

Preliminary results of an investigation of the human
skeletal remains excavated on Beacon Island,
associated with the mutiny of the *Batavia* in 1629.
Recommendations for further research

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Introduction

Since the first human skeleton was found on Beacon Island in 1960, several other occasions have led to the discovery of human remains; the number of recovered individuals is now determined between 8 and 10. The skeletal material was studied in 1995 by Bernadine Hunneybun of University of W.A. for her Bsc Honours thesis. However, Hunneybun's study left many questions unanswered, hence the material has again been investigated using a number of additional and more advanced techniques.

The attention was focused on the cause of death of the individuals, in order to reach a more precise identification, and on the personal characteristics of the individuals, such as general health status, diet, and possible occupation stress markers. Ultimately, these data shall be compared with contemporary skeletal samples derived from a variety of different contexts, such as the Spitsbergen whalers and the Spitalfield individuals. Apart from revealing contrasts between these populations, this comparative analysis will also contribute to our general understanding of 17th century life amongst the different social classes in this corner of north-western Europe.

The investigation of injuries and cause of death was done by staff of the PathCentre of QEII Medical Centre; preliminary identifications of the individuals were based on the physical anthropological data described below, the information about the cause of death, and a detailed study of the events on the Abrolhos after the ship stranded. For this I would like to thank Alanah Buck from the aforementioned PathCentre, and Marit van Huystee from the WAM Museum, who studied the relevant details in Pelsaert's journals for this project.

It must be stressed that the results described below are preliminary, as the investigation is still in progress.

The individuals

BAT M3901, the first skeleton found on the Abrolhos in 1960, was originally on display in the Netherlands Maritime Museum. It is now for an undetermined period on loan to the WAM Museum. The BAT A15508 skeleton is located in the Australian National Maritime Museum in Sydney. The skull of this skeleton has been missing for a long time, but there are strong indications that one of the supposed Zeewyck skulls from Gun Island (A15831) has been mislabelled and actually comes from Beacon island; it is possible that this skull belongs to the 15508 individual. Skeleton BAT A15507 is the most complete and is on display in the WAM Museum. The Geraldton Region Museum normally holds the skull of BAT A16316; the postcranial bones of this skeleton are still *in situ* on Beacon Island. In 1994 the remains of some other individuals were excavated on Beacon Island, BAT SK5 and SK6, which are stored in the WAM Museum. SK5 is extremely fragmentary and not complete, and SK6 consists of only part of a skull, as the remainder of the skeleton is still *in situ* on the island. Single skeletal elements, found amongst the above mentioned remains, indicate the presence of additional individuals, as discussed below.

Methods

The age and sex determinations were done according to the recommendations of the Workgroup of European Anthropologists (WEA 1980). Toothwear patterns for age determination were scored according to the system of Brothwell (1981). However, the Arolhos population is of more recent date than the early Medieval populations on which the Brothwell system is based. If wear was in disagreement with other age related skeletal features, the scoring system for the 16-18th century 'Martinikerhof' population from northern Holland (Uyterschaut, unpublished) was used, which is an adjusted version of the Brothwell system.

Specific ages of the individuals are rarely mentioned in the journals. The ages of possible candidates for identification were estimated on the basis of the description of their personal characteristics. The ages determined for the skeletal remains are biological ages, based on the developmental or degenerative stage of the skeleton, rather than 'calendar' ages.

Estimation of stature based on skeletal material can be done by calculation, or by estimation of the length of the stretched-out body in the field. Only in one case (A15507) the stature was calculated, and in another (M3901) the length was estimated in the field. In the other skeletons the long bones are damaged to such an extent that calculation of stature would not be justified.

All bone fragments were visually, and some also radiologically, inspected for traces of pathology or trauma. X-rays are especially useful for showing the presence of growth arrest lines (or Harris lines) or internal infections or trauma which are externally not visible. The age at which growth had arrested, which had occurred in the individuals A15507 and M3901, was calculated according to Maat (1984). The total length of the tibia of M3901 was derived from Table 2 in Maat (1984), as the proximal end was damaged. The traumas on the skulls of A15507, A16316, M3901 and A15831 were investigated by the PathCentre. In the future, casts will be made of the injuries in order to try and match the possible weapon used.

