviving deciduous teeth, subgingival in both.

Hypoplastic Defects – 3 teeth, single line on each of 13, 33, and 43, indicating stress between 2.5-3.5 years.

Attrition – maximum level 2 on surviving molars.

Chipping – 3 permanent teeth, incisal edges of 11, 21, and 32 are chipped.

Anomalies – the lower second deciduous molars have been retained, resulting in the non-eruption of the lower second permanent premolars.

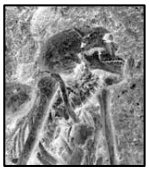
Skeletal Pathology:

Trauma – there is spondylolysis at the left pars interarticularis of L4. Right unobservable.

- there is spondylolysis at right pars interarticularis of L5. Left unobservable. In addition, the posterior process is cleft. The remains are poorly preserved and it is not possible to determine if there was spondylolisthesis.

Non-specific Infection – there is faint, but definite, healed striated bone on the anterior aspect of the proximal end of the diaphysis of the right fifth metatarsal, measuring 25.86mm proximal/distal by 8.81mm.

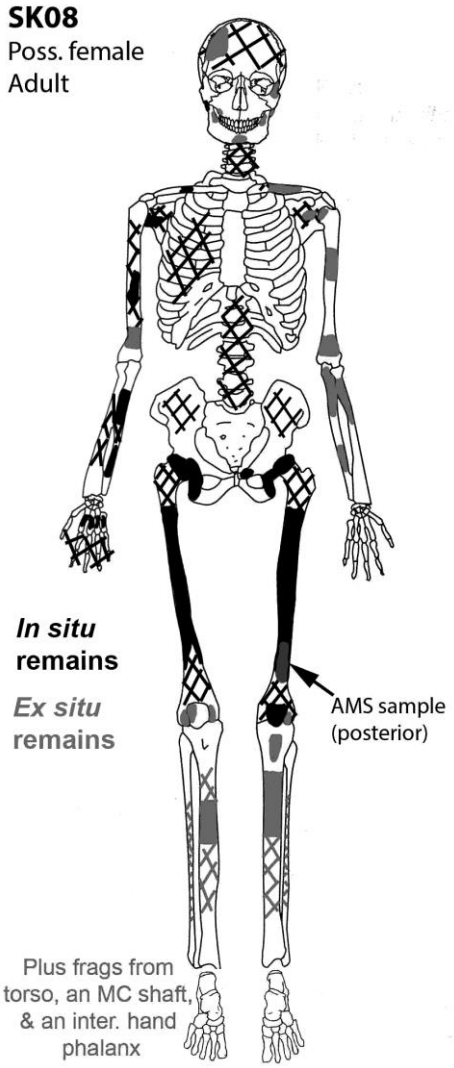
Development – there is an accessary sacral facet on the right ilium (sacrum extremely fragmented); none is visible on the left ilium.



- the posterior process of L5 is cleft (this, and L4, were also affected by spondylolysis).
Other – flattened facet at costal tuberosity.

Anomalies: -
Comments: The left tibia of this individual is also present. However, given the known issues regarding the correct measurement of this bone in relation to the original study of stature estimation (see Mitchell and Brickley 2018, 40), it is not utilised here.

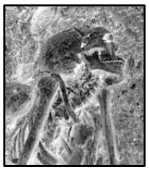
SK08



Age: Adult
Sex: Female (surviving cranium and metrics. Pelvis appeared female during excavation)
Stature: -

Skeletal Preservation: Very poor. Most elements are present but there is significant fragmentation. Much of the bone which had lain directly on bedrock, was recovered at the time of discovery as disarticulated remains. These are indicated in red in the catalogue diagram.
Skeletal Position: Supine.
Skeletal Attitude: Extended. Right elbow is bent at 90° with lower arm over abdomen and hand palm-side down. Positions of left arm and lower legs is not known as these were recovered *ex situ*.
Orientation: East/west, head to west.
Associated Skeleton/s: -
Associated Finds: -3 thin copper-alloy rings (not finger) were recovered between the right ribs and the humerus.

Bones Present: *Most, or all, of the remains are highly fragmented*. Fragments of the cranium. Extremely incomplete fragments of the clavicles, scapulae, humeri, radius, and ulna, shaft fragments of right MC2-MC5, and incomplete right hand phalanges. Minimum two right ribs, extremely incomplete fragments of the cervical (including C1 and C2 *ex situ*), thoracic, and lumbar vertebrae. Fragments of the ilia, ischia, and left pubis. Incomplete femora, patellae, tibiae, and fibulae.



Dental Inventory: *N.B. All dental remains were recovered ex situ.*

PM			P	P	P		P		P	P		P		R	P	
18	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~	
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~	
P		P	P	P	P	P		?P	P	P	P	P	P	?P		

22 permanent teeth, plus two root fragment of tooth/teeth lost to caries
(latter may be remains of a multi-rooted molar, so counted as a minimum of one tooth)

Dental Pathology:

Calculus – 19/min. 23 teeth, all except, unidentified tooth roots, 27, and 28, slight to severe (latter on at least four teeth, many subgingival.

Caries – minimum 7/minimum 23, small to moderate lesions at CEJ of 48, 46, 36, 37. Large lesion at CEJ of 28, crown of 27 entirely lost, and unidentified roots of at least one other molar lost to caries.

Attrition – maximum wear on surviving molars is level 5.

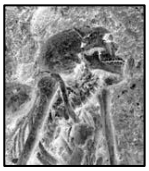
Other – enamel pearl on distal aspect of root of 28.

Skeletal Pathology:

Degenerative Joint Disease – mild DJD of right hip and thoracic spine.

