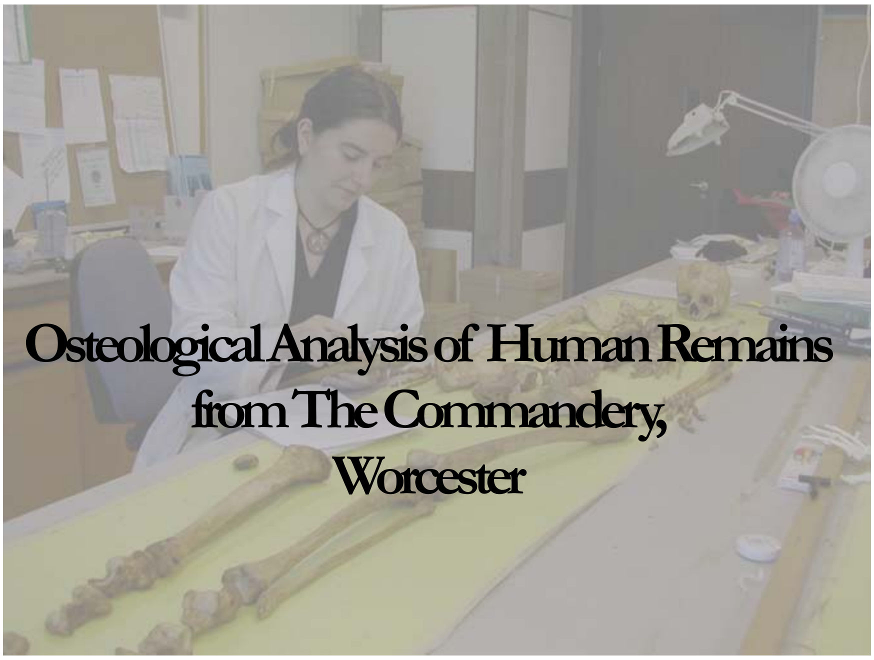

Osteological Analysis of Human Remains from The Commandery, Worcester

A report for Worcestershire Historic Environment and Archaeology Service

February 2004

Project: PJ 116

1. Introduction

This report contains the results of the osteological analysis of human remains recovered during the excavation of a 2m x 2m evaluation trench at the Commandery in Worcester city centre (Site Code WCM 101214). The excavation was carried out by Worcestershire Historic Environment and Archaeology Service during January 2004, for which a report is under construction (Goad *et al*., forthcoming).

Two human skeletons referred to as contexts [123] and [125] were excavated, each from an individual inhumation grave. The fills of both graves contained finds dating to the 14th or 15th century, including pottery sherds, ceramic building materials and finely worked stone fragments. These finds are thought to have derived from the demolition of nearby religious structures.

The osteological analysis aims to provide a detailed inventory of the skeletal and dental material recovered, the condition of the bone present, completeness of the skeletons and to provide, where possible, the age, sex and stature of the individuals recovered. Any evidence of pathological changes is also noted.

2. Methods and Process

The skeletal material was analysed according to the standards laid out by the guidelines recommended by the British Association of Biological Anthropologists and Osteologists in conjunction with English Heritage (Human Bones from Archaeological Sites: Guidelines for producing assessment documents and analytical reports, 2002).

- Recording of the material was carried out using the recognised descriptions contained in Standards for Data Collection from Human Skeletal Remains by Buikstra and Ubelaker (1994). Copies of the recording forms used are contained in Appendix A of the report.

- The material was analysed macroscopically and where necessary with the aid of a magnifying glass for identification purposes. Where relevant, digital photographs have been used for illustration.

- The material was analysed without prior knowledge of associated artefacts so that the assessment remained as objective as possible.

2.1. Reasons for the Analysis

Osteological analysis was carried out to ascertain:

- Condition of bone present

- Completeness of the skeleton

- Inventory of the skeletal material
- Sex Determination
- Age Assessment
- Non-metric Traits
- Stature
- Skeletal Pathology
- Dental Pathology

3. Condition of the Bone Present

3.1. Introduction

The condition of the bone was assessed macroscopically and recorded according to the categories and descriptions referred to by Behrensmeyer (1978).

