Report on rescue excavations and physical anthropological analyses of two archaeological graves inadvertently uncovered in Boitekong, North-West

CAS 21/06/2015
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Submitted by:

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1. Introduction

On the 2nd of June 2015 Lt. E. van der Westhuizen (cell: 0823787091) from the Victim Identification Center (VIC) of the South African Police Services (SAPS) contacted the Forensic Anthropological Research Centre (FARC) about a case of inadvertently discovered human remains that seemed to be of archaeological age. The remains were accidentally uncovered by the owner (Mr Ishmael Matshela and his wife Ms Mittah Mogobosha, cell: 0799009747) when he was digging a hole for a latrine on his property; house no AB 879, Mbeki Son, Dichibidung; an extension of the Boitekong Township located outside of Rustenburg. The discovery was reported to the Boitekong Police Station and subsequently a case docket was opened (CAS 21/06/2015). After a site visit by Lt. Van der Westhuizen photographs of the remains as found were sent to Mr W. C. Nienaber and Ms A. Meyer of the FARC to assist in determining the possible age of the remains. Based on the sitting burial position, ashy soil deposits and the presence of a circular grave pit (Fig. 1) it was confirmed that the remains were of archaeological age. Mr Nienaber recommended Lt. Van der Westhuizen to leave the remains *in situ* and Ms Meyer reported the discovery to Ms M. Seetelo and Ms I. Masiteng of the South African Heritage Resources Agency Burial Grounds and Graves (SAHRA BGG) on 03/06/2015. On 09/06/2015 Ms Masiteng requested that Ms Meyer apply for a rescue excavation permit to recover the remains. During the rescue permit application process another grave was inadvertently discovered in the same informal settlement by a Mr Watson in his yard. This case was also reported to the Boitekong SAPS and another case docket was opened (CAS 276/06/2015). The second discovery was again reported to the FARC after which SAHRA BGG was informed. On 09/07/2015 a rescue excavation permit was issued by SAHRA Burial Grounds and Graves (Permit number: 2056) for the rescue excavations, physical anthropological analyses and permanent storage of said remains and any others that may be discovered subsequently.

On the 5th of August Mr Nienaber, Ms Meyer and Ms C de Bruyn from the FARC conducted the rescue excavations. Two officers (Cst. Modisa Sikuza, cell: 0723777891; Investigating Officer assigned to CAS 276/06/2015) from the Boitekong Police Station accompanied and assisted with the recovery.

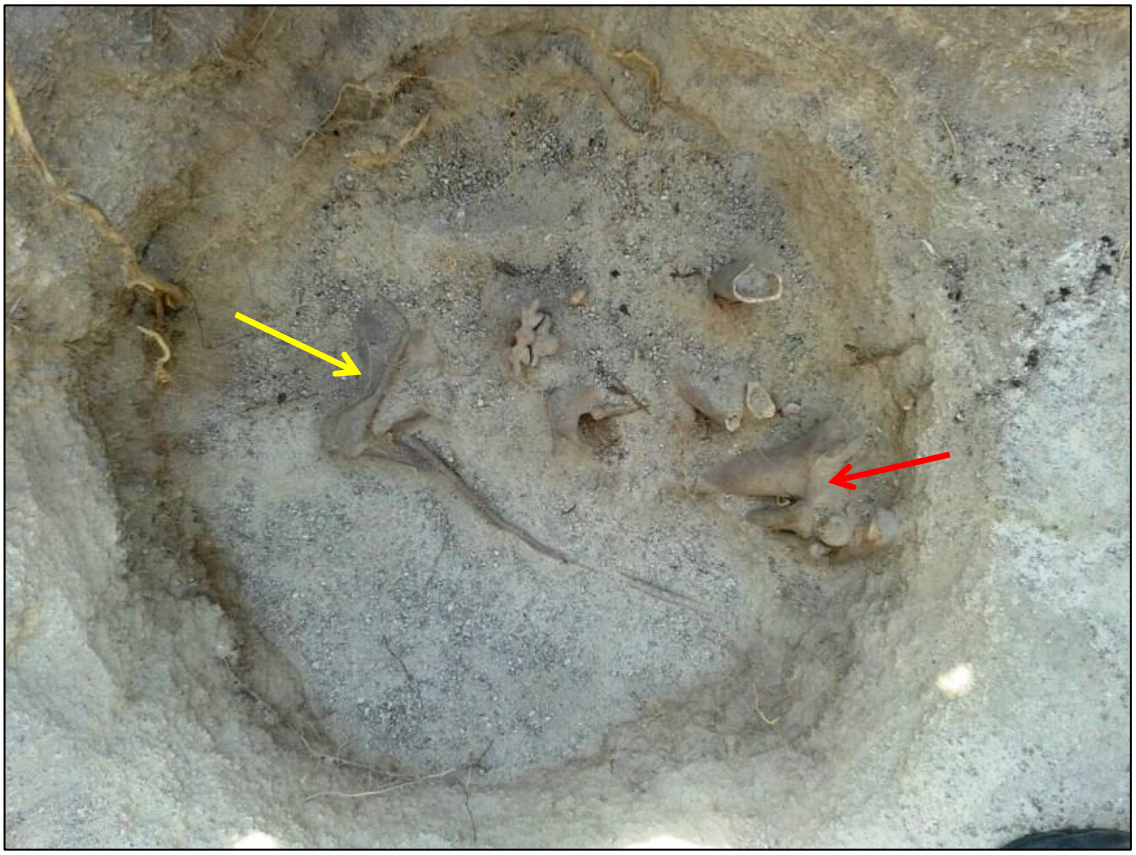

Figure 1: Grave as found by SAPS VIC. Note the circular grave pit and the ashy soil deposits. The remains seemed to be buried in a flexed sitting position (yellow arrow indicates position of scapula; red arrow indicates position of flexed knee).

2. Legal compliance

A rescue excavation permit was obtained from the South African Heritage Resources Agency (SAHRA) Burial Ground and Grave Unit as required by Section 36 of Act 29 of 1999 (Permit number: 2056 dated 9 July 2015) to continue with the mitigation of the remains. The permit also allows for physical anthropological analyses and permanent storage of the remains in the Department of Anatomy, University of Pretoria.

3. Location

The first grave (grave A: CAS 21/06/2015) was located in the yard of house number AB 879, Mbeki Son, Dichibidung. This area is an extension of the Boitekong residential area situated to the north-east of Rustenburg and to the east of the R510, in the North West Province (GPS: S25.64775, E027.29062). The second grave (grave B: CAS 276/06/2015) was also situated in the same extension; north from the first grave at GPS coordinates S25.64186, E027.28881 (Figs. 2&3).