Anomalies: -

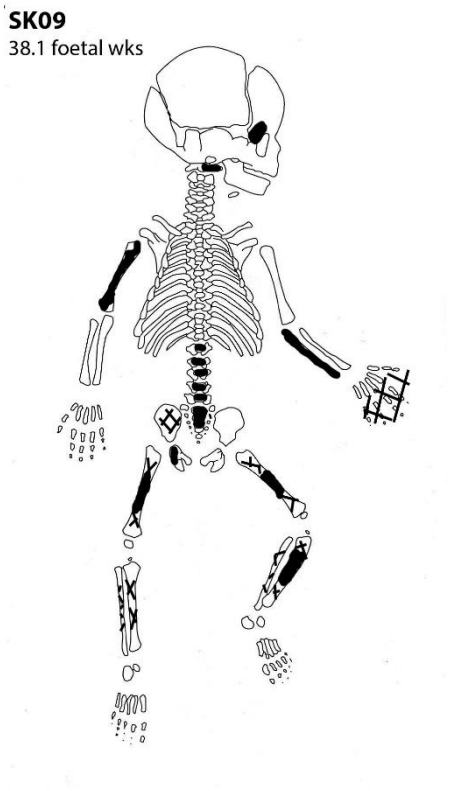
Comments: A fragment of the posterior of the distal diaphysis of the left femur (8.8g) was selected for AMS dating. It returned a date of cal AD 1477-1635, with a median probability of 1565 (UBA-48361).



SK09

Age: Full-term infant (slight incomplete long bone and dental remains)
Sex: -
Stature: 50.8cm (very slightly incomplete right humerus)

Skeletal Preservation: Very poor. Very incomplete, with some fragmentation.
Skeletal Position: Flexed on right side
Skeletal Attitude: Appears to be largely lying on right side, with legs bent at the knees out to the right lateral. The upper right arm is in front of the torso, while the left forearm was recovered over the abdomen, indicating the left elbow was bent at 90°, with the left hand likely close to the right elbow.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: -



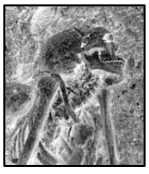
Bones Present: *Most, or all, of the remains are highly fragmented*. Fragment of right orbit, right incus, a tooth. Slightly incomplete right humerus, left ulna, a left intermediate hand phalanx. Loose rib shaft fragments, fragments of C1 and bodies of L1-S3. Fragments of the right ilium and ischia. Fragments of the femora, tibiae, and fibulae, one unsided MT.
Dental Inventory:

					U				
~~55~~	~~54~~	~~53~~	~~52~~	~~51~~	~~61~~	~~62~~	~~63~~	~~64~~	~~65~~
~~85~~	~~84~~	~~83~~	~~82~~	~~81~~	~~71~~	~~72~~	~~73~~	~~74~~	~~75~~

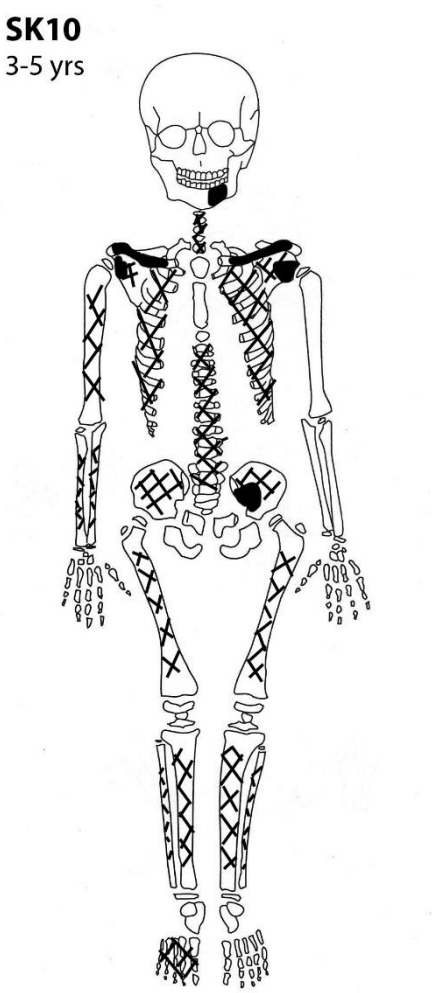
1 unerupted deciduous tooth

Dental Pathology: -
Skeletal Pathology: -

Anomalies: -
Comments: -



SK10



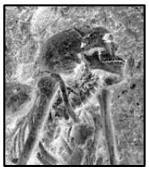
Age: Younger Juvenile 3-5 years (dentition, bones are highly fragmented but appeared to be a younger individual when initially uncovered)
Sex: -
Stature: -

Skeletal Preservation: Poor. Most elements are present but there is significant fragmentation.
Skeletal Position: Supine.
Skeletal Attitude: Extended. The right arm is parallel to torso, but is splayed out a little from the line of the body. The right lower leg is slightly veering toward left lower leg. These slight variations are likely related to the uneven grave base.
Ankles are approximately 4cm apart.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s:
Associated Finds: -

Bones Present: *Most, or all, of the remains are highly fragmented*. Highly incomplete cranium and mandible. Fragments of the clavicles, scapulae, right humerus, radius, and ulna. Shaft fragments of left ribs, minimum four right ribs, vertebrae include fragments of C1, C2, and S1, and unidentified cervical, thoracic, and lumbar fragments. Fragments of the ilia. Highly fragmented femora, tibiae, fibulae, a right metatarsal shaft.
Dental Inventory:

~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	33	~~34~~	~~35~~	36	~~37~~	~~38~~
					U	U	U	U	U	U			U		

5 unerupted permanent teeth



			P			P			
~~55~~	~~54~~	~~53~~	~~52~~	~~51~~	~~61~~	~~62~~	~~63~~	~~64~~	~~65~~
~~85~~	~~84~~	~~83~~	~~82~~	~~81~~	~~71~~	~~72~~	73	74	75
				P	P		P	P	P