3.2. Observations

The surface of the bone of both skeletons was on the whole intact. However, some inner cancellous bone had been exposed through post-mortem damage to the outer compact bone, especially around the epiphyses and vertebrae of skeleton [123]. As a result, these elements were rather fragile. Several elements of skeletons [123] and [125], such as long bones, pelvis and vertebrae, were fragmented by recent and ancient post-mortem damage.

3.3. Results

Skeleton [123] was found on the whole to be in fair condition, being graded as 1-3 (Behrensmeyer 1978). Skeleton [125] was considered to be in good condition, graded 0-1 (Behrensmeyer 1978).

4. Completeness of Skeletons

4.1 Introduction

This is a guide to the overall completeness of the individual's skeletal remains and is calculated according to the percentage of the bones present in relation the total number of bones in a complete human skeleton. This is gauged through an assessment of the amount of material representing different areas of the body. A complete skeleton comprises of:

Skull = 20%

Torso = 40%

Arms = 20%

Legs = 20%

4.2 Observations

Skeleton [123] was represented by most skeletal elements, albeit in fragmented condition, and was, therefore, relatively complete. Skeleton [125], however, due to the limitations of the evaluation excavation, was represented by a lower leg only.

4.3 Results

Skeleton [123] was estimated to consist of approximately 80% of its original skeletal content and falls into the 75%+ category (Buikstra and Ubelaker 1994). Less than 25% of skeleton [125] was recovered.

5. Inventory of Skeletal Material

5.1 Introduction

An inventory of the skeletal material was recorded in tabular form on Sheet B (contained in the appendix). Each bone has been recorded as being absent or present. The long bones are recorded according to the presence or absence of the proximal, middle and distal sections and also the proximal and distal joint surfaces. The percentage of completeness of the bones of the axial skeleton (with the exception of the spine) is recorded in categories of > 75%, 75-50%, 50-25% and <25%. This detailed recording is necessary to understand the nature of the preservation of the skeletal material and any constraints that the condition of material may put on the ensuing analysis. From the perspective of future research, a detailed inventory also allows an accurate calculation of prevalence rates of pathological conditions such as fractures and joint diseases and should prove more fruitful for future reassessment should the skeletal material be reinterred.

5.2 Observations

Observations of material present were noted on recording sheet B contained in the appendix.

5.3 Results

The inventory of skeleton [123] indicates that most joint surfaces and skeletal elements were present allowing full analysis of the remains. Skeleton [123] was represented by a lower leg only, thus limiting the potential amount of observable data.

6. Age Assessment

6.1 Introduction

There are a number of techniques available for assessing the age of both adult and juvenile remains. Juveniles can be accurately assessed by observing the stage of development of skeletal growth, dental eruption and tooth formation. The assessment of adult remains is based on the changes observed in particular joints in the body, namely the auricular surface, pubic symphysis and costal rib ends. These changes are consistent with the ageing of the skeleton but fall into broad age ranges. These categories are Young Adult (20-34 years), Middle Adult (35-49 years) and Old Adult (50+ years) (Buikstra and Ubelaker 1994). Cranial suture closure and dental attrition are not considered reliable techniques for age estimation. This is due to the high level of individual variation found from the results of analyses using these techniques.

6.2 Observations

The remains of skeleton [123] were observed to be fully developed, the epiphyses of the surviving long bones being fused to the diaphyses with no evidence of fusion lines. This indicated that these remains were those of an adult. It was observed that fragments of the auricular surface belonging to the individual had survived and that this may provide evidence of a more precise age at death.

Whilst the remains of skeleton [125] were minimal, all the elements that did survive had fully fused epiphyses, indicating that the individual was an adult.

6.3 Results

Analysis of the surviving fragments of the auricular surfaces revealed features (such as macroporosity, irregular densification of the surface and lack of any transverse organsation) that suggested this individual represented by skeleton [123] was an adult of at least 50 years of age (Lovejoy et al. 1985).

Figure 1: Left auricular surface of skeleton [123] displaying features characteristic of an older adult (dense irregular surface with no transverse organisation and macroporosity).

This individual could be classified as belonging to the older adult category (Buikstra and Ubelaker 1994). The lack of surviving pubic symphyses or costal rib ends meant that the age at death could not be corroborated by other ageing techniques.

Due to the nature of the evidence, no specific ageing techniques could be applied to the remains of skeleton [125]. Whilst being observed to be fully mature and, therefore, representing an adult individual, it was not possible to ascribe a particular category of adulthood to this individual.