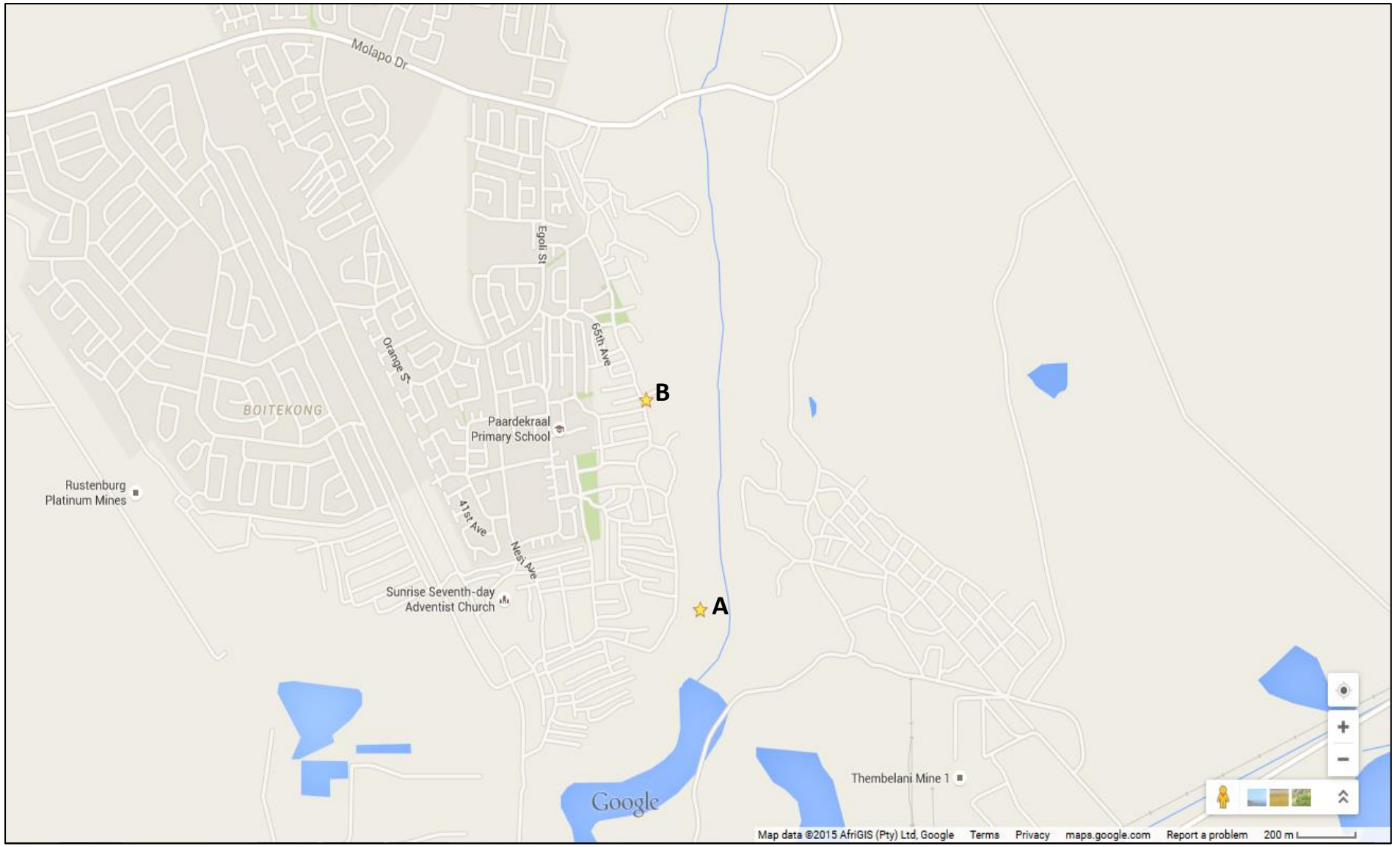

Figure 2: Map indicating the location of first (A: CAS 21/06/2015) and second grave (B: CAS 276/06/2015).

Figure 3: Satellite image indicating the location of grave A (CAS 21/06/2015) and B (CAS276/06/2015).

4. Site description

Grave A (CAS 21/06/2015):

The grave was situated in the south-eastern corner of House AB 879's yard. The particular house plot was situated towards the edges of the informal settlement, on the western banks of the Hex River. The grave was back-filled and covered by corrugated iron sheets after its initial discovery. A quick foot survey of the immediate area revealed the presence of archaeological surface deposits (ashy soil possibly associated with a midden, animal bone and potsherds).

Grave B (CAS 276/06/2015):

The grave was situated in the southern corner of the yard next to an outhouse (Fig. 4). The particular plot was situated towards the edges of the informal settlement approximately 200 meters from the Hex River. The grave was back-filled and covered by corrugated iron sheets after its initial discovery. A foot survey of the immediate area revealed ashy deposits (possibly indicative of a midden) and potsherds.

Figure 4: Location of grave B (CAS 276/06/2015) in the southern corner of the yard. Red arrow indicates position of grave

5. Recovery methodology

On arrival at the sites a foot survey of the immediate areas surrounding the graves were conducted and all finds including archaeological objects and human remains were located and documented. Documentation of the site and associated artefact were conducted by means of a text description and photography.

Standard forensic archaeological techniques (Steyn *et al*., 2000) were employed throughout the excavation to ensure the methodical retrieval of all disturbed and undisturbed human skeletal remains and associated artefacts. The graves were documented as it was left by the Boitekong SAPS and SAPS VIC after the already exposed human remains were recovered by pathological services. In both cases SAPS back-filled the excavated areas with soil (originally removed from the grave and surrounding matrix) and covered each grave with pieces of corrugated iron sheets. During the rescue excavations each grave was documented as is before the back-filled soil was removed with shovels and trowels so as the expose the original excavation. All back-filled soil was sieved and screened in order to recover all disturbed archaeological material and *ex situ* human remains. After removal of all back-filled soil all features observable and pertaining to the original grave pit was documented by means of text description and photography. After the extent of the grave pit was identified this area was systematically excavated in 10 cm layers by means of trowels and brushes. All soil was screened and archaeological material recovered. Human remains were left *in situ*, sketched, photographed and documented before being removed. All human remains and associated archaeological material were bagged, labelled and transported to the Department of Anatomy, University of Pretoria, for analyses and subsequent storage.

6. Results

6.1. Recovery of human remains

Grave A (CAS 21/06/2015):

A foot survey of the immediate area revealed ashy soil deposits possibly suggestive of archaeological habitation as well as fragments of potsherds associated with the Iron Age. The potsherds were scattered on the surface around the houses and were of low visibility with the majority of the sherds being undecorated.

The original excavation was back-filled and covered by a sheet of corrugated iron (Fig. 5) Back-filled soil was removed and screened for human remains and archaeological material.

Several undecorated potsherd fragments (Fig. 6), animal bone (Fig. 7), and ostrich eggshell beads (OES) (Fig. 8) were recovered from the backfill.

Figure 5: Grave A (CAS 21/06/2015) as found

Figure 6: Undecorated fragmented potsherds found in the back-fill of Grave A

Figure 7: Animal bone found in the back-fill of Grave A

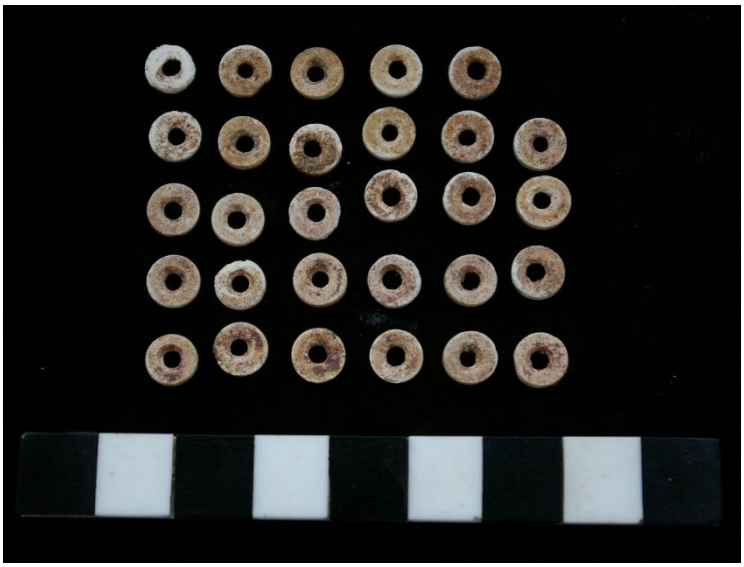

Figure 8: Ostrich eggshell beads found in the back-fill of Grave A

After all the back-filled soil was removed the edges of the original excavated trench could be observed as well as the original grave pit (Fig. 9). The grave pit was circular in shape (60 cm x 60 cm x 100 cm) and presented with ashy deposits consisting of animal bone and potsherds (Fig. 10). Following the outlines of the grave pit soil was removed by trowels and brushes and screened for archaeological material and *ex situ* human remains. Most of the original grave pit seemed to have been disturbed during the initial discovery. Some long bones and the pelvis could however still be observed *in situ* suggesting an upright sitting burial position (Fig. 11). Even though the head was removed by pathological services after the initial discovery the positioning of the long bones (femur, tibia and fibula) suggest that the individual was facing south with his/her back pressed up against the northern wall of the circular grave pit. A concentration of OES beads were found in the vicinity of the abdomen and were most probably worn as a necklace.

Figure 9: Circular grave pit with disturbed human remains, potsherds and animal bone observable on the surface.

Figure 10: Animal bone and potsherds found in ashy deposit of grave pit

Figure 11: Remains that were recovered *in situ* suggesting an upright flexed burial position. Red arrow indicates position of flexed knees. Yellow arrow indicates position of shoulders and vertebrae suggesting the individual's back were pressed against the wall of the grave pit during original internment.

Grave B (CAS 276/06/2015):

A foot survey of the immediate area revealed ashy soil deposits possibly suggestive of archaeological habitation as well as fragments of potsherds associated with the Iron Age. The potsherds were scattered on the surface around the houses and were of low visibility with the majority of the sherds being undecorated. Surface collection of diagnostic potsherds was done to enable tentative dating of the site.

The original excavation was back-filled and covered by a sheet of corrugated iron (Fig. 12) Back-filled soil was removed and screened for human remains and archaeological material. Several potsherd fragments (Fig. 13), animal bone (Fig. 14), and a glass bead (Fig. 15) were recovered from the back-fill. Two of the potsherds presented with diagnostic decorative styles.

Figure 12: Grave B (CAS 276/06/2015) as found

Figure 13: Fragmented potsherds recovered from back-fill. Two decorated potsherds representing the Uitkomst facies.