7 erupted deciduous teeth

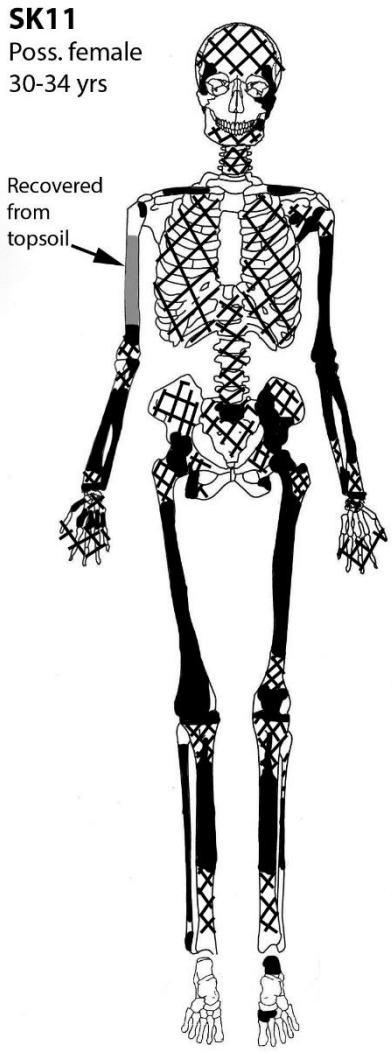
Dental Pathology: -
Skeletal Pathology:--

Anomalies: -
Comments: The approximate length of the femur was taken during excavation and, at *c*. 150mm, suggested an individual as young as perhaps 1.5 years. However, the preservation was very poor and the measurement is approximate.

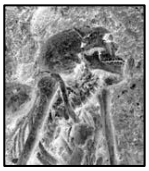
SK11

Age: Middle Adult 30-34 years (auricular ilium)
Sex: Possible Female (pelvis is somewhat ambiguous, skull is female, metrics are ambiguous)
Stature: -

Skeletal Preservation: Poor. Most elements are present but there is significant fragmentation.
Skeletal Position: Supine.
Skeletal Attitude: Extended. The left arm is extended parallel to torso, with the lower left arm turned slightly so that the left hand was positioned curled up, palm side against the left hip. The upper right arm appears to have been splayed out slightly from body. The right elbow is bent at *c*. 45°, with the right arm extended over the lumbar area of the side (that is, over the abdomen originally). The legs are extended.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: SK14 (preterm infant), was buried alongside the right hip of SK11.
Associated Finds: Oyster shells in grave fill and periwinkle shell recovered at left wrist.



Bones Present: *Most, or all, of the remains are highly fragmented*. Highly fragmented cranium and mandible. Fragments of the clavicles, left scapula, humeri, radi, ulnae,



incomplete right carpals, metacarpals, and hand phalanges, complete left carpals, metacarpals, and hand phalanges. Minimum ten left and ten right ribs, vertebrae include fragments of C1, C2, T12, L5, S1, and unidentified fragments of cervical, thoracic, and lumbar vertebrae. Fragments of the ilia and ischia. Complete, but fragmented, femora, patellae, incomplete tibiae and fibulae, incomplete left tarsals, one sesamoid with left foot, plus one unsided sesamoid.

Dental Inventory:

P	P	P	P	P	P					P	P		P	P	P
~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	44	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~
P	P		P	P	P								P	P	

18 permanent teeth (the socket of 44 is present, but it is not clearly visible above)

Dental Pathology:

Calculus – 13/18, slight to moderate deposits on all except 15, 14, 28, 18, 45. Subgingival on 36.

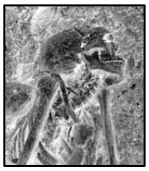
Caries – 3/18, small lesions on 27, 47 (CEJ), 37 (CEJ).

Attrition – maximum wear on surviving molars is level 3.

Skeletal Pathology: -

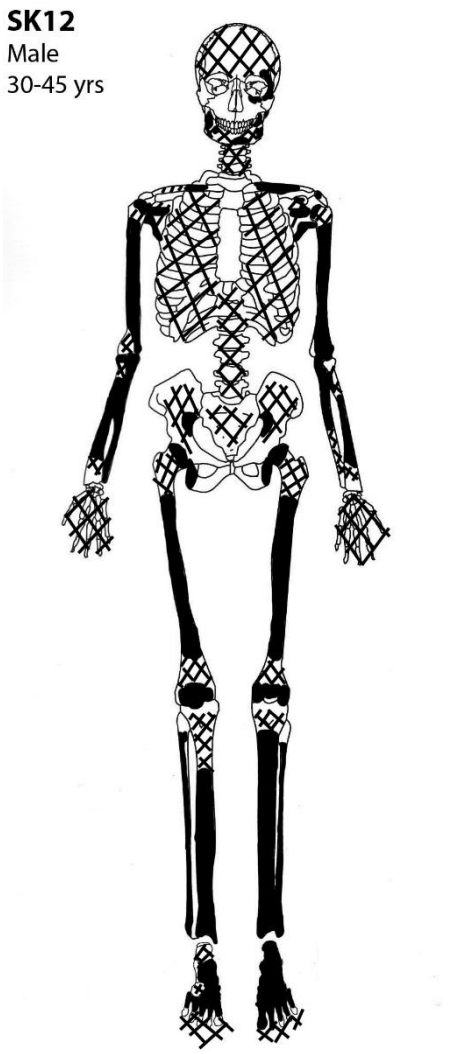
Anomalies: -

Comments: The diaphysis of the right humerus (in two fragments) was recovered from the surface, in redeposited material accumulated during the initial topsoil stripping of the site. It refitted with the surviving right humerus with the *in situ* remains of SK11.



