CHAPTER THREE

ANTHROPOLOGICAL ANALYSES OF HUMAN SKELETAL REMAINS ASSOCIATED WITH THE BATAVIA MUTINY OF 1629

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HISTORICAL BACKGROUND

In the early seventeenth century, the *Verenigde Oostindische Compagnie* (VOC) ship *Retourschip Batavia* was one of the largest and finest armed vessels of the time. Commissioned to take advantage of lucrative trade opportunities in Asia, the *Batavia,* carrying a complement of approximately 316 people, embarked from Amsterdam on 29 October 1628, destined for Batavia (modern day Jakarta). Cramped on board were men, women and children of various socio-economic backgrounds and nationalities, including VOC officers and crew, in addition to naval cadets, passengers and soldiers.[1-3] As the *Batavia* was to sail alongside six other vessels, the highest ranking officer on board, Francisco Pelsaert, was appointed *commandeur* of the fleet.[4]

The journey was to include a stop at the Cape of Good Hope, from which point it was envisioned that the *Batavia* would round the Cape and then sail east, as far as the longitude of the Sunda Straits, before navigating north for Batavia.[5-6] This was termed 'Brouwer's Route', which was in common use after 1610, and took advantage of the strong westerly winds known as the 'roaring forties'.[7-8] The speed advantage, however, came at great cost, as slight navigation misjudgements likely contributed to the wrecking of several Dutch vessels off the coast of Western Australia (e.g. *Vergulde Draeck* 1656; *Zuytdorp* 1712; *Zeewijk* 1727).[9-10] This route, in combination with the growing dissent of certain high ranking officers, would prove to be the catalyst for the ultimate downfall of this fine vessel and her unwitting crew.

After almost six months at sea the *Batavia* reached the Cape. This eight day stop-over provided the much needed opportunity to replenish depleted supplies of food and freshwater. It was at this time that the ship's skipper, Adriaen Jacobsz, accompanied by Zwaantie Hendrix (maid to one of the more privileged female passengers) and Jeronimus Cornelisz (next most senior officer to Pelsaert) left the ship without permission. Whilst enjoying the hospitality of other vessels in the fleet, Jacobsz became increasingly inebriated and both verbally and physically abusive. The following morning Pelsaert was informed of his unauthorised shore leave and indecent behaviour, and had little choice but to publicly reprimand him. Jacobsz and Cornelisz later confessed that this was a deciding moment in their desire to mutiny.[11-13]

The plan to seize control of the *Batavia* would involve manipulating the crew into joining forces with Jacobsz and Cornelisz, with whom they would murder any opposition, and then sail away from the convoy to seek their fortunes on the high seas.[14] Whether preoccupied by his planned insurrection, or just

plain negligent, Jacobsz's immediate mutiny plans were never realized; the *Batavia* became separated from the fleet, and subsequently wrecked on Morning Reef in the Houtman Abrolhos off Australia's west coast on 4 June 1629 (Figure 1). Desperate attempts to float the ship free of the reef (including throwing all cannons overboard and putting down the main mast) failed and only damaged the ship further.[15-16]

Realising that it would only be a matter of time before the ship broke apart, Pelsaert decided to put ashore 180 survivors on nearby Beacon Island, a small coral island devoid of freshwater (Figure 1). Approximately another 40 people (Pelsaert included) were landed on one of the smaller islands early the following morning, leaving around 70 to 80 survivors on the ship. Of those people still aboard, approximately 40 were reported to have drowned attempting to swim from the wreck to land.[19-21] The situation following the wrecking was dire as limited food and water supplies were not being rationed. Pelsaert decided to take a group of 48 people (including Jacobsz) in search of freshwater on nearby islands and the main 'Southland'. Unsuccessful in their search, Pelsaert resolved to attempt the hazardous voyage of more than 1,900 kilometres to Batavia.[22]