Resin casts were made of every individual's dental elements. This was done by Steven Knott and Michael Standish, both working in the field of dentistry (and forensic pathology). A first attempt was made to identify microwear on the teeth, using an Environmental Scanning Electron Microscope.

Results

The results are summarised in table 1. For a detailed description and discussion of each individual, see the appendix.

individual	age	sex	pathology	Harris Lines	trauma	possible identity
BAT M3901 skeleton	16-18	female	slight inflamed right jaw joint, imbrication lines	five lines between 9.5 and 12 years of age	shallow indentation/ cutmark on skull. not fatal	Mayken Cardoes or Willemyntjie Bastiaens
BAT M3901+ single molar	17-19	indeterminable				
BAT A15508 postcranial skeleton of A15831?	16-18	inconclusive	light scoliosis, rickets	not observed	musket shot, osteologically not confirmed	Jan Dirxsz
BAT A15831 cranium of A15508?	18-23	inconclusive	inflammations of gum and jaws, imbrication lines		skull fracture, probably post-mortem	Jan Dirxsz
BAT A15507 skeleton	35-39	male	slight inflamed palate & alveoli, lesion on clavicle possibly caused by physical activity	15 lines, 13 between 6 and 14.5 years of age	cutmark on skull, probably fatal	?
BAT A16316 cranium only	33-37	male			cutmarks on skull, fatal	Hendrick Denys?
BAT SK5 single molar belongs to SK5?	around 45 30+ - early 40s	?male? indeterminable		not observed		
BAT SK6 cranium only single rib	adult child	indeterminable indeterminable				

Table 1. Summary of the results

imbrication lines: horizontal 'scars' in teeth caused by growth interruption

Harris lines: horizontal 'scars' in long bones (visible on X-rays) caused by growth interruption

scoliosis: lateral curvature of the vertebral column

rickets: vitamin D deficiency

Recommendations and plans for further research

Clearly, much additional work remains to be done on the Beacon Island skeletons, both with the bones and from historical sources. Indeed, at this stage none of the above described individuals has been identified with certainty. Further work is required on the various injuries, specifically in regard to the types of weapons used. However, this should be accompanied by historical investigations of the types of weapons and implements in common use on VOC vessels at that time. Also, through casts of the injuries, cutmarks might be matched with a possible weapon, such as the cutlass which was found on Beacon Island.

In a few cases it was not possible to determine the age or sex, but additional study using more advanced techniques may solve this problem. Radiology applied to the dentition of the individuals will clarify the disagreements in age determinations and show oral pathology as well. DNA analysis to determine the sex would be valuable in several cases, and in particular in the case of A15831 and A15508 it is essential. For the other cases in which the sex is uncertain or indeterminable, excavation of the remaining skeletal parts might be sufficient.

DNA analysis may also be required to resolve the individuals involved in the multiple burial containing M3901, M3901+, SK5 and SK6 and the child. It is possible that we are dealing here with the mass grave of the Predikant's family and it may be possible to prove (or disprove) this by matching DNA sequences to find family relations. The main disadvantage of this technique is that it is destructive; however, samples can be taken in such a way that it will not, or hardly, be visible if the skeleton is on display. Besides, high quality reconstructions are relatively easy to produce.

High quality resin casts of the teeth of the individuals were made to study dental microwear under SEM. The prediction is that people who live in a sandy environment with only very crude facilities for food preparation will develop a different wear pattern on their teeth than people who have spent the final period of their life in the relatively clean or 'sandless' environment of a ship. In the first week or so after the ship wrecked, several people died from thirst, with a break in deaths until such time as the murdering commenced, a month or so later. In cases where there is no obvious sign of violent death or disease, differences in dental microwear may therefore distinguish between these two groups of victims. Although the necessary casts have been produced, no results have been obtained as yet; this will be further investigated in the near future. Apart from visual examination, statistical analysis of microwear patterns via Fourier transformations may be attempted.