SK12

Age: Middle Adult 30-45 years (general observances, sutures partially closing)
Sex: Male (pelvis, skull, metrics)
Stature: - (measurements were taken on-site, prior to lifting. However, these are not precise enough for stature estimation)

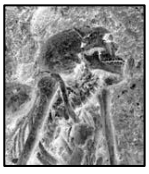


Skeletal Preservation: Poor. Most elements are present but there is significant fragmentation.
Skeletal Position: Supine.
Skeletal Attitude: Extended. The head is turned to the right. The upper arms are slightly splayed out from the torso. Both elbows are bent at *c*. 45°, and both hands are together under the chin; the fingers on both hands are curled, so that the intermediate phalanges of the right hand are resting directly against the proximal phalanges of the left hand. The legs are extended. The bones of the left foot are extended distally while the right foot is turned slightly on the right lateral aspect.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: SK13 (2-4 years) was curled up on the lower left leg of SK12.
Associated Finds: -

Bones Present: *Most, or all, of the remains are quite fragmented*. Highly fragmented cranium and mandible. Incomplete clavicles, scapulae, humeri, radi, ulnae, incomplete left and right carpals, metacarpals, hand phalanges. Minimum two left and six right ribs, vertebrae included fragments of C1 and C2, as well as unidentified cervical, thoracic, lumbar, and sacral fragments. Fragments of the ilia and ischia. Femora, patellae, tibiae, fibulae, complete left and right tarsals, slightly incomplete left and right metatarsals, incomplete left and right foot phalanges, three sesamoids recovered with left foot, one sesamoid recovered with right foot.
Dental Inventory:

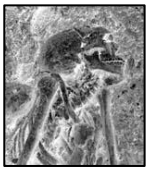
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	

29 permanent teeth

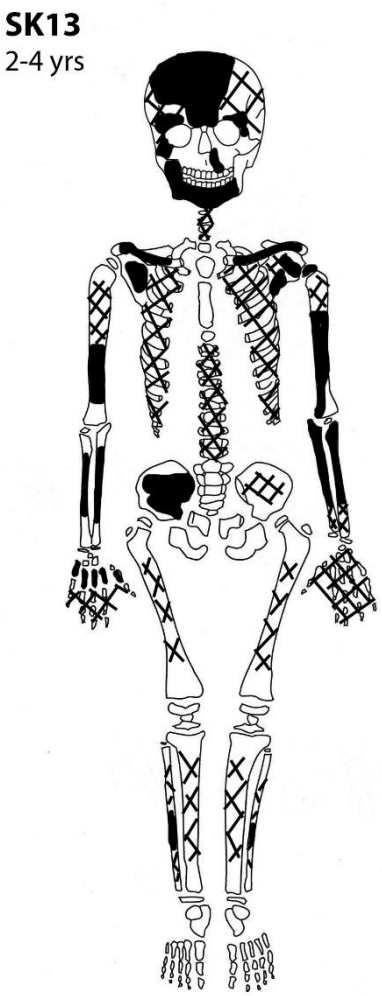


Dental Pathology: *all alveolar bone is fragmented post-mortem*
Calculus – 29/29, slight to moderate deposits on all teeth, subgingival on 17, 16, 14, 24, 26, 27, 47-44, 42-32, 34-37.
Caries – 1/29, small lesion in 47.
Attrition – maximum wear on molars level 4.
Chipping – 11 teeth: 15-21, 24-26, 41, 31, on incisal edges of incisors and canines, buccal aspect of premolars, and on mesial aspect of 26.
Skeletal Pathology:
Degeneration Joint Disease – mild DJD of C1 and C2
- left patella.
Non-Specific Infection – there is a healed lytic focus in a fragment of the shaft of a left rib. It is located 3.13mm from the inferior edge (internal aspect) and measures 7.44mm medial/lateral by 3.70mm and is a maximum of 0.68mm deep. This is essentially and oval-shaped lytic focus, which has eroded through the cortex into the trabecular bone, but which has remodelled. No other lytic foci were observed in the surviving fragments.
Developmental - symphalangism of right fifth intermediate and distal foot phalanges.
Other – entheseal change, proximal fossae at site of insertion of latissimus dorsi (fibrous entheses) in both humeri.

Anomalies:
Comments: The bones of this individuals are quite large and robust, compared with others from this burial ground.
- the sternum was visible during the excavation but crumbled on recovery.



SK13



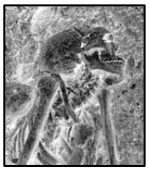
Age: Young Juvenile 2-4 years (dentition and long bones)
Sex: -
Stature: -

Skeletal Preservation: Poor. Most elements are present but there is significant fragmentation and erosion. The feet and legs were slightly higher than the rest of the skeleton, because of bedrock, and those elements were very poorly preserved.
Skeletal Position: Crouched, lying on right side.
Skeletal Attitude: The remains of this individual were recovered in a crouched position over the lower left leg (tibia, fibula, foot) of SK12 (male 30-35 years). The head of SK13 was just inferior to the left knee of SK12, while the spine of SK13 was to the lateral of the left lower leg of SK12. Both elbows of SK13 were bent at *c*. 45°, with the right arm located medial to the tibia of SK12 and the left arm just lateral to the tibia of SK12. The pelvis of SK13 was just to the lateral of the left foot of SK12. The legs of SK13 were tightly flexed at the hips and knees, with the femora tight against the abdominal area. The left foot was essentially over the area of the right hip; the buttocks of the child would have been snug against the bedrock at the edge of the grave.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: SK13 was curled up on the lower left leg of SK12 (male 30-45 years).
Associated Finds: -

Bones Present: *Most, or all, of the remains are highly fragmented*. Incomplete cranium and mandible. Incomplete clavicles, scapulae, humeri, radi, ulnae, incomplete left metacarpals and left and right hand phalanges, complete right metacarpals. Minimum eight left and seven right ribs, fragments of C1-C7, as well as unidentified thoracic and lumbar fragments. Incomplete ilia. Incomplete and highly fragmentated femora, tibiae, and fibulae.
Dental Inventory:

		U	U	U	U	U	U	U	U		U	U	U	U	
~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	21	22	23	24	25	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~
	U	U			U					U			U		