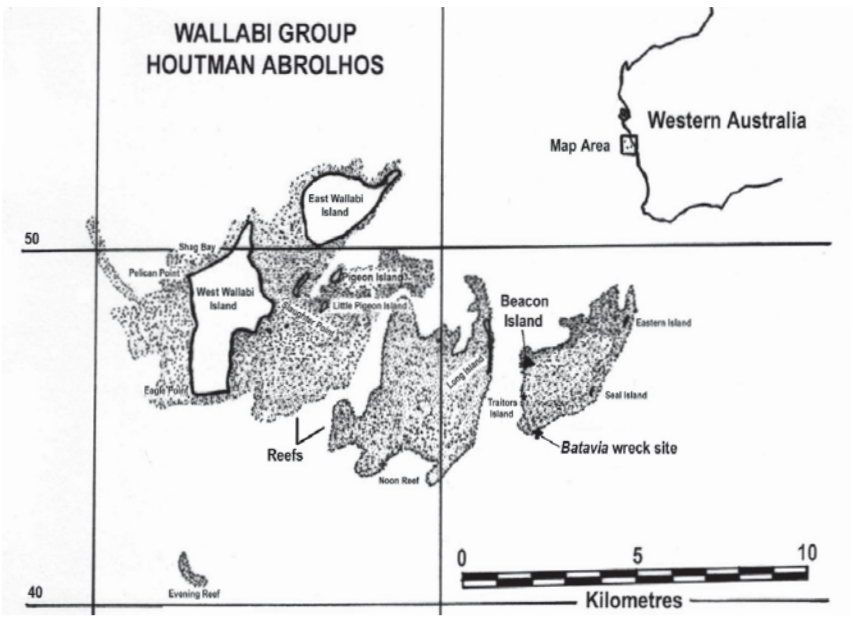

Figure 1
Wallabi Group, Houtman Abrolhos Islands, showing locations of East and West Wallabi Islands, Beacon Island (▲) and the Batavia shipwreck (✚) location (following Franklin & Freedman[17], after Green[18]).

During Pelsaert's absence, Cornelisz remained on Beacon Island and managed to establish his own 'ruling council', and with the aid of his followers began to murder all who opposed him. Cornelisz planned to reduce the total number of survivors to 40, with whom he planned to hijack the anticipated rescue ship. The first murders of the stronger men of distrusted loyalties occurred on the night of July 3. Initially by night and stealth, and later by daylight reigns of terror, victims were strangled, drowned, or killed with weapons. Although the means taken to dispose of the victim's bodies is not always entirely clear, there are records of prepared holes being used for burials.[23-24]

As these gruesome events on Beacon Island were unfolding, Pelsaert had managed to safely navigate his way to Batavia, where he was promptly ordered to return to the Abrolhos in command of the *Sardam*, to retrieve any survivors and salvage valuable cargo. Arriving at the wreck site on 17 September 1629, Pelsaert was horrified to learn that during his absence Cornelisz and his accomplices had managed to murder at least 125 men, women and children. The mutineers were quickly captured, tried and most were duly executed on purpose-built gallows erected on Seals Island (present day Long Island); two lesser offenders were stranded on the mainland as their punishment.[25-26] The primary sources of information documenting these events are survivors' accounts including the manuscript 'Droevige daghaenteyckeningh int verliesen van ons schip *Batavia'*, usually known as the 'Pelsaert Journal'.[27-28]

The *Batavia* shipwreck and associated land sites represent some of the earliest pre-colonial European activity in Australia and are thus of considerable national significance. At present the skeletal remains of ten individuals have been found on Beacon Island;[29-31] four single burials were discovered between 1960 and 1964 and a further six individuals were recovered from a multiple grave excavated between 1994 and 2001. Those remains bear witness to the gruesome events that transpired almost 400 years ago and offer a unique research opportunity to provide new information about the victims and aspects of their deaths and daily lives in the 17th century.

Following a brief account of the discovery and excavation of the burials thus far recovered on Beacon Island, the remainder of this chapter presents a brief description and interpretation (using forensic, archaeological and historical sources) of the human skeletal remains associated with the *Batavia* mutiny. Age, sex, stature, general state of health and trauma is assessed in each skeleton, in order to postulate on who the individuals may have been, and to rule out other potential burials that occurred during the mutiny.

BEACON ISLAND BURIALS

1960 – 1964

The first documented discovery of human remains on Beacon Island was in 1960, when resident fisherman, 'Pop' Marten, unearthed a skeleton while burying some rubbish south of his hut. The skeleton (M3901) was buried

face upwards, apparently with arms folded across the chest.[32-33] The area was sifted, but no associated artefacts were found. The next known discovery was a human skull (A15831) found by Max Cramer in May 1963. Two months later a postcranial (headless) skeleton (A15508) was recovered in the same region and is believed to be associated with the same individual. The postcranial skeleton was apparently found with a lead musket-ball in the chest region.[34-35] This burial was recovered from the south-west side of the Johnson hut (situated several meters south-east to the hut where skeleton M3901 was discovered). In August 1963, a joint expedition, including journalist Hugh Edwards, discovered a complete skeleton (A15507) lying on its back in a shallow pit. Next to this skeleton, mostly under the concrete slab of the Johnson hut, were the remains of another individual (A16316). Returning a year later in December 1964, Edwards dug under the north-west corner of the hut and removed the skull of the second individual.[36-37] The burial position of the postcranial remains of this skeleton were re-established by Franklin in July 2014 during the monitoring of demolition works on Beacon Island; it was subsequently excavated in February 2015 (**see Postscript**).