7. Sex Determination

7.1 Introduction

Techniques employed to determine of the biological sex of adult skeletal remains are well established and are largely based upon an assessment of the morphological features exhibited by the skull and the pelvis. These features reflect the sexual dimorphism displayed between males and females and develop as the individual matures. These features are, therefore, not observably marked during adolescence and there are no reliable techniques for determining the sex of juvenile remains, except for DNA analysis. Sex determination is relatively accurate, some researchers reporting a success rate of 95% of known in tests on known sex samples (Phenice 1969). Techniques generally used include descriptive methods, metric analysis and discriminant functions depending on the completeness of the skeletal material.

7.2 Observations

Recovery of the majority of the skull from skeleton [123] permitted the sex of this individual to be assessed upon the presence or absence of several morphological features, including the glabella, supraoribtal margins, mastoid processes, nuchal crest and jaw shape. Elements of the ilium were also present, enabling assessment of the greater sciatic notch and preauricular sulcus of the pelvis. Metric assessment of the head of the humerus and femur (Bass 1995) was also undertaken to provide additional data.

There were no morphological features surviving that may have indicated the sex of skeleton [125]. Metric analysis of the circumference of the tibia was undertaken to provide tentative evidence of the sex of this individual. This involved measuring the circumference of the diaphysis at the level of the nutrient foramen and comparing the results to those parameters recommended by Bass (1995), which have been demonstrated to be indicative of sex.

7.3 Results

The cranial and pelvic elements recovered from skeleton [123] suggested that this individual was male (Phenice 1969). Although the pubis, usually considered as displaying the most consistent dimorphic features, was not recovered, overall the observable elements were very masculine. Results of the metric analysis also indicated that the individual was likely to be male. The individual was, therefore, ascribed to the category of definite male (Buikstra and Ubelaker 1994).

The lack of skeletal elements recovered of skeleton [123] prevented the sex of the individual from being determined from the analysis of morphological features. Metric assessment of the diameter of the tibia at the level of the nutrient formamen suggested that the individual was within the parameters of being a male individual. However, this is very tentative and is a method not to be relied on solely to indicate sex. This individual was ascribed to the category of unobservable (Buikstra and Ubelaker 1994) for the present time, with the hope that further excavation will lead to the recovery of the remainder of skeleton [123] for future analysis.

8. Non-Metric Traits

8.1 Introduction

Non-metric traits are morphological features that occur both in bone and dentition. These features have no functional purpose and occur in some individuals and not in others. The origins of non-metric traits have now been shown to be highly complex, each having its own aetiology and each being influenced to differing extents by genetics, the environment, age and sex of the individual and by physical activity. Generally, the analysis of these traits requires a large sample size. Non-metric traits have been recorded for these skeletons in order to allow future comparisons with findings from other late medieval assemblages in the Worcestershire area.

8.2 Observations

Observations were noted on recording sheet I (contained in the archive). The potential analysis of the presence or absence of non-metric traits is dictated by the state of preservation of the skeletal remains.

8.3 Results

For skeleton [123], out of a total of a possible 39 non-metric traits, 3 non-metric traits (palatine torus both sides and a parietal notch bone on the right side) were recorded as present, 17 were recorded as not present and 19 were unobservable.

Only the lack of presence of squatting facets on the left tibia could be confirmed for skeleton [125].

9. Stature and Metric Analysis

9.1 Introduction

Stature of adult individuals can be reconstructed from measurements of long bones of the skeleton. Since the long bones of adolescents have not yet fully developed it is not possible to provide an estimate of stature for juveniles. Stature is the result of many factors including genetics and environmental influences, such as malnutrition and poor health. Height can be used as an indicator of health status and there is a wide range of literature on the relationships between height, health and social status.

9.2 Observations

Several of the long bones of skeleton [123] had survived intact and could be measured to provide an estimate of stature. These included the femora, the right ulna and left humerus.

The surviving tibia from skeleton [125], unfortunately, was not complete and no measurement could be taken.

9.3 Results

Using the diaphyseal length of the femora as a basis for stature estimation (considered to be more reliable than estimates from arm bones), the individual represented by skeleton [123] is likely to have been 1.80m or approximately 5’10” tall. This is well above the average height of 5’7” for the late medieval period in Britain (Roberts and Cox 2003).