17 unerupted permanent teeth, plus broken enamel of an unidentified molar



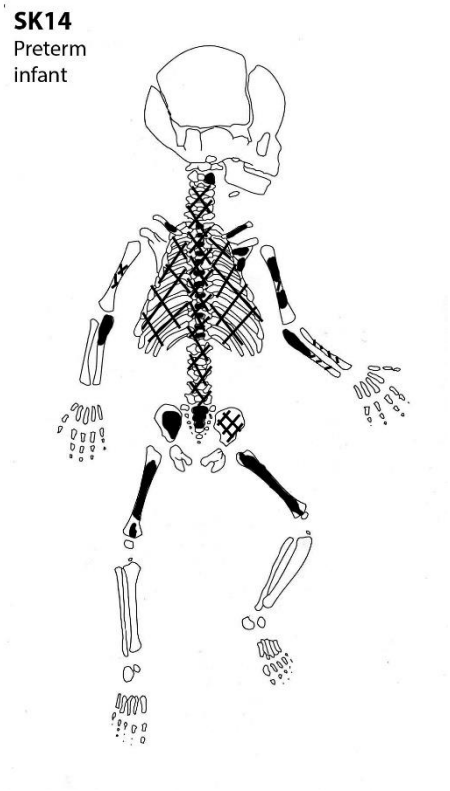
P	P	P	P	P	P	P	P	P	P
~~55~~	~~54~~	~~53~~	~~52~~	~~51~~	~~61~~	~~62~~	63	64	65
~~85~~	~~84~~	~~83~~	~~82~~	~~81~~	~~71~~	~~72~~	~~73~~	~~74~~	~~75~~
P	P	P	P	P	P	P	P	P	P

20 deciduous teeth

Dental Pathology:
Calculus – 14/20 deciduous teeth, slight to moderate deposits on 55, 52, 51, 62, 63, 85-74.
Skeletal Pathology: -

Anomalies: -
Comments: -

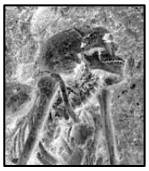
SK14



Age: Preterm Infant (bones incomplete, at least 33 foetal weeks old, not more than *c*. 35 foetal weeks, based on surviving and estimated long bone lengths)
Sex: -
Stature: -

Skeletal Preservation: Very poor. Incomplete with significant fragmentation.
Skeletal Position: Supine.
Skeletal Attitude: Laid directly on bedrock. The left lower leg may be bent slightly to the left lateral. The right arms appears to be slightly bent at the elbow and splayed out from the torso. The left arm appears to be tightly flexed at the elbow, with the hand located close to the left side of the skull.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: SK14 was buried alongside the right hip of SK11 (possible female 30-34 years).
Associated Finds: -

Bones Present: *Most, or all, of the remains are highly fragmented*. Small number of cranial fragments. Very incomplete clavicles, left scapulae, humeri, ulnae, left radius. Minimum five left and five right ribs, fragments of C2, bodies of all 12 thoracic vertebrae and S1-S3, unidentified cervical, thoracic, and lumbar vertebral fragments. Incomplete ilia. Incomplete femora, unsided tibial fragment.
Dental Inventory: -

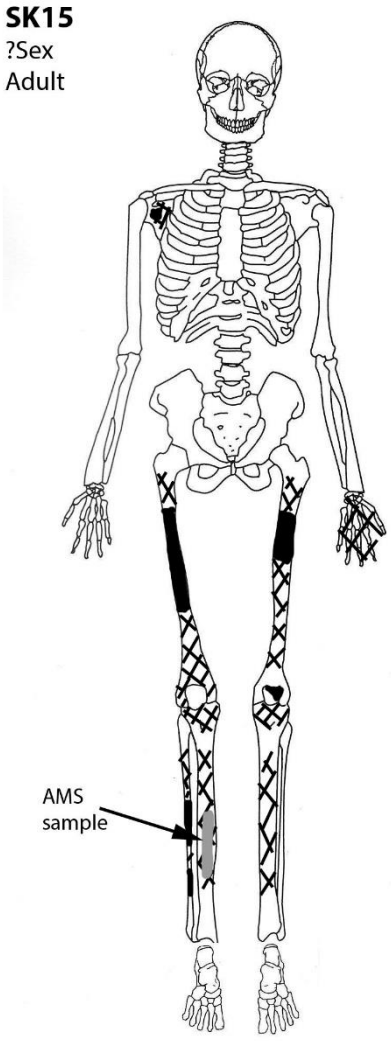


Dental Pathology: -
Skeletal Pathology:

Anomalies: -
Comments: The present length of the left femur, which has slight erosion at the proximal and distal ends, is 60.81mm. The maximum estimated length it may have been is *c*. 65cm. Using the standard equations (after Scheuer *et al.* 1980), the age-at-death is a minimum of 33.6+/-2.08 foetal weeks and a maximum of 35.0+/-2.08 foetal weeks. This strongly suggests that this is a preterm infant (<37 foetal weeks).

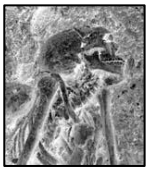
SK15

Age: Adult
Sex: -
Stature: -



Skeletal Preservation: Very poor. The remains are very incomplete and are highly fragmented.
Skeletal Position: During the excavation, the remains appeared to be supine. However, following osteoarchaeological analysis, it was discovered that the left elements were actually from the right side and vice versa. This was confirmed by analysis of the excavation records. Thus this individual was actually buried in a prone position.
Skeletal Attitude: During the excavation, it was recorded that the right hand was on the right hip. Given the subsequent evidence that this was a prone burial, the later excavation record actually indicates that at leas the left hand was placed on the posterior aspect of the body.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: Ferrous metal object located in between femora, just inferior to (below) pelvis.