1994 – 2001

In 1993, Philippe Godard reported the discovery by John Gliddon of a skeleton, while digging a hole for a 'septic tank' near his hut (formerly 'Pop' Marten's hut) in 1990.[38] The concern for potential damage by souvenir hunters, due to the relatively precise location provided by Godard, supported

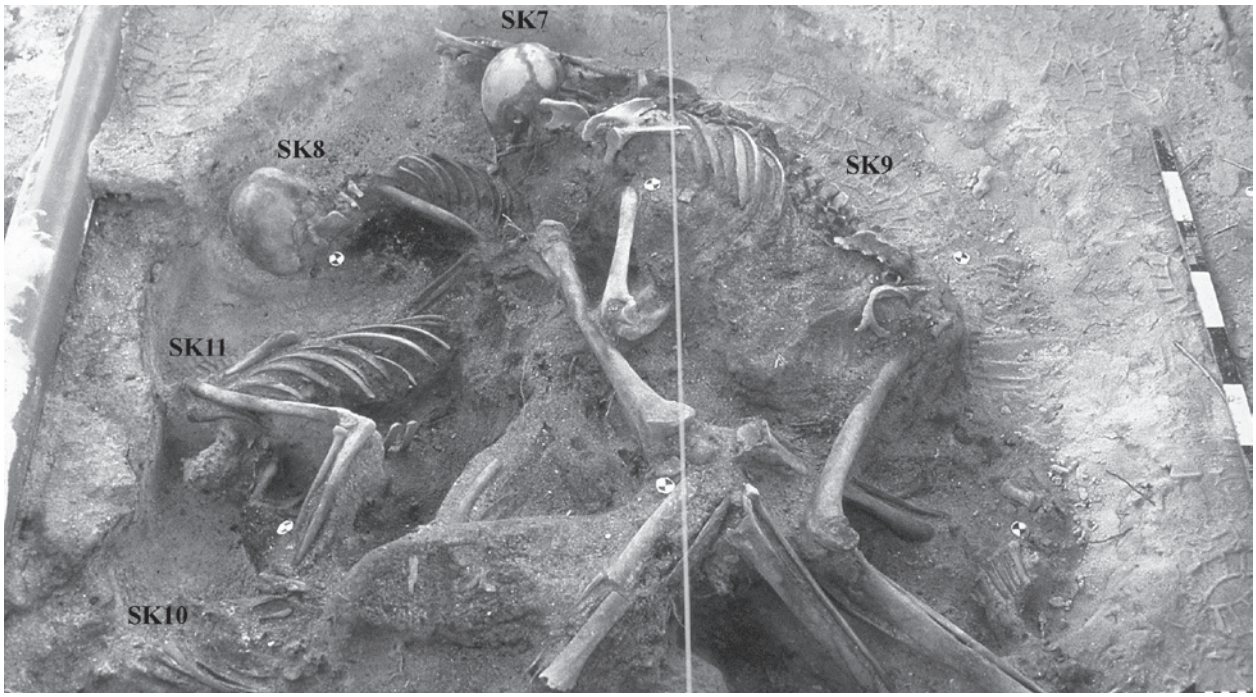

Figure 2
Four of the individuals uncovered *in situ* during the 1999 excavations; the bones of SK9 were removed at an earlier stage of excavation. Courtesy: Western Australian Maritime Museum.

by Gliddon's declaration under the Commonwealth Historic Shipwrecks Amnesty (1993-1994), provided the stimulus for the Western Australian Maritime Museum to investigate the nature and extent of the disturbance to the burial site. Excavation of the site established that at least two skeletons were significantly damaged during the leach drain construction; two adult crania (the skull without the lower jaw – SK5 and SK6) were identified – fragments of SK5 were recovered for analysis and SK6 was left *in situ*.[39-40]

The degree of prior human disturbance, together with the risk of future vandalism, led to the decision to fully excavate the burial site in 1999. An excavation grid was set up and the 1994 squares were reopened and extended further south. The excavated area was now found to include five individuals (three adults and two children) who had been laid against each other within a circular pit; these individuals were designated SK7, SK8, SK9, SK10 and SK11 (Figure 2). The crania identified in 1994 (SK5 and SK6) were believed to be associated with two of these individuals (bringing the total sample to five skeletons).[41] The skeletal remains were found over, under, or in, a large deposit of black dense matter possibly of organic origin. The bones embedded in this deposit were left *in situ* and those removed were poorly preserved.[42]

Subsequently in 2001, the black deposit was excavated and 16 deciduous and 2 permanent teeth were discovered underneath.[43] This, the sixth individual recovered from the multiple burial, was designated SK12. None of the bones of this individual were recovered, although it is well known that the lighter and more delicate bones of a child, compared to those of a fully grown adult, are much more likely to decay over a long period of time.[44-45]

ANALYSES OF THE HUMAN SKELETAL REMAINS

The following section summarises selected aspects of the physical examination of the skeletal remains of the victims of the *Batavia* mutiny; those readers seeking a more thorough treatment and specialist description of the specific methods employed are directed to consult Franklin & Freedman.[46]