Additional studies may also expand our knowledge of the social background of the various individuals. Since there was a wide spectrum of people on board with markedly different professions and social backgrounds, we might expect to see evidence of significant differences in the diet that they had over the last 10 years or so of their lives. VOC officers as well as passengers were presumably quite affluent, while sailors and soldiers in the 17th century were presumably of a lower social status and had less access to high quality food products. These differences may be reflected in the chemical composition of the skeleton and can be determined by stable isotope analysis. In cases where the identification remains uncertain, information on social standing may well allow a decision amongst a limited range of possibilities. One other aspect considering social background has already been investigated in considerable detail: the general health status at the moment of death, as well as during childhood. Two individuals showed signs of repeated health problems during their period of growth, and one of them had suffered from vitamin D deficiency. In both cases, the evidence suggests that these individuals grew up under harsh circumstances, perhaps in the context of poor or otherwise disadvantaged families.

The two most recently recovered individuals, SK5 and SK6, are, at this stage, the most difficult to identify, essentially because of their incompleteness and state of preservation. Much of SK6 is still *in situ* on the island and it is obviously highly desirable that these remains be excavated with all possible care. The same is true for the postcranial remains of A16316. The postcranial skeleton provides information about traumatic lesions, the person's health status and posture; it supports the age and sex determination; and, finally, it provides suitable bone samples for various chemical or histological analyses. These should preferably be taken from the postcranial skeleton as it will have the least impact on either the anatomical or the public display value of the skeleton.

The potential for identification of the individuals from the Abrolhos is greatly increased by careful, systematic excavation. Because most of the skeletal remains described above (except for SK5 and 6) have been casual discoveries, rather than finds which were systematically excavated, many small but important bones may not have been recognised during excavation. Hand bones, for example, may show small injuries as a result of the victim's defence. Bones of a foetus in the area between the pelvis and the rib cage provides evidence of pregnancy. Such details may be very important for identification, and it is therefore stressed that any future excavations on the Abrolhos Islands should be carried out in the presence of an experienced physical anthropologist.

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Appendix

Detailed results for each individual

BAT M3901

The skeleton is very fragile, relatively complete and moderately well preserved. The skull is incomplete and reconstructed. Many epiphyses are unfused, which means that this individual was a subadult. The age was estimated, based on epiphysial fusion to be 15 or 16 years old; the relief of the pubic symphysis indicated an age younger than about 18 years; however, the eruption of the 3rd molar points to an age of a little older than 18, so we may estimate the age between 16 and 18 years. Usually, determination of the sex of immature individuals is somewhat hazardous, as the sex-related features in the skeleton are not yet fully developed. However, the older the child is, the more certain the sex determination will be. Especially the skull of this individual, but also the general appearance of the bones, indicate the female sex. The stature was estimated in the field to be 5'7 1/2" (ref?).

Pathology and trauma

The right joint of the mandible shows signs of bone reaction, which might have been caused by irritation or inflammation of the joint. This has probably been a minor defect. The teeth of the individual show imbrication lines on the incisors and the canines, which indicates that the normal development of the teeth was interrupted during early childhood. A similar phenomenon was visible on X-ray photo's taken from the right tibia: 5 transverse lines (Harris Lines) indicate repeated growth arrest during childhood. Arrested growth may be caused by periods of malnutrition or illness, or both; however, it is not possible to tell whether this was a long period of chronic disease or malnutrition, or a short period of severe illness and/or malnutrition. It was calculated that growth arrest occurred almost every half year for this individual, from about 9.5 years on to 12 years old. However, the lines in the tibia are not very clear, which may either indicate that the events were minor, or that they have faded by the remodelling process of the bone. In the latter case it should be emphasised that too much precision in these calculations would be unjustified. The imbrication lines on the teeth are probably the result of similar events, but generally the relation between the occurrence of imbrication lines and Harris lines is unclear. X-ray photo's were also taken from the left radius and ulna, but no transverse lines were found in these bones; this may partly be due to damage of the distal ends of the bones.

Trauma was present on the skull, which has been investigated by staff of the *PathCentre* of QEII Medical Centre: a shallow indentation along the sagittal suture was most likely formed by a sharp implement. The trauma is consistent with a glancing blow, given while the victim probably was facing away from the assailant, considering the location of the trauma. It must have been caused perimortem, but was probably not the cause of death (A.Buck, pers.comm.).

Preliminary identification

As the sex is female and the age 16 to 18 years, the number of candidates for identification are limited. The only females who might fall in this age category, who are mentioned to have been killed and buried on Beacon Island, are Mayken Cardoes, the middle daughter of the Predikant Willemyntgie Bastiaensz, and the Predikant's family maid Wybrecht Claasz.