10. Skeletal Pathology

10.1 Introduction

Palaeopathology is the study of diseases of past peoples and can be used to infer the health status of groups of individuals within a population as well as indicate the overall success of the adaptation of a population to its surrounding environment. Pathologies are categorised according to their aetiologies; e.g. congenital, metabolic, infectious, traumatic, neoplastic etc. Any pathological modifications to the bone are described. The size and location of any lesion is also noted. Distribution of lesions about the skeleton should be noted to allow diagnosis. A differential diagnosis for any pathological lesions should be provided.

10.2 Observations

Pathological changes to 4 zygopophyseal (posterior) joints of the vertebrae were observed in skeleton [123]. These joints were enlarged and irregular, with gross changes to the joint surface being visible. Micro- and macroporosity, osteophytic lipping and eburnation were present on these joint surfaces. Degenerative changes were also present in 4 vertebral body joints, which exhibited macro and microporosity. These changes in both the vertebral bodies and zygapophyseal joints were noted to be mainly located in the upper thoracic spine. In the lower thoracics, 4 Schmorls nodes were observed as well as 1 Schmorls node in the lumbar region.

In addition to vertebral pathology, changes were observed in the lower legs of skeleton [123], more specifically the right tibia and left tibia and fibula. These changes consisted of the presence of porotic and striated lamellar bone, known as periostitis, deposited on the middle and distal thirds of the diaphyses. Some of this pathological bone growth has occurred in discrete areas on the diaphyses whilst the majority is diffuse.

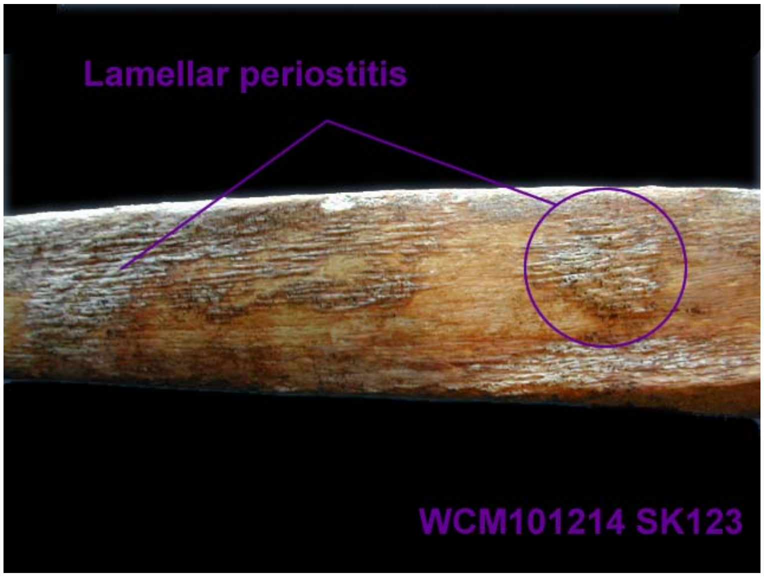

Figure 2: Diffuse lamellar periostitis

Small spiculated bony outgrowths were also observed in both maxillary sinuses of skeleton [123].

Finally, changes were observed to have occurred to the surfaces of both eye orbits of skeleton [123] in the form of the impression of a network of trabecular structure, which correspond to the changes described by Stuart-Macadam (1991) as stage 1 Cribra Oribtalia.

Figure 3: Trabecular changes to the orbit roof diagnostic of Cribra Orbitalia (stage 1).

Skeleton [125] exhibited no observable pathological changes.

10.3 Results

The pathological changes observed in the vertebrae of skeleton [123] can be diagnosed as being the result of degenerative joint disease or osteoarthritis. This can be of a primary type, associated with age, or secondary to a traumatic event. The primary or idiopathic type is more common in older adults women and is consistent with the findings of the age of this individual; it develops spontaneously in middle age and develops slowly as the individual grows older (Salter 1999). The Schmorl's nodes observed are also the result of degenerative joint disease and occur when the intervetebral disc degenerates and part of it protrudes into the vertebral body. These changes are known clinically to be common in the lower spine. The development of Schmorl's nodes to the advances stage observed in skeleton [123] is again consistent with his older age (Salter 1999).