DEMOGRAPHICS: DETERMINATION OF SEX, AGE AND STATURE

The basic demographic profile of each of the skeletal remains, including estimated sex, age and stature, is summarised in Table 1. It is important to note that attempting to determine sex in the juvenile (non-adult) skeleton is very difficult and unreliable, until such time that they have undergone puberty.[47] This is because it is not until puberty that the morphological features in the skeleton that distinguish males from females, begin to develop. For this reason it was not possible to conclusively determine the sex of the youngest of the mutiny victims – SK9 and SK12 (Table 1). From Table 1 it is also evident that the estimated age ranges are greater for adults (e.g. A15507) compared to juveniles (e.g. SK9). The reason for such a difference is because the juvenile skeleton grows at a relatively predictable rate; once

growth ceases, as in the adult skeleton, it becomes increasingly difficult to estimate age with the same level of confidence.[48]

Individual	Description	Sex	Age-range*	Stature†
	Individual Burials			
M3901	Damaged calvaria + postcranial skeleton	Female	18-20 yrs	1.61 m
A15831 / A15508	Skull + postcranial skeleton	Male	19-21 yrs	N/A
A15507	Skull + postcranial skeleton	Male	20-34 yrs	1.82 m
A16316	Cranium	Male	20-34 yrs	N/A
	‡Multiple Burial			
SK5 / SK11	Damaged cranium + postcranial skeleton	Male	35-49 yrs	N/A
SK6 / SK10	Damaged cranium + postcranial skeleton	Male	35-49 yrs	1.79 m
SK7	Skull + postcranial skeleton	Male	20-34 yrs	1.76 m
SK8	Skull + postcranial skeleton	Likely male	15-16 yrs	N/A
SK9	Skull + postcranial skeleton	?	5-6 yrs	N/A
SK12	Deciduous + permanent teeth	?	8-9 mo	N/A

Table 1
Main features of the *Batavia* skeletal material including proposed associations (/) of cranial and postcranial skeletons.
*yrs = years; mo = months; †reconstructed mean stature; ‡following Franklin.[78]

Of those individuals for whom skeletal sex could be ascertained, it was apparent that most appeared morphologically male, with the exception of M3901 (Table 1). Such a sex bias is not unexpected given that the *Batavia's* complement comprised mostly males, who were regarded by the mutineers as the greatest threat, and were thus the primary targets in the initial murders. Analysis of skeletal age markers indicated that the age-at-death distribution of the sample ranged from 8 months to no older than 49 years (Table 1). There appears to be no older adults (50+ years), but this is probably not unusual given the generally shorter life expectancy in 17th century Europe, compounded by the shipboard conditions endured by a career sailor serving aboard a VOC vessel.[49-50] Statures were calculated from the reconstructed lengths of damaged leg and arm bones; the average adult male height was 1.78m, somewhat taller than the mean male stature (1.72m) of 18th to 19th century individuals exhumed from the Spitalfields burial crypt in London.[51]

PALAEOPATHOLOGY: BONE INJURIES AND ABNORMALITIES

Trauma

Evidence of violent trauma is apparent in the skeletal remains of each of the single burial individuals. A15508 was apparently recovered with a lead

musket-ball in the chest region; M3901, A15507 and A16316 all show sharp weapon trauma in the skull, likely to have occurred at, or around, the time of death – the cut marks on A16316 being particularly brutal (Figure 3).[52-53] In almost total contrast, there appears to be no evidence of these types of trauma in any of the individuals recovered from the multiple burial.[54] The only evidence of possible violent trauma in the multiple burial victims, although certainly not contributing to the death of the individual, was in the cranium of SK6, where the upper right central incisor has been forced through the upper jaw into the nasal cavity, likely the result of a heavy blow against the teeth (Figure 4).

There are also incidences of old injuries. In the postcranial skeleton of SK11 the shaft of the left ninth rib was broken near the costal angle. This injury appears to have occurred a significant time before death, as the rib has healed, but at an obviously abnormally acute angle. The relatively poor alignment of the rib fracture may attest to low quality or no medical attention to the injury, although the bone has healed well, which is a general indicator of good health.[55]

Figure 3
Lateral and posterior views of the cranium of A16316 showing trauma (cut marks) indicative of a fatal attack. The injuries were produced by a heavy sharp-bladed instrument with a force so severe that the cranium was fractured and the lambdoid suture split open (arrow).

Figure 4
The damaged cranium of SK6: arrow points to impacted upper right central incisor. Photo by Patrick Baker, Western Australian Maritime Museum.

Developmental Stress Indicators

Macroscopic (visible with the naked eye) hypoplastic defects (pits and/or continuous lines or grooves) on tooth enamel and Harris lines (zones of high density bone that are visible under x-ray) in arm and leg bones, are generally considered useful indicators of temporary cessation of growth processes due to disease, malnutrition, or other metabolic insults.[56-57] Enamel defects (grooves consistent with hypoplasia) were observed on the teeth of M3901 and A15831. Harris lines were present on SK7, M3901 and A15507. The presence of enamel hypoplasia and Harris lines may indicate that these individuals suffered from a period of childhood nutritional deficiency, stress or illness, probably not uncommon in 17th century Europe.[58-59]

Nutritional Related Deficiencies

Approximately one-quarter of the upper end of the left tibial shaft (around the knee joint) of SK7 is markedly roughened and porous, a pattern indicating a deficiency in bone production and calcium deposition.[60-61] A shell of layered new bone on the surface appears to be attached to the original bone by a web of more porous bone, which has completely obliterated the nutrient foramen (opening through which blood vessels pass). This implies some metabolic disturbance in the immediate period before death and this has been tentatively identified as possibly being scurvy, a condition caused by a deficiency of vitamin C.