Figure 14: Animal bone recovered from back-fill

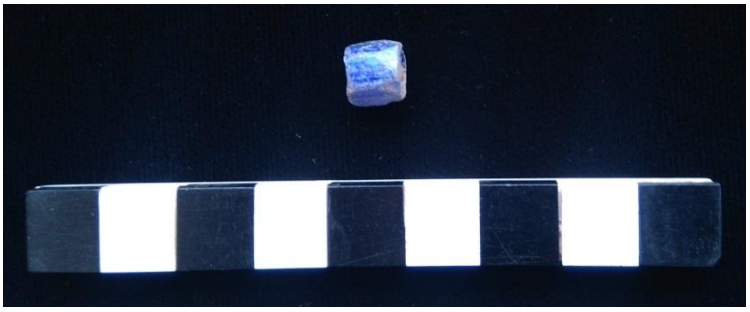

Figure 15: Glass bead recovered from back soil

These potsherds presented with stamped arcades as well as blocks of parallel incisions created by stamping and cord impressions (Fig. 13). These features are characteristic of the Uitkomst pottery dating to AD 1650 – 1829 (Huffman, 2007). The Uitkomst pottery is viewed as a combination of Ntsuanatsatsi and Olifantspoort (Boeyens, 2003; Huffman, 2007; Hall, 2012). Huffman (2007) states that the Uitkomst facies is directly associated with the Fokeng cluster. This means that the Ntsuanatsatsi facies is closely related to the oral histories of the Early Fokeng and reflects the movement of Nguni people out of Kwazulu-Natal (Huffman, 2002; Boeyens, 2003). The Bafokeng settled at Ntsuanatsatsi Hill in the present-day Free State Province (Walton, 1953). Subsequently, the BaKwena lineage broke away from the Bahurutshe cluster and crossed southward over the Vaal River where they came in contact with the Bafokeng (Walton, 1953; Huffman, 2002; Huffman, 2007). These two groups intermixed causing the Bahurutshe to adopt some of the Sotho customs (Walton, 1953; Huffman, 2002; Boeyens, 2003; Huffman, 2007). This intermixing of these groups and their associated cultural practices and pottery styles lead to the formation of Uitkomst facies type pottery which effectively contains elements of both Nguni and Sotho-Tswana speakers (Walton, 1953; Huffman, 2002; Huffman, 2007). Based on the pottery analysis the site and the human remains associated with it can therefore be tentatively dated to the Late Iron Age.

After all the back-filled soil was removed the edges of the original excavated trench could be observed. In the north-western wall of the original excavation a colour difference indicated the outline of a circular grave pit. *Ex situ* human remains recovered during the screening of the back-filled soil contained mainly fragmented skeletal elements associated with the skull, cervical vertebrae and ribs, suggesting that most of the body was still *in situ*.

The original excavation was extended approximately 80 cm to the north-west so as to expose and observe the rest of the grave pit (Fig. 16). An *in situ* archaeological deposit layer of approximately 30 cm (consisting of ashy soil, animal bone, and potsherd fragments) could be observed. Within this archaeological deposit and approximately 20 cm from the surface the top part of the original grave pit could be observed (Fig. 17). The grave pit was circular in shape and presented with whitish ashy soil with a granular texture, clearly distinguishable from the surrounding matrix. The grave pit was carefully excavated by means of trowels and brushes and all soil screened. A broken pot could be observed approximately 30 cm from the surface and 10 cm within the grave pit (Figs. 17&18).

At approximately 75 cm several human skeletal elements could be identified *in situ* (Figs. 17&18). These were cleaned and left *in situ* to observe the original burial position which seemed to have been a flexed upright sitting position. The positioning of the thorax and arms however suggest that the body fell backwards after burial (possibly due to decomposition and associated soil shift) with the legs remaining tightly flexed with the rest of the body flat and on its back (Figs. 19&20). The left arm was flexed at the elbow with the hand resting on the thorax, palm facing down, whereas the right arm was extended along the right side of the body with the palm facing upwards. The head was not present as it was recovered during the initial discovery by pathological services, but would have been positioned south-south east with the feet north-north west.

Figure 16: Grave B after the original trench (bottom of image) was extended. Note the dashed red line indicating the circular grave pit outline

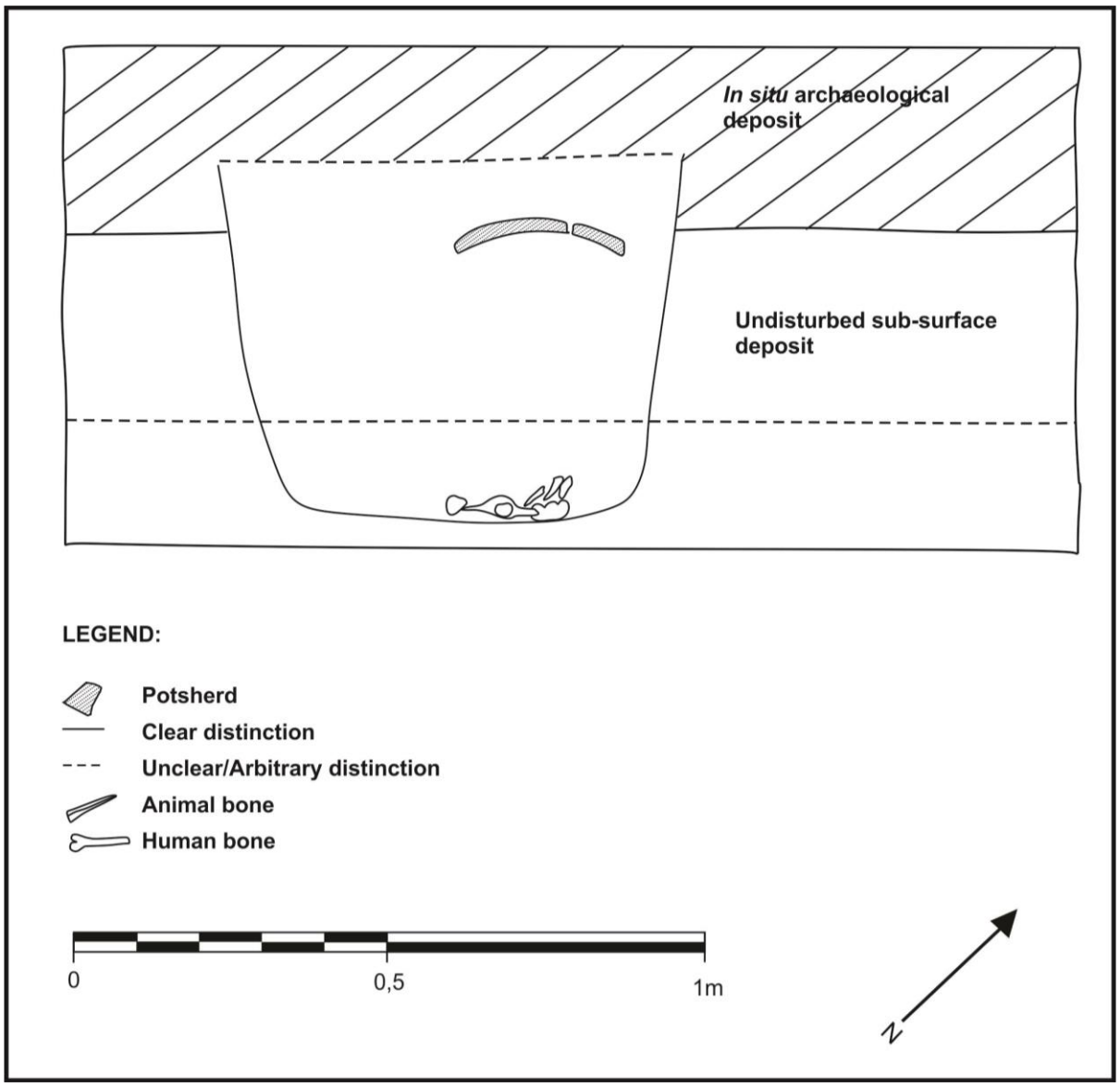

Figure 17: Profile view south western north eastern wall of trench indicating the archaeological deposit and grave pit