Bones Present: *Most, or all, of the remains are highly fragmented*. Single cranial fragment. Extremely incomplete fragment of right scapula and left metacarpals and hand phalanges. Extremely fragmented and incomplete rib and vertebral fragments. Highly fragmented ilia. Highly fragmented femora, left patella, tibia, and fibulae
Dental Inventory: -
Dental Pathology: -



Skeletal Pathology: -

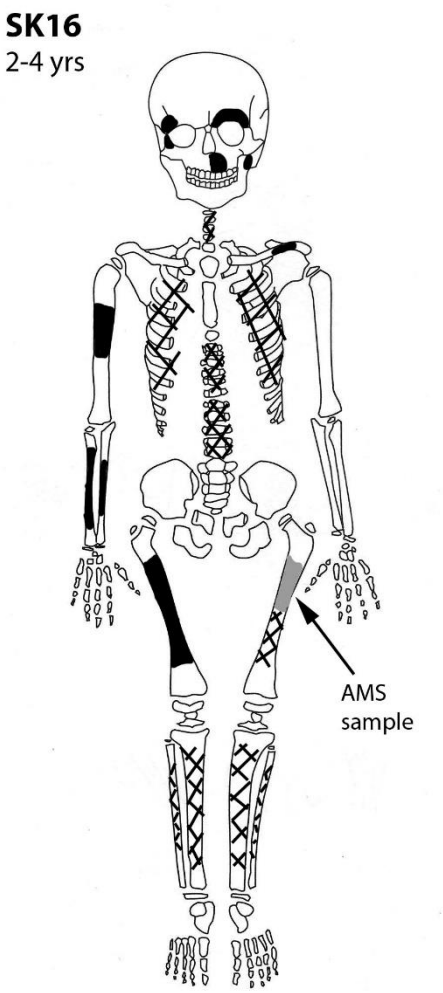
Anomalies:
Comments: Two fragments of the right tibia (5.3g) were selected for AMS dating. It returned a date of cal AD 1494-1640, with a median probability of 1562 (UBA-48362).

SK16

Age: Young Juvenile 2-4 years (dentition)
Sex: -
Stature: -

Skeletal Preservation: Very poor. Very incomplete. Burial was inadvertently truncated during exposure, with only the lower legs left *in situ*. All of the remaining skeletal and dental remains were recovered from the loose soil adjacent to the burial.
Skeletal Position: Supine.
Skeletal Attitude: Extended.
Orientation: Westsouthwest/eastnortheast, head to westsouthwest.
Associated Skeleton/s: -
Associated Finds: -

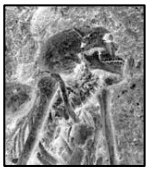
Bones Present: *Most, or all, of the remains are quite fragmented*. Fragments of the cranium and mandible. Small fragments of the left clavicle, right humerus, radius, ulna. Small number of rib shaft fragments, fragment of C2, plus highly incomplete fragments of other cervical, thoracic, and lumbar vertebrae. Possible iliac fragment. Fragments of the femora, tibiae, and fibulae.



Dental Inventory:

		U				U							U		
~~18~~	~~17~~	~~16~~	~~15~~	~~14~~	~~13~~	~~12~~	~~11~~	~~21~~	~~22~~	~~23~~	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
~~48~~	~~47~~	~~46~~	~~45~~	~~44~~	~~43~~	~~42~~	~~41~~	~~31~~	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	~~37~~	~~38~~

3 unerupted permanent teeth



P					P	P	PM	P	P
~~55~~	~~54~~	~~53~~	~~52~~	~~51~~	61	62	63	64	65
~~85~~	~~84~~	~~83~~	~~82~~	~~81~~	~~71~~	~~72~~	~~73~~	~~74~~	~~75~~

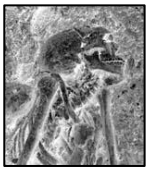
6 erupted deciduous teeth, including an unsided lower central incisor, not included in chart

Dental Pathology: -

Skeletal Pathology: -

Anomalies: -

Comments: A fragment of the midshaft of the left femur (3.2g) was selected for AMS dating. It returned a date of cal AD 1539-1950, with a median probability of 1655 (UBA-48363).

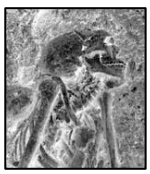


6.2 Metrics

6.2.1 Adult Cranial Metrics (mm)

Abbreviations based on Buikstra & Ubelaker (1994)

Burial	SK01 F Adult	SK04 ?M 35-39 yrs	SK07 F 18-23 yrs	SK08 F Adult	SK11 ?F 30-34 yrs	SK12 M 30-34 yrs	SK15 ? Adult
g-op	-	-	-	-	-	-	-
eu-eu	-	-	-	-	-	-	-
ba-b	-	-	-	-	-	-	-
ect-ect	-	-	-	-	-	-	-
pr-alv	-	-	-	-	-	-	-
au-au	-	-	-	-	-	-	-
ft-ft	-	-	-	-	-	-	-
n-pr	-	-	-	-	-	-	-
fmt-fmt	-	-	-	-	-	-	-
n-ns	-	-	-	-	-	-	-
al-al	-	-	-	-	-	-	-
Orb.H	-	-	-	-	-	-	-
d-ec	-	-	-	-	-	-	-
id-gn	-	-	-	-	-	-	-
go-go	-	-	-	-	-	-	-

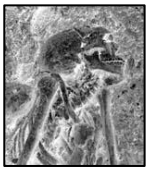


6.2.2 Adult Post-Cranial Metrics (mm)

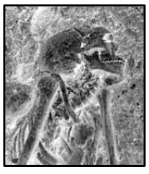
Burial	**SK01**	**F**	**SK04**	**?M**	**SK07**	**F**	**SK08**	**F**	**SK11**	**?F**	**SK12**	**F**
		AA		**35-39 yrs**		**18-23 yrs**		**AA**		**30-34 yrs**		**30-45 yrs**
	left	*right*	*left*	*right*	*left*	*right*	*left*	*right*	*left*	*right*	*left*	*right*
HuL_1	-	-	-	-	-	-	-	-	-	-	-	-
RaL_1	-	218	-	-	230	-	-	-	-	-	-	-
UlL_1	-	-	-	-	-	-	-	-	-	-	-	-
FeL_1	-	-	-	-	-	-	-	-	-	-	-	-
FeD_1	-	-	-	-	-	-	-	-	23.98	24.41	28.12	27.93
FeD_2	-	-	-	-	-	-	-	-	32.25	31.54	32.79	33.77
FeE_1	-	-	-	-	74.25	73.17	-	-	-	-	-	-
TiL_1	-	-	-	-	374	-	-	-	-	-	-	-
TiD_1	-	-	-	-	30.3	30.9	31.1*	-	31.79	30.85	35.69	32.16
TiD_2	-	-	-	-	20.52	21.82	17.11*	-	-	23.72	26.71	24.6
TiE_1	-	-	-	-	-	-	-	-	-	-	-	-
FiL_1	-	-	-	-	-	-	-	-	-	-	-	-