Not much is known about Mayken Cardoes; she is mentioned to have had a young suckling infant (Drake-Brockman 1995:111;231). This fact indicates that her age could be anything between roughly 16 and 36; 16 to 18 years of age can therefore not be excluded. She is stated to have been hit on the head while struggling to get away before her throat was cut, and afterwards dragged into the hole dug for the Predikant's family.

The age of the middle daughter of the Predikant, Willemyntgie, is difficult to estimate. We know that the Predikant had 7 children, the eldest son Gijsbert being assistant and book keeper, and next one in line was Judith, who was the only one of his children kept alive. Coenraat van Huysen wanted to marry her, in which case she would probably have been at least about 18. His youngest son Roelant must have been roughly between 3 and 6, as he was small enough to run between the legs of one of the murderers. This leaves the middle daughter Willemyntgie to be between about 7 and 16 or 17. She was killed, like the rest of her family, with an adze.

Wybrecht Claasz was the Predikant's family maid and, as she is mentioned to have been 'young', she could have been any age between roughly 15 to 20. It is said that she was called from the tent and stabbed to death, but it is not mentioned that she was hit on the head, in which case she can be considered the least probable of these candidates.

M3901 was found buried close to two other (and possibly more) individuals (SK5 and SK6, see below). The three women mentioned above were buried with the rest of the Predikant's family in one large grave.

BAT M3901+, which was thought by Hunneybun to be a child represented by a deciduous molar and a small styloid process has not been found. However, a left upper 3rd molar is present which cannot belong to M3901 (S. Knott, pers. comm.). The root is not fully developed, indicating that, again, a 17-19 year old individual must have been buried close to M3901.

BAT A15508

This skeleton consists of only postcranial material, the skull having been collected on an earlier occasion and now misplaced; however, as shall be explained below, BAT A15831 may be the cranium of this individual. The postcranial material is in a moderate state of preservation and very fragile. It belongs to a sudadult individual, as is indicated by some unfused epiphyses. The age of the individual has been determined to be 16-18 years. The sex is considered inconclusive; there is only one fragment of the right innominate (the ilium including the sciatic notch) available for sex determination, and the sciatic notch in itself is intermediate in shape. Although there is a preauricular sulcus present, this does not prove that the individual was female.

Pathology and trauma

The vertebral column of the individual shows a slight scoliosis (lateral curvature), which might not have been noticeable or might not have affected the functioning of the body. Both femora are slightly anterior-posterior curved and the linea aspera is stronger developed in the lower half of the bones. This phenomenon is also seen in individuals with a lack of vitamin D (Rickets). The skeleton was found associated with musket shot in the ribs (ref?). However, no signs of trauma related to this were found in the bones of this part of the body that were sent across from Sydney. An X-ray photo of the right tibia shows no Harris lines or other indications of diseases or trauma. It must be mentioned, however, that the bone is damaged especially at the ends, where Harris lines would be most common; no transverse lines were found elsewhere in the bone either.

Preliminary identification

The only individual mentioned in the journals who died of a musket wound is Jan Dirxsz, a gunner. He was involved in the fight against the people on 'High Island' (Drake-Brockman, 1995:222), underway at the moment Pelsaert arrived at the Abrolhos. It appears that he died 11 days after he was shot. Although this is not mentioned in the journals, it is reasonable to think that he was taken back to Beacon Island and, as Pelsaert had already returned by then, given a proper burial when he died.

BAT A15831

This is a skull and mandible which are reasonably well-preserved and almost complete. The age of this individual is estimated to be in his/her early twenties (about 18 to 23). This was based on average toothwear, the incomplete eruption of the third molars, and the incomplete sphenoccipital fusion. The sex is inconclusive, as it has both male and female characteristics.

Pathology and trauma.

Some calculus is attached to the teeth, but no signs of caries or periodontitis have been found. The right M₂ was antemortem lost and the 3rd lower right molar is malpositioned. Close to this 3rd molar, as well as between the upper left premolars, traces of inflammations are visible. Imbrication lines are present on the front teeth, across the incisors, canines and the first premolars.