Figure 18: Broken pot observed within the grave pit

Figure 19: Human skeletal remains as found *in situ*

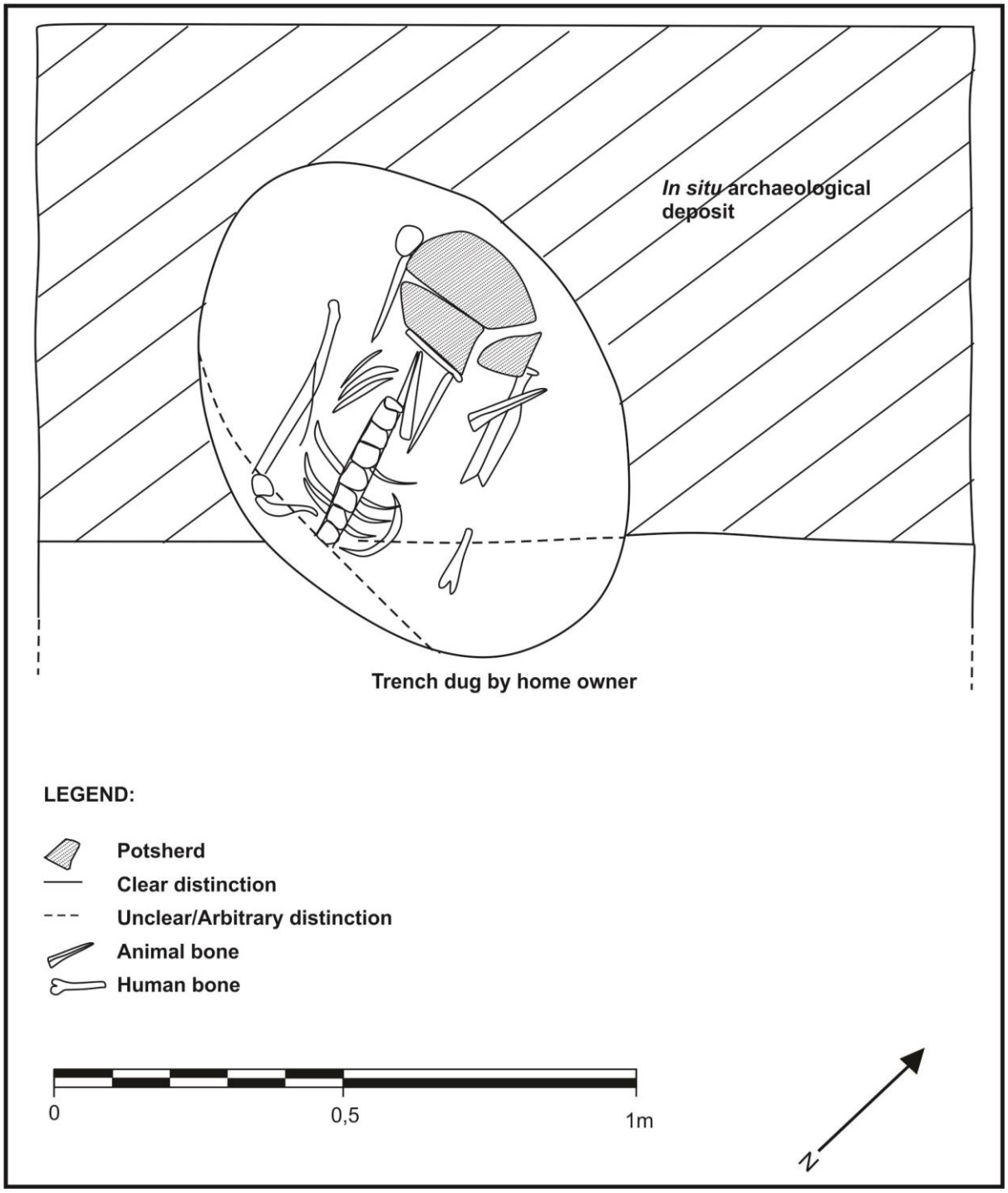

Figure 20: Burial position indicating flexed legs and thorax that most probably fell backwards as a result of decomposition and soil shift. This would suggest that the initial internment was similar to that of Grave A i.e. flexed upright sitting position.

6.2. Standard physical anthropological analysis

6.2.1. Analytical methods

The remains were cleaned and analysed using standard physical anthropological techniques taken from Buikstra and Ubelaker (1994) and Íşcan and Steyn (2013) in order to determine the osteobiological profile of each individual.

Age at death was estimated by the degree of epiphyseal closure and tooth development for possible adolescent individuals (Krogman & Işcan, 1986; Scheuer & Black, 2000; Schaefer *et al.*, 2009). For adult individuals age at death was estimated by the morphological changes associated with senescence. These usually include the morphological changes in the pubic symphyses (Brooks & Suchey, 1990) and auricular surfaces (Lovejoy *et al.,* 1985) as well as the degree of cranial suture closure (Acsadi & Nemeskéri, 1970; Krogman & Işcan, 1986; Buikstra & Ubelaker, 1994). Additionally transition analysis using the ADBOU 2.1 software program was used to record the macroscopic traits of each of the above mentioned skeletal regions (Boldsen *et al.,* 2002; Milner and Boldsen, 2012). Any observable degenerative changes on the post-crania and dental wear (Loth & Işcan, 2000; Ortner, 2003; İşcan & Steyn, 2013) were noted for each individual where present which would suggest an older age.

Sex estimation from the skeletal remains followed morphological and metric assessment of the skull and pelvis. The morphological methods include the Walker, (2008) method (modified by Krüger *et al.* (2014)) for sex estimation from the skull and the Klales *et al*. (2012) method (modified from Phenice (1969)) for sex estimation from the pelvis.

For the determination of ancestry both non-metric and metric techniques were used where possible. This included the non-metric characteristics observable on the skull and mandible (Íşcan *et al.,* 2000; Krogman and Íşcan, 1986) as well as the metric assessment using cranial indices for South African population specific data sets (Liebenberg *et al*., 2015). Both the cranial and postcranial measurements were also analysed using FORDISC 3.2. The archaeological context of the remains, however, already suggests an African ancestry for these individuals.

Stature was determined by regression formulae for single long bone measurements where possible (Lundy and Feldesman, 1987; Steyn and Smith 2007).

Macroscopic assessment of possible pathology and/or trauma was done for each individual. Pathology and/or trauma were described in terms of its location, type, and extent. Several sources were referred to for the pathology observed on the skeleton including Lovell (1997), Aufderheide & Rodriguez-Martin (1998); Hillson (1998); Ortner (2003); and Waldron (2008). The fragmentary and incomplete nature of some of the skeletal elements however hampered the use of some of these techniques.

6.2.2. Results

6.2.2.1. Grave A (CAS 21/06/2015):

Preservation and inventory

The remains were completely skeletonized and in a fair state of preservation. Most of the cranial and post-cranial remains were present. For a full skeletal inventory refer to Table 1. Some post-mortem damage was evident on the skull, teeth and on some of the long bones. This may have occurred during the discovery or subsequent recovery of the remains.

Age at death

The third molars of the individual were in full occlusion and the spheno-occipital synchondrosis was completely fused suggesting an age older than 20 years. The teeth showed extensive occlusal wear especially on the first upper right molar and on the second upper left molar while the third upper left molar had almost no wear suggesting an adult age. For dental measurements refer to Table 4.

The pubic symphyses represented phase 3 (Brooks & Suchey, 1990) suggesting an age range of between 21 and 53 years at the time of death. The auricular surfaces represented phase 4 to 5 which suggest age ranges of between 35 and 39 and 40 and 44 respectively. Transition analysis of the pubic symphyses, auricular surfaces and cranial sutures using ADBOU 2.1 provided an age estimate range, with a 95% confidence interval, of between 36 and 75 years with a mean age of 53 years.

The presence of degenerative pathologies throughout the skeleton however suggest a possible older adult age for this individual. A final age range of 45 to 75 years was therefore estimated for this individual.

Sex

The morphological features observable on the skull were ambiguous with the supra-orbital margins and glabella being more consistent with females and the nuchal crest and mastoid more consistent with males (Walker, 2008) (Figs. 21&22). Analysis using the population-specific formulae for black South Africans (Krüger *et al.,* 2014) resulted in a 50% probability of female with 90% accuracy when the glabella, mastoid and mental eminence were assessed. It also provided a male estimate at 50% probability and 88% accuracy when the glabella, mastoid and mental eminence were used.

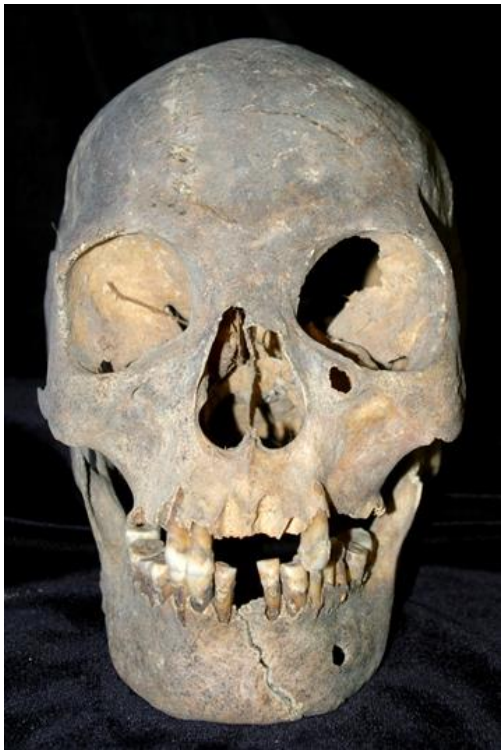

Figure 21: Frontal view of skull

Figure 22: Profile view of skull

The morphological features of the pelvis however seemed to correspond more with those associated with females. The overall gracile form of the pelvis, the rounded and more obtuse angle of the subpubic angle and the triangular obturator foramen as well as the large and wide sciatic notches and the more circular pelvic inlet is indicative of the female sex.

Using the Klales *et al.*, (2012) method the presence of a ventral arc, subpubic concavity, and a narrow and sharp ischiopubic ramus could be observed. These features are consistent with a female. This method produced a 97% accuracy and a 99% probability that the individual belongs the female sex when the ischiopubic ramus ridge and ventral arc are used.

