



Case report

The contributions of anthropology and mitochondrial DNA analysis to the identification of the human skeletal remains of the Australian outlaw Edward ‘Ned’ Kelly



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ABSTRACT

This paper details the anthropological and genetic analyses that contributed to the identification of the notorious Australian outlaw (‘bushranger’) Edward (‘Ned’) Kelly. In 1880 at the age of 25, Kelly was hanged and buried at the former Melbourne Gaol in Victoria, Australia. In 1929, the remains of executed prisoners (including those of Kelly) were haphazardly disinterred following the demolition of parts of the Melbourne Gaol and haphazardly reinterred in three distinct ‘pits’ at the Pentridge Prison. In 1999 the Pentridge Prison was sold for commercial development and subsequently in 2008 and 2009 the human remains of prisoners were recovered.

A total of 41 cases of unidentified human skeletal remains from Pentridge were examined using traditional anthropological techniques. At least one representative sample from each of the remains (mostly clavicles) from all three pits was selected for DNA analysis. Comparative ante-mortem reference samples were also located. Given the antiquity and condition of remains recovered from Pentridge, and the 130 years that had passed since Kelly’s execution, mitochondrial DNA analysis was chosen as a suitable DNA analysis tool to examine the Pentridge cases to assist in the inclusion or exclusion of remains as being those of Ned Kelly. Only one of the Pentridge cases (Pen14) matched the HV1/HV2 mitochondrial DNA haplotype of the reference sample. Additional anthropological analyses indicated a number of pathological features that provided support that the remains of Pen14 are those of Edward (‘Ned’) Kelly.

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1. Introduction

The former Melbourne Gaol in Victoria, Australia was the burial place for prisoners executed between 1865 and 1924. Of historical significance was the hanging and burial of Edward (Ned) Kelly who was a notorious Australian outlaw (‘bushranger’). On the 28th June 1880 at the age of approximately 25, Kelly (whose exact birthdate is unknown) was arrested following a violent confrontation at Glenrowan in the state of Victoria, and convicted of the murder of one of three policemen killed previously at Stringy Bark Creek,

Constable Thomas Lonigan. Kelly was subsequently hanged at the Melbourne Gaol on the 11th November 1880.

As an iconic Australian figure with folk law status, Kelly is regarded by some as charismatic [1–3] and by others as one of Australia’s cold blooded police killers [4]. Among the legends that surround the death of Kelly, were rumors that following judicial execution, his body was subjected to various forms of anatomical dissection and that his skull and other body parts were collected as souvenirs [5].

In 1929, the remains of executed prisoners (including those of Kelly) were disinterred following the demolition of parts of the Melbourne Gaol and reburied at the Pentridge Prison. In 1999 the Pentridge Prison was sold for commercial development and consequently between 2008 and 2009 archaeologists excavated three burial pits which they labeled ‘A’, ‘B’ and ‘C’ [6]. The human skeletal remains recovered from the pits were brought to the

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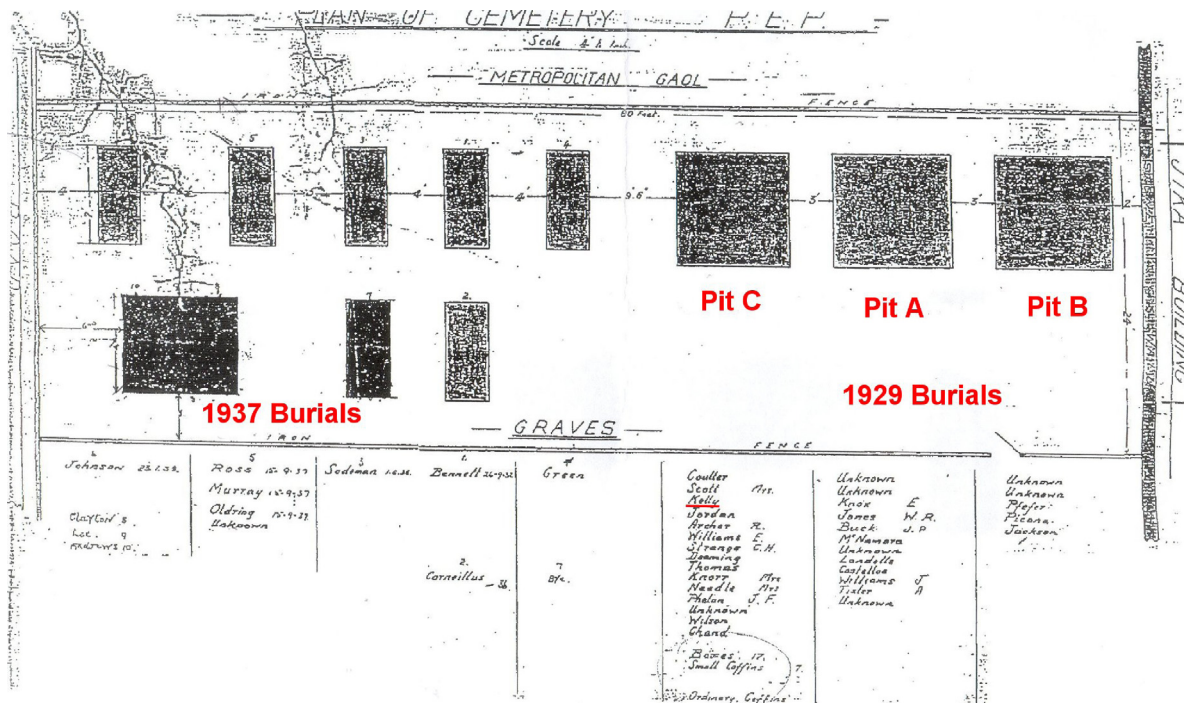