Scurvy was common in sailors of the period, and is a plausible diagnosis because affected individuals are susceptible to bleeding due to abnormal blood vessel development. This bleeding often results in the formation of porous bone lesions, most commonly observed on the skull, but also documented in the long bones (legs in particular).[62] Since bleeding and the resulting changes to surrounding bone tend to occur in regions where blood vessels are stressed by muscle activity, the porous structure of the tibia around the knee joint is probably not unusual.[63-64]

INTERPRETATION

The ultimate goal of research of this nature is to help answer the question of who had been buried in the single and the multiple burials. As tentative identities of the single burial victims recovered in the 1960s have been previously suggested,[65-66] the focus here is on the interpretation of the more recently excavated multiple burial only.

From Pelsaert's Journal it is apparent that there are at least two groups of murder victims buried in multiple graves on Beacon Island; the first was a group of sick individuals, the second the *Predikant*'s (the *Batavia*'s official minister) family.[67] There are, however, many other instances where multiple burials might have been made, among them the large number of people reported to have drowned attempting to swim from the wreck to land.[68-69] The following analysis considers two possible interpretations of the Beacon Island multiple burial: the first that they were the family of the *Predikant*; the second that they were drowning victims. I suggest that both interpretations appear to be improbable in consideration of the anthropological, archaeological and historical evidence currently available, and propose another more plausible theory backed by supportive evidence.

The Family of the *Predikant*

The *Predikant*'s family, including his wife, maid and six of his seven children (two girls, three boys and a baby), were beaten to death on July 21. The historical accounts of this murder describe 'the beating in of the skull of the wife and that of one of the children'.[70] The evidence excavated from the multiple burial clearly does not fit the profile of the *Predikant*'s family; although all of the skeletons discovered in the 1960s show markers of violent trauma, there is no such evidence in the skeletal remains excavated from the multiple burial. Further, the number of individuals in the *Predikant*'s family and their stated ages and sexes clearly do not match the profile of the individuals exhumed from the multiple burial (Table 1).

Drowning Victims Following the Wrecking

It would appear very unlikely that the multiple burial represents the deliberate interment of those individuals who drowned attempting to flee the wreck. The skeletal remains were obviously hastily thrown into the pit, without due care or consideration of religious beliefs (Figure 2). Although

their situation was dire, it would seem improbable that the survivors would abandon their religious and social values so soon after the wrecking. Even when facing lethal epidemics such as the 'Black Plague', there are well documented examples of burials that were organised methodically and with care.[71] This burial is in fact analogous, albeit on a small scale, to crude and hasty modern mass graves associated with the murder of civilians in regions such as Argentina, Rwanda and the former Yugoslavia.[72]

A Probable Scenario: Early 'Sick' Victims of the Massacre

Around 10 July, Passchier van den Enden (a gunner), Jacop Hendricxsz (a carpenter), Jan Pinten (an English soldier) and a cabin boy, all of whom were ill and could offer little resistance, had their throats cut by Cornelisz's accomplices.[73-74] At least one body was dragged into a ready made pit, although it would be reasonable to assume that all four bodies were disposed of simultaneously. There are what appear to be three male adults (SK5/SK11, SK6/SK10 and SK7) interred in the multiple burial pit (Table 1). The apparent lack of violent trauma on these skeletons is consistent with historical accounts of the throats of these victims having being cut; relatively poor preservation conditions could explain the absence of any evidence of such trauma.[75]

Interestingly, the mutineers asked to spare the life of Jacop Hendricxsz, for he was 'a good carpenter'. Cornelisz, however, was adamant in his orders, and reportedly replied that he was 'only a turner, furthermore, his is half lame', so he must be killed.[76]

If by 'lame' Cornelisz meant that the carpenter was physically disabled in some manner, it is worth considering that SK7 very likely had some degree of pain and/or movement impediment due to the infection in his left tibia. Skeleton SK8 was estimated to be around 15 to 16 years of age, close to the typical age of a cabin boy (Table 1). So, after reconciling historical accounts with biological evidence, it would seem reasonable to suggest that the four individuals described above are those recovered from the multiple burial pit.

Approximately two days earlier than the murder of the sick individuals (July 8), the six-year-old daughter of Hans Hardens was strangled;[77] SK9 is approximately the same age and does not display any visible evidence of trauma (Table 1). There is no mention of how this body was disposed, but with the pit available, the body might well have been buried there as well. This murder took place before the first 'public' murder on 14 July, thus the body would have required concealment until it could be permanently disposed. SK12 is approximately 8 to 9 months of age (Table 1); this individual cannot be directly accounted for from historical accounts, but there were several children of unspecified ages murdered and how their bodies were disposed of is not always recorded.