Due to the conflicting results only a tentative estimate of sex can be given. Based on the high probabilities of a female sex when the pelvic dimensions were assessed this individual was estimated to be of possible female sex.

Ancestry

The morphological features observable on the skull was consistent with someone of African ancestry as suggested by the wide nasal opening, guttered nasal sills, rectangular orbit, prognathic facial profile and long and low skull. Cranial indices also suggested an African ancestry with the cranial index (71.73%) and the orbital index (92.31%) falling within the limits for South African blacks (Liebenberg *et al.,* 2015). The archaeological context of the remains however already suggests an African ancestry for this individual.

Metric analysis of the cranial measurements was utilized to estimate ancestry (refer to table 2 and 3 for skeletal measurements). Sixteen standard cranial measurements were uploaded into FORDISC 3.1 (FD3) in order to compare the unknown cranium to a custom database that is comprised of known 20th century Black (n=162), Coloured (n=85), and White (n=56) South Africans. FD3 is a statistical software program that applies discriminant function analyses to classify an unknown cranium into one of the known comparative reference groups (Jantz and Ousley, 2005). One of the limitations of using FD3 for estimating ancestry is that only three modern socially defined groups are available for comparison in the South African custom database. Therefore, discriminant function analysis will force classify the unknown into one of the three groups, even if the unknown does not belong to any of these

groups. However, when the unknown cranium is dissimilar to the sample population, low posterior probabilities and typicality are often the result.

However, since the remains were of archaeological origin the cranial measurements of Grave A were also compared to the “Zulu” (n= 101) and “Bushman” (n=90) reference groups from the Howells population database. Archaeological populations may be difficult to classify using FD3 due to the occurrence of intra-population differences and secular trends that occur over time (Jantz and Ousley, 2005). Analysis of an unknown skull of historic/archaeological age using 20th century reference groups would therefore not be appropriate. The “Zulu” and “Bushman” reference groups are to date the only pre-20th century South African reference samples available for use in FD3. However, the use of these reference samples is also problematic since it is not representative of all historical population groups within South Africa.

A discriminant analysis, using ten Forward Wilks stepwise selected variables, was done in order to compare the cranium of Grave A to the three modern (black, coloured and white South Africans) and two historical (“Zulu” and “Bushman”) South African ancestral reference groups. Results suggested that the cranial measurements of Grave A were most similar to The “Zulu” reference sample with a posterior probability of 52% (likelihood that the individual belongs to this particular ancestral group) and significant typicality (how typical the unknown is for the group to which it was classified) with a cross validation of 54.5% (Table 5).

Low posterior probabilities suggest that this individual cannot be definitively classified into the “Zulu” group as there are also significant similarities with the modern South African Black group (Table 5). Nevertheless, it could be concluded that individual from Grave A did not present with characteristics associated with the South African white, Coloured or “Bushman” reference sample banked within FD3. Therefore, the individual from Grave A was most likely of African ancestry.

Stature

The ante-mortem stature was determined by using the physiological length of the right femur. The stature of this individual was calculated as being 166.96 ± 2.79 cm. This is

regarded as a tall stature for someone of this population group and sex (Steyn and Smith, 2007).

Dentition

All the teeth were present except for those lost ante-mortem. Ante-mortem tooth loss was limited to the maxillary teeth and included the left second premolar and second and third molars. The upper right first and second premolars as well as the first molar were also lost ante-mortem (Fig. 23).

Dental pathology that could be observed included dental calculus on the buccal and lingual surfaces of most of the teeth, occlusal wear with dentine exposure on most of the teeth, but especially on the upper and lower molars, periodontal disease and dental caries (Fig. 24). A large carious lesion could be observed on the lower left first molar affecting the distal portion of the crown (Fig. 24). The alveolar bone in this region showed resorption and signs of infection consistent with abscess formation. A periapical abscess could also be observed in the region of the mental foramen (Fig. 24), possibly caused by the infection of the lower left first molar root following the caries.

Figure 23: Antemortem tooth loss of the maxillary teeth

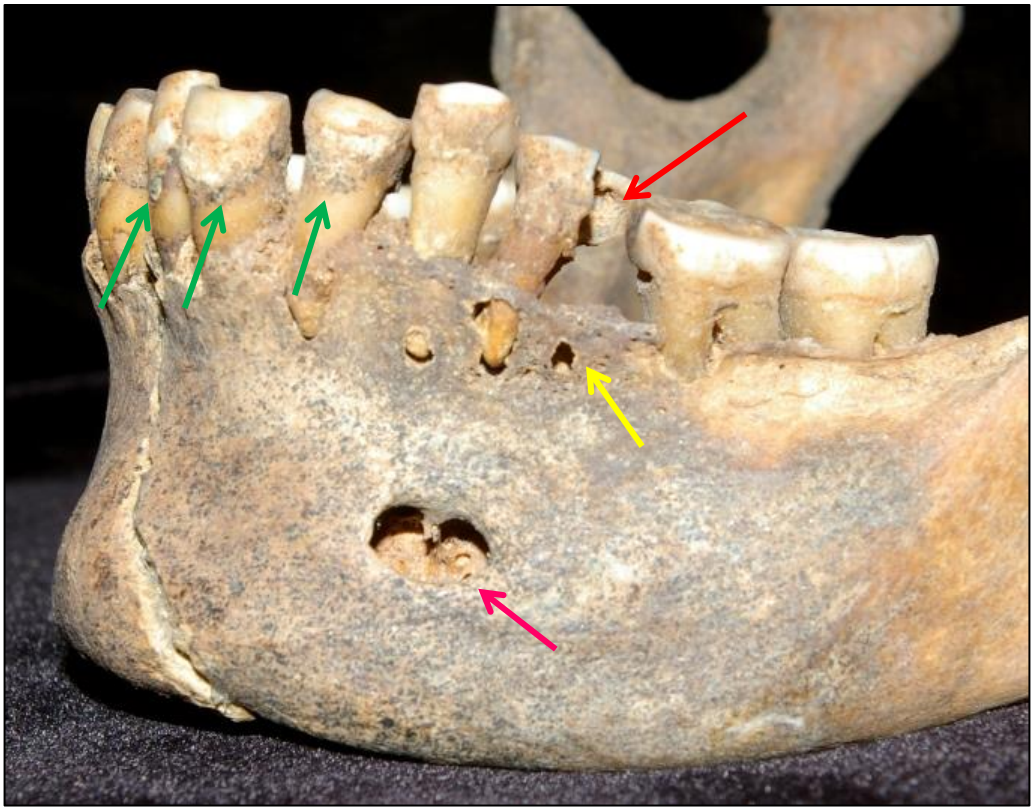

Figure 24: Dental pathology observable in the mandible. Note the carious lesions observable in the left first molar (red arrows), dental calculus (green arrows), alveolar resorption (yellow arrow) and the presence of an apical abscess (pink arrow).

Trauma and Pathology

No ante-mortem or peri-mortem trauma could be observed.

Slight periostosis was observed on the medial and distal portions of the left and right tibia as well as on the left and right femur. Periostitis is an indicator of non-specific disease that is usually caused by an inflammation of the periosteum and is most commonly found in the long bones (Ortner, 2003). It is possibly indicative of poor health and population stress (Ortner, 2003).

Osteophytic lipping of the major synovial joints, specifically the elbow, was observed (Fig. 25). This type of pathology is indicative of osteoarthritis which usually develops as a result of progressive degeneration of the articular cartilage of the synovial joints due to long-term mechanical stress (Ortner, 2003, Weiss, 2014). Osteophytes were also observed on the vertebrae especially in the lumbar and thoracic region (T3-L5) (Fig. 26).

Spondylolysis was observed on L5 (Fig. 26). Spondylolysis is the separation of the neural arch from the vertebral body due to mechanical stresses to the lower back (Ortner, 2003). This condition has also been suggested to have a genetic aetiology which means that some people are genetically more inclined to developing the condition than others (Aufderheide and Rodriguez-Martin, 1998).

Calcaneal exotoses on the posterior end of the left and right calcaneus was also observed (Fig. 27). Calcaneal spur formation is thought to be due to periosteal detachment or calcification of part of the plantar fascia (Koopman *et al*, 2003). This usually occurs in middle-aged individuals (Koopman *et al*, 2003).

Figure 25: Osteophytic lipping and arthritic changes observable on the trochlear notch of the left ulna

Figure 26: Spondylolysis was observed on L5. Also note the presence of osteophytes on the body rim (red arrow)

Figure 27: Calcaneal spurs (red arrows)

6.2.2.2. Grave B (CAS 276/06/2015):

Preservation and inventory

The remains were completely skeletonized and in a fair state of preservation. Most of the postcranial remains were present, while only some of the crania were present including the occipital bone, the left and right maxilla, the left and right mandible and parts of the left and right temporal bones. Some post-mortem damage was evident on the skull, teeth and on some of the long bones. This may have occurred during the discovery or subsequent recovery of the remains. The mandible and maxilla were broken in half and some of the teeth were lost post-mortem. For a full skeletal inventory refer to table 6.