On the left side of the skull a fracture is present, running from the lambdoid suture along the squamosal suture of the temporal bone, ending close to the temporal line on the frontal bone. Staff of the PathCentre are uncertain about the timing of this fracture; it looks consistent with antemortem fractures, caused by the impact of an object with a large surface (such as a brick, a broad piece of wood, or a hit against a wall), but it cannot be excluded that the fracture is postmortem. There are no traces of the impact of a sharp or blunt object.

The colour and preservation of BAT A15831 are similar to the postcranial skeleton of BAT A15508, and it is feasible that these two samples derive from the same burial. However, more compelling evidence of association comes from another source: the missing skull was described to have been collected on Beacon island along with a tibia fragment, which was found on the beach some 200-300 yd away from the skull; and skull no. A15831, registered in the WAM collection as one of the Zeewyk individuals, is accompanied by a very bleached tibia fragment of a grey kangaroo (K. Aplin, pers. comm.), also bearing the number A15831. The estimated individual age of the skull is slightly older than the estimated age for the postcranial skeleton A15508. However, the same discrepancy between dental and postcranial age estimates was observed in individual M3901, hence the differences between the ages of tooth eruption, sphenoccipital fusion and epiphysial fusion may still be within the range of variation. For the present, it is regarded as probable, but not yet proven, that the skull and the postcranial remains belong to the same individual.

Preliminary identification

Impossible to identify from only the skull. Assuming that it belongs to the postcranial remains of BAT A15508, then possibly, as above, Jan Dircxsz. Lack of trauma on cranium is consistent with this identification as cause of death was gunshot wound.

BAT A15507

This skeleton belongs to an adult individual and is nearly complete; it is mainly bones from hands and feet that are missing. The material is well-preserved. The age of this individual is estimated between 35 and 39 years. The age could be determined on the basis of the pubic symphysis, the toothwear, and the general appearance of the cranial sutures. The skeleton belonged to a male individual, considering the robust skull and the sex-related features on the pelvis. The stature of this individual was calculated by Hunneybun (1995) to be 1.8 m.

Pathology and trauma

A small lesion present on the sternal end of the right clavicle, gives the impression that the bone has been inflamed; however, this is more likely to be related to intensive use of the muscles attached to this bone. Both the upper and lower dentition are in good health. However, remarkable are the very shallow alveoli of the front teeth in the upper jaw. The infill of the alveoli may have

been caused by an inflammation, as the palate shows signs of a little bone reaction, mostly towards the front teeth, suggesting that the bone has been inflamed. Also the socket of the left central incisor shows a little bone reaction. Whether the front teeth were lost during life shortly before he died, or after his death is impossible to say.

X-ray photos were taken from the right tibia as well as the left ulna and radius. A total of 15 transverse lines were present in the bones (in varying degree of visibility), suggesting repeated growth stops due to malnutrition and/or illness during childhood. The lines are only visible on one side of the tibia, due to the advanced remodelling of the bone. The period of malnourishment or repeated illness started very young, when he was about a month old. The second event occurred around 1.5 years of age. After that, this individual had periods of bad health every six to nine months from about 6 years of age on until he was between 14 and 14.5 years old. As mentioned at the description of Harris lines in M3901, too much precision in calculating the age at which the lines were formed is not justified. The ages given here are meant as an indication of the period and frequency of health problems.

Earlier accounts of this skeleton suggested that the right shoulderblade was broken, presumably implying a traumatic (ante- or perimortem) fracture. However, closer inspection failed to confirm this. Also the pelvis was said to show trauma, which could have led to limping. On the upper part of the pubic symphysis a little bone growth is present; this may or may not have been caused by trauma, but it seems unlikely to me that this would have caused any defect in his movements.

On the frontal bone, just before the coronal suture on the left side, there is a cutmark running sagittal across the skull. A flake of bone has chipped away on the right side of the cutmark. Investigation by staff of the PathCentre has shown that the injury was caused either by a right handed person, who hit the victim standing in front of him, or by a left handed person, attacking the victim from behind. The victim was probably standing at the time. The injury in itself was not fatal, but the blow was probably of such a force that this might have caused death. The weapon was a sharp-bladed instrument (A.Buck, pers.comm.)