* recovered *ex situ*

Burial	**SK15**	**?**
		AA
	left	*right*
HuL_1	-	-
RaL_1	-	-
UlL_1	-	-



FeL_1	-	-
FeD_1	-	-
FeD_2	-	-
FeE_1	-	-
TiL_1	-	-
TiD_1	-	-
TiD_2	-	-
TiE_1	-	-
FiL_1	-	-



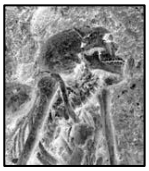
6.2.3 Juvenile Post-Cranial Metrics (mm)

All long bone measurements exclude epiphyses, unless otherwise stated

Burial	**SK02**	**9-10 yrs**	**SK03**	**9-12 yrs**	**SK05**	**M 15-16 yrs**	**SK06**	**?M 13-16 yrs**	**SK09**	**Full-term infant**
	left	*right*	*left*	*right*	*left*	*right*	*left*	*right*	*left*	*right*
HuL_1	-	-	-	226	-	-	-	-	-	64.28
RaL_1	-	-	165	-	-	-	-	-	-	-
UlL_1	-	-	-	-	-	-	-	-	-	-
FeL_1	-	-	317	-	-	-	-	-	-	-
TiL_1	-	-	-	-	-	-	-	-	-	-
FiL_1	-	-	-	-	-	-	-	-	-	-

Burial	**SK10**	**3-5 yrs**	**SK13**	**2-4 yrs**	**SK14**	**Preterm infant**	**SK16**	**2-4 yrs**
	left	*right*	*left*	*right*	*left*	*right*	*left*	*right*
HuL_1	-	-	-	-	-	-	-	-
RaL_1	-	-	-	-	-	-	-	-
UlL_1	-	-	-	-	-	-	-	-
FeL_1	-	-	-	-	60.81*	-	-	-
TiL_1	-	-	-	-	-	-	-	-
FiL_1	-	-	-	-	-	-	-	-

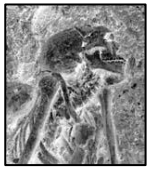
* very slightly incomplete



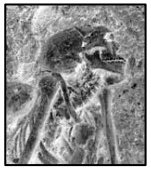
6.3 Disarticulated Human Remains

Codes used in disarticulated database
(based on Chamberlain and Witkin 2000).

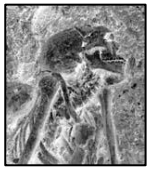
??	Unknown
GB	Burnt bone
GC	Calcified soft tissue
GT	Soft tissue
KK	Skeleton
WW	Unknown (faunal)
AI	Auditory: Incus
AM	Auditory: Malleus
AS	Auditory: Stapes
CC	Cranium
CE	Endocast
CF	Frontal
CH	Ethmoid
CL	Lacrimal
CN	Nasal
CO	Occipital
CP	Parietal
CS	Sphenoid
CT	Temporal
CV	Calvaria
CX	Vault Fragment
CZ	Zygomatic
QH	Hyoid
D1	Upper dI1
D2	Upper dI2
D3	Upper dC
D4	Upper dM1
D5	Upper dM2
E1	Lower dI1
E2	Lower dI2
E3	Lower dC
E4	Lower dM1
E5	Lower dM2
D?	? Deciduous tooth
DD	Deciduous tooth
DR	Decid. tooth root
DX	Decid. crown frag.
M1	Lower I1
M2	Lower I2
M3	Lower C
M4	Lower P1
M5	Lower P2
M6	Lower M1
M7	Lower M2
M8	Lower M3
X1	Upper I1
X2	Upper I2
X3	Upper C
X4	Upper P1
X5	Upper P2
X6	Upper M1
X7	Upper M2
X8	Upper M3
MC	Mandibular body
MM	Mandible
MR	Mandibular ramus
MS	Mandib. symphysis
MY	Mandibular condyle
XD	Demimaxilla
XP	Premaxilla
XX	Maxilla
PP	Permanent tooth
PR	Perm. tooth root
PX	Tooth crown frag.
QM	Manubrium
QS	Sternum
QX	Sternum frag.
QC	Clavicle
S?	? Scapula
SA	Acromion
SB	Scapula blade
SC	Coracoid
SG	Scap. glenoid cavity
SS	Scapula
SX	Scapula frag.
QR	Rib
VC	Cervical vertebra
VT	Thoracic vertebra
VL	Lumbar vertebra
VS	Sacrum
VY	Coccyx
VV	Vertebra
VX	Vertebra fragment
I?	? Hip bone
IA	Acetabulum
II	Hip bone
IL	Ilium
IP	Pubis
IS	Ischium
IX	Hip bone frag.
H?	? Humerus
HH	Humerus
HP	Humerus-proximal
HM	Humerus-midshaft
HD	Humerus-distal
R?	? Radius
RR	Radius
RP	Radius-proximal
RM	Radius-midshaft
RD	Radius-distal
U?	? Ulna
UU	Ulna
UP	Ulna-proximal
UM	Ulna-midshaft
UD	Ulna-distal
YC	Carpal
YY	Handbone
YS	Scaphoid
YL	Lunate
YQ	Triquetral
YI	Pisiform
YZ	Trapezium
YD	Trapezoid
YA	Capitate
YH	Hamate
YM	Metacarpal
YP	Phalanx (hand)
LS	Sesamoid
F?	? Femur
FF	Femur
FP	Femur-proximal
FM	Femur-midshaft
FD	Femur-distal
LL	Patella
T?	? Tibia
TT	Tibia
TP	Tibia-prox
TM	Tibia-midshaft
TD	Tibia-distal
B?	? Fibula
BB	Fibula
BP	Fibula-proximal
BM	Fibula-midshaft
BD	Fibula-distal
ZT	Tarsal bone
ZZ	Footbone
ZA	Talus
ZC	Calcaneus
ZN	Navicular
ZE	Medial cuneiform
ZI	Intermed. cuneiform
ZL	Lateral cuneiform
ZU	Cuboid
ZM	Metatarsal
ZP	Phalanx