Age at death

All the long bones were fused and the third molars were in full occlusion suggesting an adult age for this individual. This includes the complete fusion of the medial ends of the clavicles as well as S1 and S2 suggesting an age older than 25 years.

The pubic symphyses represented phase 2 (Brooks & Suchey, 1990) suggesting an age range of between 19 and 40 years at the time of death. The auricular surfaces represented

phase 2 to 3 which suggest age ranges of between 25 and 29 and 30 and 34 respectively. Transition analysis of the pubic symphyses and auricular surfaces using ADBOU 2.1 provided an age estimate range, with a 95% confidence interval, of between 25 and 49 years with a mean age of 33 years. A final age range of 25 to 49 was estimated for this individual.

Sex

Sex was estimated for this individual by observing the morphological features of the pelvis as the skull was too fragmented and incomplete to be assessed.

The morphological features of the pelvis seemed to correspond more with those associated with females such as the rounded and more obtuse angle of the subpubic angle and the triangular obturator foramen. Using the Klales *et al.*, (2012) method the ventral arc and subpubic concavity could be observed with a narrow and sharp ischiopubic ramus. These features are consistent with a female. This method produced a 97% accuracy and a 100% probability that the individual belongs the female sex. This individual was therefore estimated to be female.

Ancestry

Due to a lack of cranial bones the morphological features on the skull could not be observed. However the archaeological context of the remains already suggests an African ancestry for this individual.

Metric analysis of the post-crania was utilized to estimate ancestry (refer to table 7 for skeletal measurements). Twenty eight standard postcranial measurements were uploaded into FD3 to compare the unknown post-crania to a custom database that is comprised of known Black (n=62), Coloured (n=57) and White (n=56) South Africans. Using 15 Forward Wilks stepwise selected variables the results indicated that the unknown post-crania was most similar to Black individuals with an 88% posterior probability and significant topicalities (Table 8). The posterior probability indicates the likelihood for unknown remains to belong to a particular group, whereas the typicality indicates how typical the unknown is for the group to which it was classified. This individual is therefore estimated to be of African ancestry.

Stature

The ante-mortem stature was determined by using the physiological length of the left femur. The stature of this individual was calculated as being 171.94 ± 2.79 cm. This is regarded as a relatively tall stature for someone of this populations group and sex (Steyn and Smith, 2007).

Dentition

Almost all the teeth were present except for the upper right second premolar, the upper left lateral incisor, the upper left first molar and the lower right central incisor. These teeth were all lost post-mortem.

Dental pathology that could be observed included dental calculus on the buccal and lingual surfaces of most of the teeth as well as periodontal disease (Fig. 28). Small coronal caries could also be observed on the upper right third molar, lower right second and third molars as well as on the buccal surfaces of the lower left second and third molars.

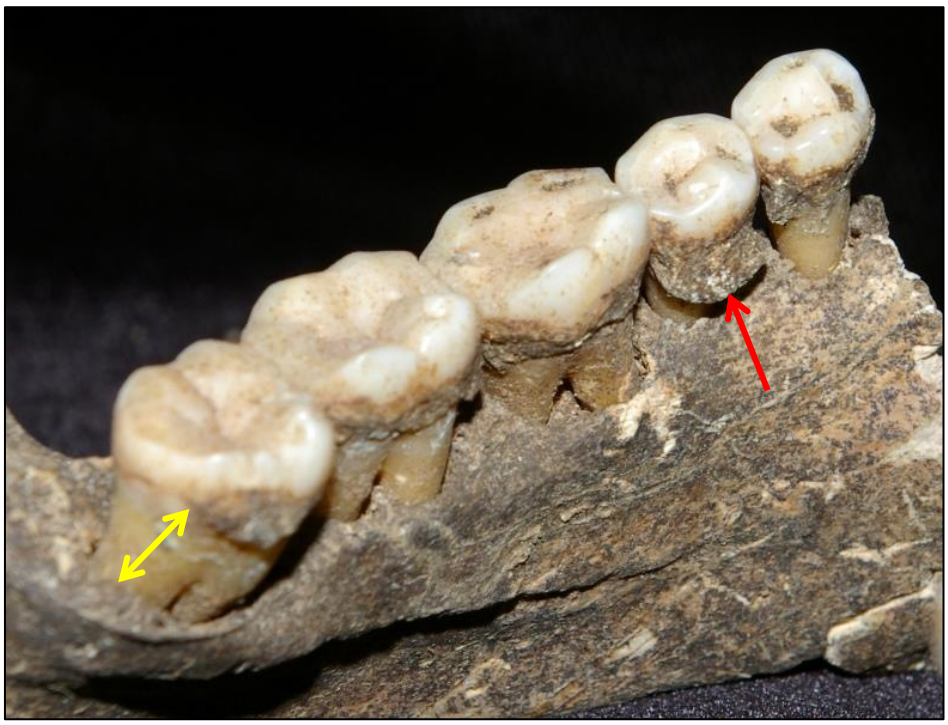

Figure 28: Dental pathology observable in the mandible. Red arrow indicates dental calculus and yellow arrow indicates alveolar regression suggestive of periodontal disease

Trauma and Pathology

Ante-mortem trauma could be observed in one of the left proximal phalanges (Fig. 29). Slight arthritic changes could be observed on the proximal ends of the left and right metatarsals as well as slight calcaneal and patellar spurs/exostoses. Additional both the left and right patellae presented with a developmental anomaly referred to as bipartite patellae (Fig. 30).

Figure 29: Proximal phalange of the left foot presenting with a healed fracture

Figure 30: Bipartite patellae

7. Conclusion

Two sets of inadvertently discovered human remains were uncovered at an extension of the Boitekong Township located outside of Rustenburg. The two discoveries were reported to the Boitekong SAPS and case dockets were opened. The Victim Identification Center (VIC) of the South African Police Services (SAPS) contacted the Forensic Anthropological Research Centre (FARC) in order to determine the nature of the remains. Rescue excavations were undertaken after a rescue excavation permit was obtained from SAHRA BGG. These rescue excavations were conducted on the 5th of August 2015. Results from the excavations suggest that both individuals were interred in ashy deposits, possibly suggestive of ash middens, in a flexed sitting position, within a circular grave pit. This type of burial practice is consistent with internment methods used by the Iron Age populations of southern Africa.

The archaeological context associated with the graves indicates an Iron Age occupation of the area. The Uitkomst pottery found in association with Grave A is suggestive of Nguni and Sotho-Tswana occupation of the Rustenburg area between AD 1650 and AD 1829. Findings in the present study are consistent with the findings of sites in and around the Rustenburg area, since the ceramic decoration tradition fits into the broader settlement chronology of the region (Huffman, 2007; Loubser, 1991). This finding, while preliminary, suggests that the site was occupation by Middle to Late Iron Age faming groups who had cultural elements of both Nguni and Sotho-Tswana speaking population groups.

The physical anthropological analysis of the two sets of skeletal remains recovered suggested that both individuals were adult females of African ancestry. The individual recovered from Grave A was that of an older female individual estimated to be between the ages of 45 and 75 years when she died. The second individual recovered from Grave B was that of a younger female individual estimated to be between 25 and 49 years at the time of her death. Both individuals presented with dental pathology suggestive of poor oral hygiene and a carbohydrate rich diet. Most of the skeletal pathology that could be identified can be associated with activity and/or age related degenerative processes.

8. Recommendations

Based on the findings from the follow-up visit, excavation and physical anthropological analysis an archaeological age for the remains can be confirmed.

- It is therefore recommended that the SAPS investigation be closed.

- That retrospective studies be undertaken to determine the archaeological age and significance of the human remains and associated site.

- That all retrospective work be undertaken after the necessary permission has been obtained from the applicable legislative bodies.

- That until an affected family/community can be identified, and arrangements can be made for reburial of the remains, it be permanently stored as part of the Archaeological Human Remains Collection at the Department of Anatomy, university of Pretoria.