Fig. 1. Schematic plan of cemetery at the Pentridge Prison (no date) courtesy of Heritage Victoria. Red text illustrates the archaeologists' labeling of the burial pits. Red underline highlights Kelly's name.

Victorian Institute of Forensic Medicine (VIFM) for curation and analysis.

Heritage Victoria located a schematic plan of the burial grounds at the Pentridge Prison site, which included three 'pits' used for the burial of executed prisoners moved from the Melbourne Gaol to the prison. The plan lists the names of 12 individuals buried in Pit A, five in Pit B and 15 (including men and woman) in Pit C. Of particular note was the inclusion of the name "Kelly" on the plan for Pit C (Fig. 1).

A specialized team of VIFM staff and colleagues from the Argentine Forensic Anthropology Team (EAAF)¹ was established to address the question of what happened to Ned Kelly's remains. Specific funding for the project was provided by the Victorian Attorney General. The identification effort consisted of a multidisciplinary approach including scientific disciplines (forensic anthropologists, pathologists, odontologists, and geneticists) as well as historians and legal experts. This paper reports on the anthropological and DNA evidence which supports the identification of Ned Kelly.

2. Materials and methods

2.1. Anthropological examinations

Each box and/or coffin of human remains recovered from Pits A (12 case files), B (5 case files) and C (24 case files) at Pentridge was assigned an individual case/VIFM number. The remains from each box/coffin were cleaned using warm water and soft brushes and were analyzed at the VIFM using standard anthropological techniques. All surviving dentition and associated prosthetics (e.g., dentures) were independently examined by a forensic

odontologist. All skeletal remains were photographed and CT scanned as part of the documentation process.

2.2. Post-mortem DNA Samples

Following an anthropological analysis, a bone and/or tooth sample was collected from each case for DNA analysis. Samples of skeletal and teeth remains were sent to the EAAF DNA Forensic Laboratory, to be analyzed by HV1/HV2 mitochondrial DNA (mtDNA) analysis. The sample type (teeth, clavicle, femur, tibia, ulna or cranium fragments) subjected to mtDNA analysis varied from case to case and was dependent on the samples available for analysis.

DNA protocols were carried out in a specially designed laboratory for DNA extraction from aged skeletal remains, to minimize the risk of contamination. Laminar flow cabinets were used in every step of DNA extraction and PCR setup. All plastic ware used were DNA-free (as provided by the vendor or following UV irradiation). The staff wore protective equipment including facial masks, hair covering, single use lab gowns and sterile gloves. Any spurious DNA was removed from workbenches using a 5% (v/v) bleach solution and UV light irradiation. Tools used to manipulate bone samples, like tweezers, forceps, rotary tool accessories like carving, cutting and sanding elements were UV irradiated at 254 nm in a cross-linker for 15 min each side.

2.3. Control of contamination

All DNA protocols were carried out in laboratories specially designed for DNA extraction from skeletons with facilities to minimize the risk of contamination. Laminar flow cabinets were used in each step of DNA extraction and PCR setup. All plasticware was DNA-free, autoclaved and, whenever possible, UV irradiated as an additional precaution. Benches were sterilized with 5% bleach and UV irradiation, while all tools used to manipulate bone samples were autoclaved or UV irradiated in a UVP CL-1000 gel cross-linker (254 nm) for 15 min each side. The post PCR area is

¹ The EAAF has been involved in human identification in different countries around the world for the past 25 years. Consequently, EAAF has developed a dedicated DNA Forensic Laboratory specializing in the analysis of several nuclear genetic markers as well as mitochondrial DNA sequencing from aged human skeletal remains.

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