CONCLUSION

Dutch activity in Western Australia in the 17th century was generally accidental in nature, resulting from navigational misjudgements or other unfortunate circumstances. The wrecking of the *Batavia* and other VOC ships led to expeditions to recover survivors and valuable cargo, which concurrently initiated further exploration of Australia's west coast. Archaeological sites, both underwater and on land, are an important source of information on the earliest Dutch activity in Western Australia.

The recent excavation of a multiple burial on Beacon Island recovered more victims of the *Batavia* mutiny. This burial appeared to have been hastily dug by hand, in order to conceal victims killed in the early stages of the mutiny. Analysis of their skeletal remains indicated that most were male; the age-at-death distribution ranged from about 8 months to no older than 49 years; and up until the point of their premature demise, these individuals were mostly healthy, with relatively little evidence of serious disease, illness or trauma [78].

POSTSCRIPT

Demolition Works on Beacon Island (2014)

As part of a Community Heritage Programme grant and an Australian Research Council Linkage grant, (Shipwrecks of the Roaring 40s: A maritime archaeological reassessment of some of Australia's earliest shipwrecks – LP130100137[79]), the Western Australian Museum, Fisheries and associated industry and academic partners are involved in a large-scale programme to return Beacon Island to its natural state, and ultimately provide visitor facilities and security to the island. The latter programme necessitates the monitored demolition of structures on Beacon Island in the immediate vicinity of archaeological sites known to be associated with the 1629 mutiny of the *Retourschip Batavia*.

The supposed burial of the postcranial remains of A16316 lie directly in an area that would be subjected to disturbance from heavy machinery during demolition works. To mitigate the high risk of damage to the remains, a small test excavation (50cm x 50cm) was performed in the most likely region of the burial in the attempt to rediscover its exact location[80]. The area excavated was determined based on the interpretation of previous archaeological research that initially identified the presence of a burial in the region of the north-west corner of Johnson's Hut[81].

Excavation proceeded to a depth of 40cm, at which point a distal right human femur was revealed. This burial was designated SK13 until it could be conclusively identified as belonging to the skull of individual A16316. The femur was left undisturbed *in-situ* and backfilled; appropriate protective measures were then established to secure the burial site[82].

Archaeological Excavations (2015)

A multi-disciplinary collaboration of national and international partners performed a series of targeted excavations on Beacon Island in January and February of 2015. The aim was to excavate the known site of the burial of SK13 (see above), in addition to excavating an area where Mr Bob Sheppard (Honorary Associate Western Australian Museum) visually located a human molar during a metal detector survey in May of 2013. Teeth and bone fragments can be brought to the surface by burrowing animals (in this instance Shearwater – commonly known as muttonbirds) and can thus indicate the presence of buried remains. The latter discovery proved to be fortuitous; excavation revealed more human teeth and miscellaneous human bone fragments, culminating in the discovery of an intact human burial (designated SK14) at over one meter in depth. Further excavation in the area to the immediate north of SK14 led to the discovery of a further two individuals buried in direct association, one on top of the other; these are designated SK15 and SK16 respectively (Table 2). Interestingly, many of the teeth and bone fragments recovered above these burial do not appear to belong to SK14, SK15 or SK16; it is perhaps possible that there may have once been, or there is an as yet undiscovered, grave in close proximity.

Preliminary analyses suggest that SK13 is 20-34 years of age, of male sex (see also A16316 – above) and was approximately 1.70m tall – the skeleton is in an excellent state of preservation. SK14 is approximately 12-14 years of age and of indeterminate sex – the skeleton is highly fragmented due to the influx of water into the grave, which erodes the organic component of bone. SK15 is likely of male sex, 20-34 years of age and had a living height of approximately 1.68m – there is some degree of damage, mostly in the facial region of the skull and the articular ends of the long bones. SK16 is likely of female sex, 20-34 years of age and had a living height of approximately 1.60m – most of the face of the skull is missing and the articular ends of most long bones are damaged. This individual also suffered poor oral health in life, with numerous caries and abscesses. Cause and/or manner of death of SK14, SK15 and SK16 are not immediately apparent and forms part of ongoing investigations led by the University of Western Australia, the Western Australian Museum, and other partners.

Individual	Description	Sex	Age-range*	Stature†
‡SK13	Postcranial skeleton	M	20-34 yrs	1.72 m
SK14	Skull + postcranial skeleton	?	12-14 yrs	N/A
SK15	Skull + postcranial skeleton	likely male	20-34 yrs	1.68 m
SK16	Skull + postcranial skeleton	likely female	20-34 yrs	1.60 m

*yrs = years; †reconstructed mean stature; ‡Postcranial skeleton of A16316 originally discovered by Hugh Edwards.

Table 2
Batavia skeletal material discoveries made during 2014-15.