The periostitis observed on the diaphyses of the lower legs of skeleton [123] is the result of inflammation of the periosteum or soft tissue sheath surround the outside of the bones. This can occur due to low-grade infection or through trauma to the bone. This is a relatively common condition and is unlikely to have had major consequences for the health of this individual (Roberts and Manchester 1997).

The small bony spicules observed in the maxillary sinuses are indicative of sinusitis and again relate to the inflammation of the surrounding soft tissues associated with an infection originating in the throat, ear, nasal sinuses or chest (Roberts and Manchester 1997).

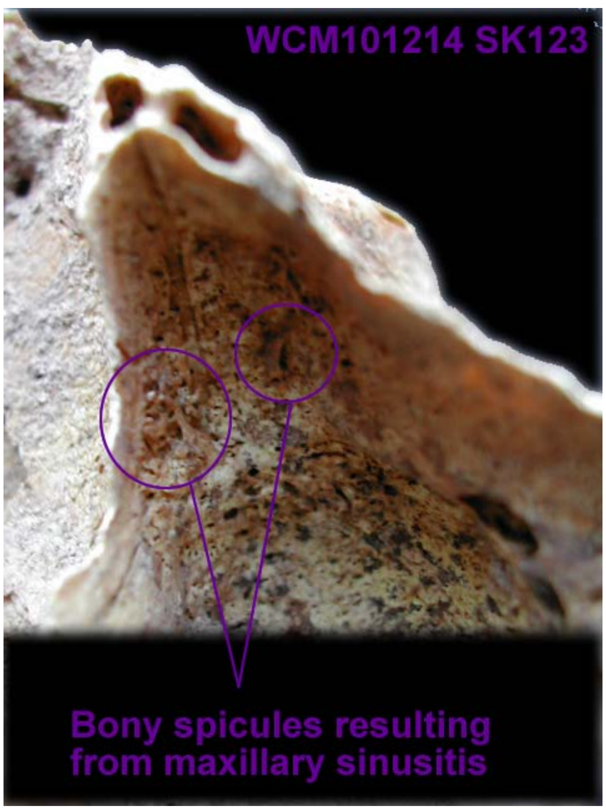

Figure 3: Small bony spicules in the maxillary sinuses

It has been found that maxillary sinusitis is more common in urban populations and is indicative of the increased levels of pollution of the surrounding environment (Roberts and Manchester 1997).

Finally, cribra orbitalia has been associated with iron-deficiency anaemia resulting from dietary deficiency, chronic blood loss or malabsorption due to gastrointestinal infections (Roberts and Manchester 1997, Stuart-Macadam 1991). Roberts and Cox (2003) report that the overall prevalence rate for this pathology in the late medieval period is 10.82% but, interestingly, hospital sites have a prevalence rates of 25.61% compared to 9.33% for non-hospital sites.

Whilst the pathological changes observed in skeleton [123] are generally minor, on the face of it, it may be inferred from the presence of cribra orbitalia, maxillary sinusitis and periostitis that the overall health status if this individual was not overly good. Of course, however, it must be remembered that having survived these conditions long enough for them to have resulted in bony remodelling, it may well be that, according to the osteological paradox, he was one of the healthier individuals who lived to a decent age (Wood et al 1992).

11. Dental Pathology

11.1 Introduction

Dental pathologies recorded can provide a wide range of information. For example, calculus, caries, abscesses and periodontal disease may be indicative of poor oral hygiene, infection or high sugar intake. Enamel hypoplasia is the product of defective enamel growth and is linked to poor nutrition and health status during childhood. Congenital abnormalities can also noted such as those that are genetic in origin or those that are the result of pathologies such as syphilis.

11.2 Observations

Skeleton [123] had a total number of 23 observable teeth, 3 having been lost post-mortem and 9 having been lost ante-mortem. Twelve teeth had minor calculus, 10 having medium calculus deposits. Five teeth displayed minor enamel hypoplastic defects and 23 of the observable tooth sockets had periodontal disease. Also present were 4 externally draining abscesses and 3 caries.

Figure 4: Dental abscess, antemortem loss of the first molar, caries and periodontal disease indicating poor levels of oral hygiene.

Skeleton [125] had no dentition surviving.