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Table 1: Skeletal inventory: CAS 21/06/2015
*** damaged and fragmented**
(n)=The number of the particular skeletal element present (where applicable)

Skeletal element	Present=1 / Absent=0
Cranial Bones:	
Frontal	1
Parietal	1
Occipital	1
Temporal	1
Temporal-mandibular joint	1
Sphenoid	1
Zygomatic	1
Maxilla	1*
Palatine	1
Mandible	1
Post-cranial bones:	
Cervical vertebrae	1*(7)
Thoracic vertebrae	1*(12)
Lumbar vertebrae	1*(5)
Sacrum	1
Manubrium	1
Sternum	1
Right clavicle	1
Left clavicle	1
Right scapula	1
Left scapula	1
Right ribs	1* (12)
Left ribs	1* (11)
Right humerus prox. epip.	1
Right humerus prox. third	1*
Right humerus middle third	1*
Right humerus distal third	1*
Right humerus distal epip.	1*
Left humerus prox. epip.	1
Left humerus prox. third	1
Left humerus middle third	1
Left humerus distal third	1
Left humerus distal epip.	1
Right radius prox. epip.	1
Right radius prox. third	1
Right radius middle third	1
Right radius distal third	1
Right radius distal epip.	1
Left radius prox. epip.	1
Left radius prox. third	1
Left radius middle third	1
Left radius distal third	1
Left radius distal epip.	1
Right ulna prox. epip.	1
Right ulna prox. third	1
Right ulna middle third	1
Right ulna distal third	1
Right ulna distal epip.	1
Left ulna prox. epip.	1
Left ulna prox. third	1
Left ulna middle third	1
Left ulna distal third	1
Left ulna distal epip.	1

Right os coxae	1
Left os coxae	1
Right femur prox. epip.	1
Right femur prox. third	1
Right femur middle third	1
Right femur distal third	1
Right femur distal epip.	1
Left femur prox. epip.	1
Left femur prox. third	1
Left femur middle third	1
Left femur distal third	0
Left femur distal epip.	0
Right tibia prox. epip.	1
Right tibia prox. third	1
Right tibia middle third	1
Right tibia distal third	1
Right tibia distal epip.	1
Left tibia prox. epip.	1
Left tibia prox. third	1*
Left tibia middle third	1
Left tibia distal third	1
Left tibia distal epip.	1
Right fibula prox. epip.	1
Right fibula prox. third	1
Right fibula middle third	1*
Right fibula distal third	1
Right fibula distal epip.	1
Left fibula prox. epip.	0
Left fibula prox. third	0
Left fibula middle third	1*
Left fibula distal third	1
Left fibula distal epip.	1
Right patella	1
Left patella	1
Right carpals	1* (6)
Left carpals	1* (7)
Right metacarpals	1* (4)
Left metacarpals	1* (5)
Right hand phalanges	1* (12)
Left hand phalanges	1* (6)
Right tarsals	1* (7)
Left tarsals	1.*(7)
Right metatarsals	1 *(5)
Left metatarsals	1*(5)
Right foot phalanges	1*(9)
Left foot phalanges	1*(7)

Table 2: Cranial measurements

All measurements in mm.

- skeletal element was absent or damaged and therefore measurements could not be obtained

*** indicates right side**

Skeletal dimension	CAS 21/06/2015
Max. cranial length	184
Max. cranial breadth	132
Bizygomatic diameter	-
Basion-bregma height	140
Cranial base length	130
Basion-prosthion length	128
Maxillo-alveolar breadth	-
Maxillo-alveolar length	57
Biauricular breadth	-
Upper facial height	73
Min. frontal breadth	91
Upper facial breadth	107
Nasal height	51
Nasal breadth	27
Orbital breadth	39
Orbital height	31
Biorbital breadth	102
Interorbital breadth	25
Frontal chord	111
Parietal chord	117
Occipital chord	95
Foramen magnum length	36
Foramen magnum breadth	28
Mastoid length	30
Chin height	31
Height of mandibular body	34
Breadth of mandibular body	13
Bigonial width	-
Bicondylar breadth	-
Min. ramus breadth	43
Max. ramus breadth	41
Max. ramus height	58
Mandibular length	-
Biasterionic breadth	108

Table 3: Post-cranial measurements

All measurements in mm.

- skeletal element was absent or damaged and therefore measurements could not be obtained

*** indicates right side**

Skeletal dimension	CAS 21/06/2015
Clavicle max. length	160
Clavicle ant.-post. diameter midshaft	13
Clavicle sup.-inf. diameter midshaft	11
Scapula height	-
Scapula breadth	93
Humerus max. length	311*
Humerus epicondylar breadth	56*
Humerus vertical diameter head	39*
Humerus max. diameter midshaft	20*
Humerus min. diameter midshaft	15*
Radius max. length	250
Radius ant.-post. diameter midshaft	11
Radius med.-lat. diameter midshaft	14
Ulna max. length	269
Ulna ant.-post diameter	13
Ulna med.-lat. diameter	14
Ulna physiological length	238
Ulna min. circumference	31
Sacrum anterior length	-
Sacrum ant.-sup. breadth	98
Sacrum max. transverse diameter base	59
Os coxae height	-
Os coxae iliac breadth	141
Os coxae pubis length	94
Os coxae ischium length	-
Femur max. length	467*
Femur bicondylar length	466*
Femur epicondylar breadth	73*
Femur max. diameter femur head	43
Femur ant.-post. subtrochanteric diameter	34
Femur med.-lat. subtrochanteric diameter	26
Femur ant.-post. midshaft diameter	28
Femur med.-lat. midshaft diameter	26
Femur midshaft circumference	91
Tibia length	419*
Tibia physiological length	394*
Tibia max. prox. epiphyseal breadth	70*
Tibia max. distal epiphyseal breadth	42*
Tibia max. diameter nutrient foramen	32*
Tibia med.-lat. diameter nutrient foramen	22*
Tibia circumference nutrient foramen	86*
Fibula max. length	-
Fibula max. diameter midshaft	14
Calcaneus max. length	78
Calcaneus middle breadth	42

Table 4: Dental measurements

All measurements were taken in mm.

- dentition was absent or damaged and therefore measurements could not be obtained

*** indicates right side. MD=mesiodistal, BL = buccolingual**

Maxilla	CAS 21/06/2015	Mandible	CAS 21/06/2015
MDI1	8.24	**MD I1**	-
BL I1	6.72	**BL I1**	-
MD I2	6.94	**MD I2**	-
BL I2	7.10	**BL I2**	-
MD C	7.20	**MD C**	6.40
BL C	8.89	**BL C**	7.64
MD PM1	-	**MD PM1**	7.02
BL PM1	-	**BL PM1**	8.19
MD PM2	-	**MD PM2**	7.21
BL PM2	-	**BL PM2**	8.81
MD M1	11.29	**MD M1**	-
BL M1	9.90	**BL M1**	10.36
MD M2	11.26	**MD M2**	10.41
BL M2	1.59	**BL M2**	10.62
MD M3	-	**MD M3**	10.93
BL M3	-	**BL M3**	10.88

Table 5: FORDISC 3.1 Analysis of Current Case CAS 21/06/2015

```
Using Africa.adt
DF results using 15 Forward Wilks selected (min: 1 max: 15, out of 16) measurements:
 NLB     OBH     FRC     BBH     DKB     OBB     MDH     NPH     FOL     EKB
 GOL     OCC     XCB     XFB     PAC
 ------------------------------------------------------------------------------
    From   Total          Into Group                              Percent
    Group  Number         B   BUSHMAN         C         W      ZULU   Correct
 ------------------------------------------------------------------------------
        B    162          67        20        27         1        47    41.4 %
  BUSHMAN     90           7        72         5         0         6    80.0 %
        C     85          15        13        30        13        14    35.3 %
        W    109           3         2        23        72         9    66.1 %
     ZULU    101          25        11         7         1        57    56.4 %
 ------------------------------------------------------------------------------
 Total Correct:      298 out of 547 (54.5 %) *** CROSSVALIDATED ***

          Multigroup Classification of Current Case
 ------------------------------------------------------------------------------------
  Group     Classified      Distance    Probabilities
               into           from      Posterior  Typ F   Typ Chi    Typ R
 ------------------------------------------------------------------------------------
     ZULU      **ZULU**          7.2        0.520    0.972    0.953    0.275 (75/102)
        B                       7.8        0.387    0.950    0.933    0.423 (95/163)
        C                      10.8        0.085    0.862    0.767    0.360 (56/86)
        W                      16.0        0.006    0.529    0.384    0.464 (60/110)
  BUSHMAN                      18.0        0.002    0.443    0.264    0.022 (90/91)
 ------------------------------------------------------------------------------------
  Current Case is closest to ZULUs
```

```
 ---------------------------------------------------------------------------------------
                                  Group Means
                               B   BUSHMAN         C         W      ZULU
   Current Case    Chk       162        90        85       109       101
-------------------------------------------------------------------------
       NLB     27              27.5      26.5      25.8      23.9      28.3
       OBH     36      +       33.4      30.9      33.8      34.8      33.4
       FRC    111      +      110.0     107.0     104.6      79.9     110.6
       BBH    140      +      128.9     120.9     123.2      95.0     131.4
       DKB     25      +       23.4      21.7      21.9      19.4      23.0
       OBB     39              39.2      38.4      40.2      40.7      39.9
       MDH     30      +       27.1      23.3      25.4      28.4      27.1
       NPH     73      +       59.7      56.8      51.1      60.7      65.5
       FOL     36              37.1      35.9      37.2      38.6      36.7
       EKB    102      +       98.2      95.3      95.2      96.1      99.5
       GOL    184      +      178.2     174.7     166.5     122.8     182.3
       OCC     95              93.9      88.5      89.0      88.0      95.8
       XCB    132             129.2     130.9     126.5     125.3     133.0
       XFB    107             109.3     108.2     102.6     100.6     114.9
       PAC    117      +      111.7     107.2     104.8      77.2     113.8
-------------------------------------------------------------------------
 +/- measurement deviates higher/lower than all group means; ++/-- deviates one to two STDEVs
 +++/--- deviates two to three STDEVs; ++++/---- deviates at least three STDEVs
-------------------------------------------------------------------------
Natural Log of VCVM Determinant =  60.3222
```