Preliminary identification

At this stage of the investigation too many individuals can be considered as candidates for this skeleton. It needs further investigation before a selection of these can be made.

BAT A16316

Of this skeleton only a skull is present, fortunately in a very good condition. The mandible has become lost over the years. Based on toothwear, and general appearance of the cranial sutures, the age could be determined to be between 33 and 37. The robust skull is very likely to have belonged to a male individual.

Pathology and trauma

The skull did not bear any sign of diseases that had affected the bone or teeth. RM³ is postmortem lost but it is visible that it was somewhat out of position. However, severe trauma is visible on the skull, represented by deep cutmarks and fractures.

There are two major injuries, one on the left parietal bone and one on the occipital bone. A minor injury is present near the *foramina parietale* on top of the skull, and a small one below the occipital cutmark. The injury at the left side of the skull shows that a flake of bone was chipped away, and fractures are running from the cutmark both towards the occipital bone, and behind the temporal bone. The cutmark in the occipital bone has gone straight through the bone and must have been given with great force. Members of the PathCentre established that of the major injuries the blow on the left parietal was given first: the lambdoid suture is split open by the blow on occipital

bone, and the fracture could only have run across this suture if it was still closed. The occipital blow in particular was of such a force that it was definitely fatal. The blow was either given by a right-handed person, while the victim was facing the assailant, or by a left handed person, facing away from the assailant. The weapon used was a sharp-bladed instrument, probably heavier than the ones discussed for the above mentioned individuals (A.Buck, pers.comm.).

Preliminary identification

Although this is very tentative, as many people have been killed with a sharp-bladed instrument, this skull could have belonged to Hendrick Denys, VOC assistant. He was said to have been killed with an adze, which is a heavy sharp-bladed instrument, and he was one of the few mentioned to have been buried on Beacon Island. Further investigation about the actual circumstances of death is necessary.

BAT SK5

This skeleton is incomplete and in a very bad state of preservation, and the individual's grave was disturbed. The bones are very fragmentary. The age was based on the wear of a few teeth, a first premolar and a canine fitting in a part of the left maxilla, that presumably belongs to this individual: about 40-45 years old. The general appearance of the cranial sutures indicate an advanced age, which confirms the age based on toothwear. A separate right upper 2nd molar is also present and is less worn, but it could still have belonged to an individual of this age category. It is not excluded, though, that this tooth belonged to another individual (e.g. SK6, who was found very close to SK5). Only a part of the skull is present. The eyebrow region is very robust, a male characteristic, but more sex-related features are needed before this sex can be confirmed.

Pathology and trauma

No signs of diseases or trauma have been observed in the skeletal remains, probably also due to its bad state. As all other bones of this individual are very fragmentary, the almost complete left ulna and radius have been X-rayed in order to detect growth arrest lines, bearing in mind that these bones in general are not the best ones to show Harris lines (but A15507, who has Harris lines in his right tibia, does show these lines in his left ulna and radius as well). No growth arrest lines have been found in this individual's lower left arm.

Preliminary identification

Not possible on the basis of the skeletal remains. Its location close to M3901, who is possibly one of the individuals buried in the 'Predikant's family's grave', suggests tentatively that this individual *could* represent one of the members of the Predikant's family. Further investigation is necessary.

BAT SK6

This individual is represented by only part of a skull and the atlas. The rest of the skeleton was left *in situ*. However, as mentioned above, it is possible that the right M² which was found with SK5 *might* also belong to this individual. If this is so, the age is probably 30+ to in its forties. There are not enough relevant skeletal parts present to determine the sex.

Pathology and trauma

No traces of diseases or trauma have been observed in these few fragments.

Preliminary identification

Not possible, although its location close to SK5 and M3901 suggests that it *might* represent one of the Predikant's family (see SK5). Further investigation and excavation is necessary.

Other individuals

Amongst the remains of SK5 and SK6 also a child was mentioned to be present, represented by a distal part of a femur. Although this part has not been found, there is a very small first rib present, which is likely to belong to a young individual. No sex can be determined from only a rib. The age could be estimated with use of appropriate reference material.

Preliminary identification

Not possible, although its location close to SK5, SK6, and M3901 suggests that it *might* represent one of the Predikant's family (see SK5). Further investigation and excavation is necessary.