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MOLECULAR ANALYSES OF HUMAN SKELETAL REMAINS OF THE *BATAVIA* MUTINY VICTIMS

Daniel Franklin

INTRODUCTION

Evidence from bones alone, especially when poorly preserved, provides a particularly limited insight into an individual's life history; the combination that data with molecular evidence (e.g. DNA and bone chemistry) offers the opportunity to delve deeper. The possibility of undertaking molecular osteological analyses of the *Batavia* mutiny victims, however, has been a tantalising objective that has only recently been achieved with provisioning of research funding by The University of Western Australia and the Australian Research Council. The purpose of the present *vignette* is to very briefly describe the results and implications of recent research into the *Batavia* victims and contribute further information complementary to the previous chapter; more detailed descriptions of the molecular studies are available in the published literature.

The focus of the molecular studies was directed towards seeking clarification and/or quantification of two issues:

i) to establish if any maternal familial relationships exist between the multiple burial victims (whether they share a common mother); and

ii) to conclusively reassign the disassociated skull of individual A15831 with the postcranial skeleton of A15508.

The first study is especially important in placing the multiple burial in its correct historical context; although the osteological and historical evidence strongly infer that it is highly unlikely that these remains are those of the family of the Batavia's *Predikant*, the only conclusive answer is in their DNA.[1]

The second study was designed to quantify strong anecdotal evidence that the skull of A15831, and postcranial skeleton of A15508, belong to the one individual using a trace element analysis (evaluating concentrations of elements in the bones, such as iron, lead and strontium); this has direct bearing on reassociating those remains – the skull is stored in the Western Australian Maritime Museum (WAMM – Fremantle) and the postcranial skeleton was formerly on display in the Australian National Maritime Museum (ANMM – Sydney).

DNA ANALYSIS

For this study, a single molar was extracted from five of the multiple burial individuals (SK5/11; SK6/10; SK7; SK8; and SK9); the teeth of the sixth individual (SK12) are too immature for viable analysis. Following mounting and decontamination, the pulp chamber of the teeth were drilled (Figure 1) and the powder obtained was used in the DNA extraction procedure. The

methodology for DNA extraction, PCR amplification, DNA sequencing and analysis, in addition to the steps taken to avoid contamination, are detailed in Yahya et al.[2] Sample contamination, most likely from the positive control, meant that it was not possible to derive any conclusions regarding the familial relationships of SK5/11, SK6/10 and SK7. It was, however, possible to examine familial relationships, using the HV1 and HV2 regions of the mtDNA sequence, for individuals SK8 and SK9.

Variations in those sequences can be used to exclude the possibility that the sequences come from the same source or maternal lineage; in other words, these two individuals are not maternally related. This suggests that these two individuals cannot be members of the *Predikant*'s family. It must be noted, however, that the results of this study have yet to be replicated by a second independent analysis; this is not a high priority in the immediate future given the cost and destructive nature of such analyses. Irrespective, with regard to placing the multiple burial in its correct historical context, in light of this new preliminary molecular evidence, the theory that the multiple burial victims were sick individuals killed early in the massacre, remains more plausible.

TRACE ELEMENT ANALYSIS

For this study three bones from the postcranial skeleton of A15508 (left scapula, right ulna and fibula) were sent from the ANMM (Sydney); those bones, in addition to the cranium and mandible of A15831 in the WAMM (Fremantle) were sampled (Figure 2). It is also worth noting that the colour and condition of the postcranial bones and mandible are visually an extremely close match (Figure 2; Plate A). Prior to drilling, any debris was carefully removed from the surface of the bone sampling sites; 50 to 100mg of bone material in total was removed from each bone using a 3 and 4mm drill-bit. The specific method followed for sample dissolution and analysis (Inductively Coupled Plasma Mass Spectrometry – ICP-MS) is fully detailed elsewhere.[3]

The resulting elemental association patterns (concentrations of the specific elements analysed) for all the bones are remarkably similar; only seven of the 54 analytes were significantly different between the five bones analysed (Figure 2; Plate C). While the comparison of the elemental signatures of these bones cannot be said to be definitive (because during the period of inhumation there is obviously a significant possibility of diagenetic alteration – exchange of elements between the bone crystal and grave soil[3]) the extremely close comparability of these elements between all bone samples definitely implies a co-provenance of the remains. This means that the remains were originally in the same, and not in two different, grave sites.