Table 6: Skeletal inventory: CAS 276/06/2015

*** damaged and fragmented**

(n)=The number of the particular skeletal element present (where applicable)

Skeletal element	Present=1 / Absent=0
Cranial Bones:	
Frontal	0
Parietal	0
Occipital	1*
Temporal	1*
Temporal-mandibular joint	0
Sphenoid	0
Zygomatic	0
Maxilla	1*
Palatine	0
Mandible	1*
Post-cranial bones:	
Cervical vertebrae	1*(7)
Thoracic vertebrae	1*(11)
Lumbar vertebrae	1*(3)
Sacrum	1*
Manubrium	0
Sternum	1*
Right clavicle	1*
Left clavicle	1*
Right scapula	1*
Left scapula	1*
Right ribs	1* (11)
Left ribs	1* (9)
Right humerus prox. epip.	1*
Right humerus prox. third	0
Right humerus middle third	1
Right humerus distal third	1
Right humerus distal epip.	1
Left humerus prox. epip.	1
Left humerus prox. third	1
Left humerus middle third	1

Left humerus distal third	1
Left humerus distal epip.	1
Right radius prox. epip.	1
Right radius prox. third	1
Right radius middle third	1
Right radius distal third	1
Right radius distal epip.	1
Left radius prox. epip.	1
Left radius prox. third	1
Left radius middle third	1
Left radius distal third	1
Left radius distal epip.	1
Right ulna prox. epip.	1
Right ulna prox. third	1
Right ulna middle third	1
Right ulna distal third	1
Right ulna distal epip.	1
Left ulna prox. epip.	1
Left ulna prox. third	1
Left ulna middle third	1
Left ulna distal third	1
Left ulna distal epip.	1
Right os coxae	1*
Left os coxae	1*
Right femur prox. epip.	1
Right femur prox. third	1
Right femur middle third	1*
Right femur distal third	1
Right femur distal epip.	1
Left femur prox. epip.	1
Left femur prox. third	1
Left femur middle third	1*
Left femur distal third	1
Left femur distal epip.	1
Right tibia prox. epip.	1
Right tibia prox. third	1
Right tibia middle third	1*
Right tibia distal third	1
Right tibia distal epip.	1*
Left tibia prox. epip.	1
Left tibia prox. third	1
Left tibia middle third	1*
Left tibia distal third	1
Left tibia distal epip.	1*
Right fibula prox. epip.	1
Right fibula prox. third	1
Right fibula middle third	1
Right fibula distal third	1
Right fibula distal epip.	1
Left fibula prox. epip.	1
Left fibula prox. third	1
Left fibula middle third	1
Left fibula distal third	1
Left fibula distal epip.	0
Right patella	1
Left patella	1
Right carpals	1*(7)
Left carpals	1*(7)
Right metacarpals	1(5)
Left metacarpals	1(5)

Right hand phalanges	1*(13)
Left hand phalanges	1*(14)
Right tarsals	1(7)
Left tarsals	1(7)
Right metatarsals	1(5)
Left metatarsals	1(5)
Right foot phalanges	1*(9)
Left foot phalanges	1*(8)

Table 7: Post-cranial measurements

All measurements in mm.

- skeletal element was absent or damaged and therefore measurements could not be obtained

*** indicates right side**

Skeletal dimension	CAS 276/06/2015
Clavicle max. length	-
Clavicle ant.-post. diameter midshaft	12
Clavicle sup.-inf. diameter midshaft	9
Scapula height	-
Scapula breadth	-
Humerus max. length	317
Humerus epicondylar breadth	60*
Humerus vertical diameter head	43
Humerus max. diameter midshaft	19
Humerus min. diameter midshaft	15
Radius max. length	249
Radius ant.-post. diameter midshaft	10
Radius med.-lat. diameter midshaft	13
Ulna max. length	268
Ulna ant.-post diameter	12
Ulna med.-lat. diameter	14
Ulna physiological length	240
Ulna min. circumference	31
Sacrum anterior length	-
Sacrum ant.-sup. breadth	-
Sacrum max. transverse diameter base	48
Os coxae height	198*
Os coxae iliac breadth	-
Os coxae pubis length	87*
Os coxae ischium length	101*
Femur max. length	488
Femur bicondylar length	484
Femur epicondylar breadth	-
Femur max. diameter femur head	44
Femur ant.-post. subtrochanteric diameter	27
Femur med.-lat. subtrochanteric diameter	31
Femur ant.-post. midshaft diameter	29
Femur med.-lat. midshaft diameter	25
Femur midshaft circumference	88
Tibia length	401*
Tibia physiological length	389*

Tibia max. prox. epiphyseal breadth	-
Tibia max. distal epiphyseal breadth	-
Tibia max. diameter nutrient foramen	36*
Tibia med.-lat. diameter nutrient foramen	21*
Tibia circumference nutrient foramen	92*
Fibula max. length	-
Fibula max. diameter midshaft	15
Calcaneus max. length	78
Calcaneus middle breadth	46

Table 8: FORDISC 3.1 Analysis of Current Case CAS 276/06/2015

```
Using SA_PC_2015.adt
DF results using 15 Forward Wilks selected (min: 1 max: 15, out of 28) measurements:
 innoht    ulnxln    calcbr    humxln    femstv    clavrd
 humhdd    femhdd    femmap    femmtv    radxln    ulndvd
 ulnphl    claapd    ulntvd
 ------------------------------------------------------
    From   Total          Into Group          Percent
    Group  Number         B         C         W   Correct
 ------------------------------------------------------
        B     62          44        15         3    71.0 %
        C     57          11        43         3    75.4 %
        W     56           0         3        53    94.6 %
 ------------------------------------------------------
 Total Correct:      140 out of 175 (80.0 %) *** CROSSVALIDATED ***

          Multigroup Classification of Current Case
 ------------------------------------------------------------------------------------------
   Group     Classified      Distance    Probabilities
                into          from      Posterior  Typ F   Typ Chi    Typ R
 ------------------------------------------------------------------------------------------
        B         **B**         15.5        0.883    0.663    0.413    0.524 (31/63)
        C                       19.6        0.116    0.476    0.188    0.224 (46/58)
        W                       29.9        0.001    0.140    0.012    0.070 (54/57)
 ------------------------------------------------------------------------------------------
  Current Case is closest to Bs
 ------------------------------------------------------------------------------------------
                             Group Means
                               B         C         W
   Current Case   Chk         62        57        56
-----------------------------------------------------
    innoht    193           197.6     191.3     213.6
    ulnxln    268     +     264.7     244.2     255.0
    calcbr     46    ++      41.9      41.7      40.9
    humxln    317           310.6     299.8     319.9
    femstv     31            30.2      30.3      31.2
    clavrd      9     -      10.0       9.8       9.8
    humhdd     43            41.7      40.3      45.1
    femhdd     44            43.3      42.1      44.5
    femmap     29     +      28.6      27.3      28.6
    femmtv     25     -      26.1      25.0      26.9
    radxln    249     +     246.5     227.1     237.3
    ulndvd     12    --      14.7      14.4      14.4
    ulnphl    240     +     232.6     214.2     222.9
    claapd     12            12.0      11.6      11.6
    ulntvd     14     -      14.7      14.2      14.8
-----------------------------------------------------
 +/- measurement deviates higher/lower than all group means; ++/-- deviates one to two STDEVs
 +++/--- deviates two to three STDEVs; ++++/---- deviates at least three STDEVs
-----------------------------------------------------
Natural Log of VCVM Determinant =  26.1017
```

Table 9: Dental measurements
All measurements were taken in mm.
- dentition was absent or damaged and therefore measurements could not be obtained
*** indicates right side. MD=mesiodistal, BL = buccolingual**

Maxilla	CAS 276/06/2015	Mandible	CAS 276/06/2015
MDI1	8.97	**MD I1**	4.91
BL I1	7.24	**BL I1**	5.78
MD I2	-	**MD I2**	5.91
BL I2	-	**BL I2**	6.05
MD C	8.12	**MD C**	7.50
BL C	9.10	**BL C**	7.88
MD PM1	6.77	**MD PM1**	7.19
BL PM1	9.63	**BL PM1**	8.04
MD PM2	5.98	**MD PM2**	7.54
BL PM2	9.08	**BL PM2**	8.48
MD M1	10.7	**MD M1**	10.83
BL M1	11.17	**BL M1**	10.21
MD M2	10.44	**MD M2**	11.28
BL M2	11.7	**BL M2**	10.32
MD M3	8.32	**MD M3**	10.66
BL M3	10.26	**BL M3**	11.06