ID	Detail	Skel Element	Code	Side	Age1	Age2	Age3	Sex	Skel Path	Dental Path	Notes	No of Frags
1000	From monitoring, assoc. SK01 & SK02	Unidentified	??		JUV						x 50 small fragments	50
1001	From monitoring, assoc. SK01 & SK02	Cranial	CX		AA			M			x 3 vault fragments, including occipital	3
1002	From monitoring, assoc. SK01 & SK02	Cranial	CX		JUV						x 10 vault fragments	10
1003	From monitoring, assoc. SK01 & SK02	Vertebra	VC		JUV	JUV2					C2, dens not complete	1
1004	From monitoring, assoc. SK01 & SK02	Vertebra	VC		JUV	JUV2					x 2 left body and arch	4
1005	From monitoring, assoc. SK01 & SK02	Clavicle	QC	L	JUV	JUV2					shaft fragment	1
1006	From monitoring, assoc. SK01 & SK02	Scapula	SB	L	JUV	JUV2					blade fragment	1
1007	From monitoring, assoc. SK01 & SK02	Tarsal	ZC	L	AA/JUV?						calcaneus	1
1008	From monitoring, assoc. SK01 & SK02	Tooth	D2	R	JUV	JUV1	2-4 yrs				upper deciduous I2	1
1009	From monitoring, assoc. SK01 & SK02	Tooth	D3	R	JUV	JUV1	2-4 yrs				upper deciduous C	1
1010	From monitoring, assoc. SK01 & SK02	Tooth	D4	R	JUV	JUV1	2-4 yrs				upper deciduous M1	1
1011	From monitoring, assoc. SK01 & SK02	Tooth	D5	R	JUV	JUV1	2-4 yrs				upper deciduous M2	1
1012	From monitoring, assoc. SK01 & SK02	Tooth	D1	L	JUV	JUV1	2-4 yrs				upper deciduous I1	1
1013	From monitoring, assoc. SK01 & SK02	Tooth	E2	L	JUV	JUV1	2-4 yrs				lower deciduous I2	1



ID	Detail	Skel Element	Code	Side	Age1	Age2	Age3	Sex	Skel Path	Dental Path	Notes	No of Frags
1014	From monitoring, assoc. SK01 & SK02	Tooth	E2	R	JUV	JUV1	2-4 yrs				lower deciduous I2	1
1015	From monitoring, assoc. SK01 & SK02	Tooth	E1	?	JUV	JUV1	2-4 yrs				lower deciduous I1	1
1016	From monitoring, assoc. SK01 & SK02	Tooth	E3	L	JUV	JUV1	2-4 yrs				lower deciduous C, Rc	1
1017	From monitoring, assoc. SK01 & SK02	Tooth	X3	R	JUV	JUV1	2-4 yrs			severe hypoplastic defects, Cr1/4 - 1/21.5-3.5 yrs	upper right permanent C, Cr1/2	1
1018	Stray surface bone, 31/07/2020	Unidentified	??		AA/JUV?						x 14 irregular fragments	14
1019	Stray surface bone, 31/07/2020	Tarsal	ZN		AA						fragment of navicular	1
1020	Stray surface bone, 31/07/2020	Tooth	X8	R	JUV	ADOL	12-14 yrs				tentative ID, Cr1/2 or 3/4	1
1021	Assoc. with SK01, disturbed by machine, 13/07/2020	Cranial	CT	L	JUV	JUV1					complete	1
1022	Assoc. with SK01, disturbed by machine, 13/07/2020	Cranial	CX		JUV	JUV1					x 30 vault fragments	30
1023	Assoc. with SK01, disturbed by machine, 13/07/2020	Vertebra	VC		JUV	JUV1					right arch of C2	1
1024	Assoc. with SK01, disturbed by machine, 13/07/2020	Mandible	MY	L	JUV	JUV1					condyle	1
1025	Assoc. with SK01, disturbed by machine, 13/07/2020	Mandible	MC	R	JUV	JUV1					right body and ramus fragment	1
1026	Assoc. with SK01, disturbed by machine, 13/07/2020	Maxilla	XX	L	JUV	JUV2	6-7 yrs				maxilla with 1027 and 1028	1
1027	Assoc. with SK01, disturbed by machine, 13/07/2020	Tooth	D5	L	JUV	JUV2	6-7 yrs			mild calculus	upper deciduous M2 in 1026	1
1028	Assoc. with SK01, disturbed by machine, 13/07/2020	Tooth	X6	L	JUV	JUV2	6-7 yrs			hypoplastic pitting, Coc, c. 1.5 yrs	upper permanent M1 in 1026	1



ID	Detail	Skel Element	Code	Side	Age1	Age2	Age3	Sex	Skel Path	Dental Path	Notes	No of Frags
1029	Assoc. with SK01, disturbed by machine, 13/07/2020	Tooth	D5	R	JUV	JUV1	c. 2 yrs				upper decidous M2, Rc	1
1030	Assoc. with SK01, disturbed by machine, 13/07/2020	Tooth	X5	R	JUV	JUV1	c. 2 yrs				upper perm PM2, Cr1/2	1
1031	Assoc. with SK01, disturbed by machine, 13/07/2020	Vertebra	VC	R	JUV	JUV1/2					right arch fragment	1