11.3 Results

Skeleton [123] showed signs of infection or inflammation in the jaws with the presence of periodontal disease (associated with gingivitis of the soft tissues) possibly caused by the considerable deposits of calculus (mineralised plaque). The presence of 4 abscesses also testifies to the poor oral hygiene of this individual. Although it is known that tooth-picks were in use during the late medieval period (Roberts and Cox 2003) this individual clearly was not persuaded about the benefits of this practice. Instead, like the majority of the late medieval population in Britain who did not use toothbrushes, he seems to have preferred the option of gum disease and halitosis!

Figure 5: Calculus deposits and periodontal disease

The presence of minor enamel hypoplastic defects may indicate that the individual have suffered periods of childhood stress from malnutrition or disease. The relative lack of caries may indicate that the individual did not have a diet that was high in sugar – although it may be possible that the 5 molar teeth lost antemortem were carious.

No inferences could be made about the dental health of skeleton [125] due to the lack of observable dentition.

12. Conclusion

The table below summarises the findings of the osteological analysis of skeletons [123] and [125]: -

	Skeleton [123]	Skeleton [125]
Condition	Fair 1-3 Some fragmentation	Good - 1
Completeness	80% (75%+)	<25%
Age	50+ (OldAdult)	Adult
Sex	Male	Unobservable (Metrics – possibly male?)
Stature	1.80 (5' 10")	Unobservable
Skeletal Pathology	Osteoarthritis and Degenerative Joint Disease in Spine Periostitis on R Tibia and L Tibia and Fibula Minor Maxillary Sinusitis Cribra Orbitalia (Stage 1)	None observed
Dental Pathology	Dental Abscesses, Periodonal Disease, Medium Calculus, Minor Enamel Hypoplasia, Ante-Mortem loss of some teeth.	Unobservable

The results of the osteoarchaeological analysis indicate that the remains of skeleton [123] were those of an adult male whose age is likely to be 50 years or over. He would have been approximately 1.80m tall. His skeletal remains suggest that he had suffered from some minor inflammatory and metabolic conditions as well as degenerative changes in his spine. His oral hygiene appears to have been poor, as is indicated by the presence of four dental abscesses, medium calculus deposits, periodontal disease and ante-mortem tooth loss. He was interred in a burial that was roughly aligned E-W and with no grave goods, consistent with Christian burial practices of the late medieval period. Skeleton [125] was represented by a left lower leg only due to the restraints of the evaluation excavation carried out. It is hoped that more data will become available for this individual at a later date.

Although only 1 complete individual was recovered in this excavation, the analysis has shown that there is significant potential for furthering our understanding of medieval Worcester from excavation of human remains from the Commandery site. The skeletal remains excavated were in good condition and have allowed a full analysis to be undertaken to establish the age, sex and stature of this individual as well as the presence of dental or skeletal pathology. The preservation of these remains may also allow further research to be undertaken in the future such as stable isotope analysis of the teeth, ancient DNA analysis or microscopic analysis of calculus.

The results of the analysis of this particular individual confirm the presence of metabolic and inflammatory conditions and poor oral hygiene in the medieval population of Worcester, which has been noted in other contemporary urban populations. Further recovery of humaan remains from this site may be able to elucidate some areas of our knowledge of medieval Worcester, such as:

- *Are the human remains from this site associated with a specific context such as a hospital or religious building? What is the nature of this cemetery population?*
- *Are there specific burial practices in this cemetery? Why is the grave not aligned directly E-W? Is it aligned with contemporary structures or boundaries?*
- *What is the demographic profile of this skeletal population of this cemetery?*
- *What diseases were present in medieval Worcester? Do these tell us anything about the living conditions of the population?*
- *How does the health status of this community compare with other populations, rural or urban, in and around Worcestershire? How does it compare with contemporary urban sites, such as populations from York or London?*
- *Do patterns of health and disease change over time in Worcestershire?*

13. Acknowledgements

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THE ARCHIVE

Type	No	Type	No
Skeleton Recording Form A	2	Skeleton Recording Form M	1
Skeleton Recording Form B	2		
Skeleton Recording Form D	2		

Skeleton Recording Form E	1		
Skeleton Recording Form H	2		
Skeleton Recording Form I	2		
Skeleton Recording Form J	1		
Skeleton Recording Form K	1		

Appendix

Recording Sheets for Skeleton [123] and [125]