CONCLUSIONS

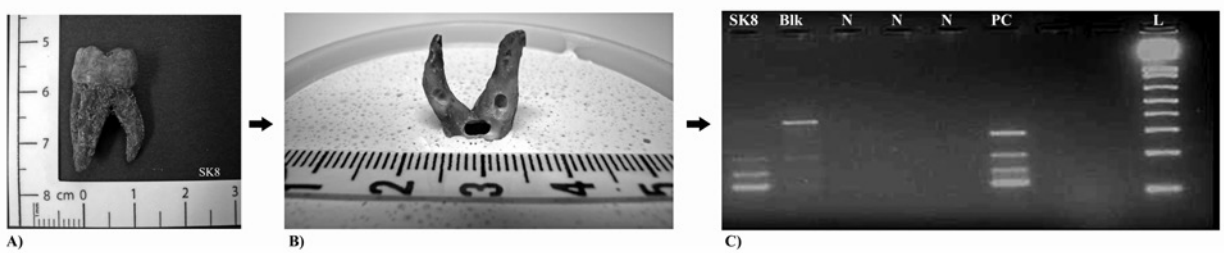
Although it was possible to extract viable DNA from all of the teeth sampled, it is clearly apparent that sample contamination was a confounding factor. Nonetheless, the study did provide previously unknown insights towards establishing the identity of the multiple burial individuals. The lack of a maternal genetic relationship between two individuals, strongly infers that the multiple burial does not hold the remains of the *Predikant*'s family. This obviously supports, what is the extremely strong supportive evidence, derived from the anthropological, archaeological and historical data that was discussed in the previous chapter.

The results of the trace element analysis demonstrates the distinct probability that the bones analysed all belong to the one individual.[3] The strong circumstantial case for such an association (colour, condition, anthropological profiles and historical evidence – see previous chapter) all further support this result. On this basis, therefore, an appropriate resolution is to recommend that the appropriate museum records are updated to record their association; whether those remains are repatriated into the one institution is at the discretion of museum authorities.

The opportunity to undertake invasive sampling of the *Batavia* skeletal remains afforded a valuable opportunity to re-evaluate previous findings based on the analysis of anthropological, archaeological and historical data.

Figure 1
Selected steps in the process of obtaining and analysing DNA from individual SK8. Plate A: distal view of right upper third molar prior to decontamination and preparation; Plate B: the molar following mounting and drilling; Plate C: DNA amplification products of mtDNA analysis using the multiplex primers for sample SK8.

Key for Plate C:
Blk – extraction blank;
N – negative control;
PC – positive c.



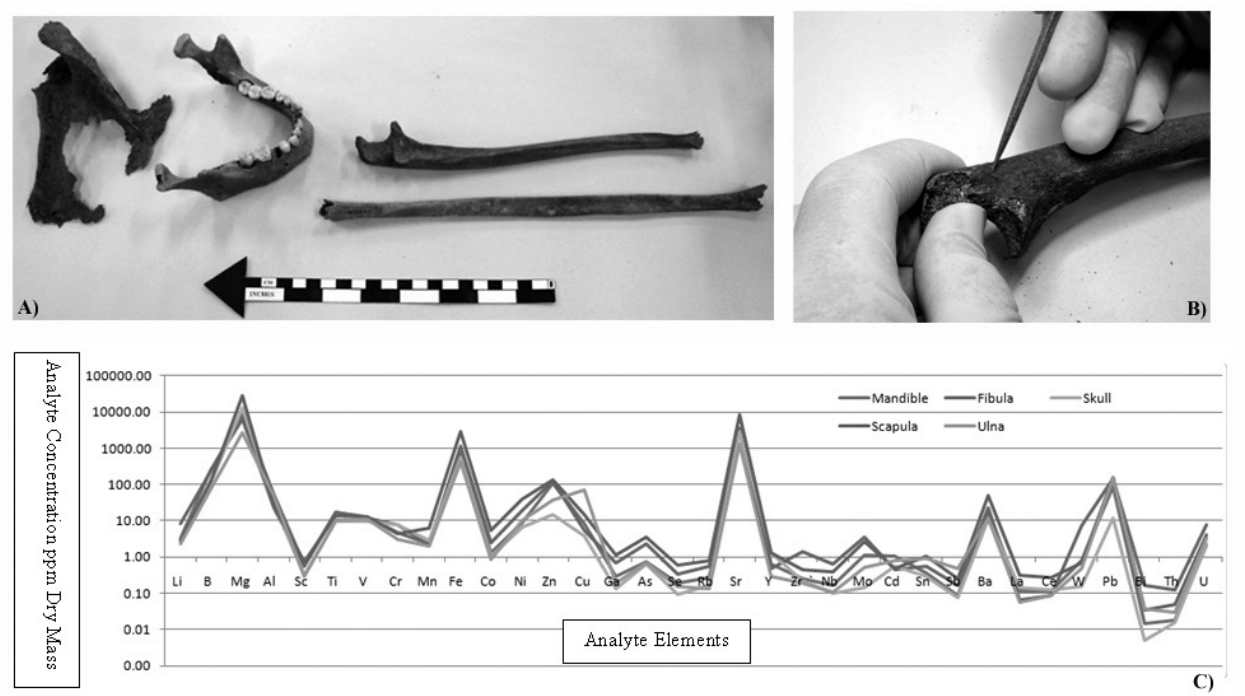


Figure 2
Selected steps in the trace element analysis of A15831 and A15508.
Plate A: post-cranial bones from A15508 (left scapula; right ulna; right fibula) and the mandible of A15831 – note the similarity in colour;
Plate B: location of ulna drill sites;
Plate C: comparison of the elemental association patterns of all five bone types.

ENDNOTES

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