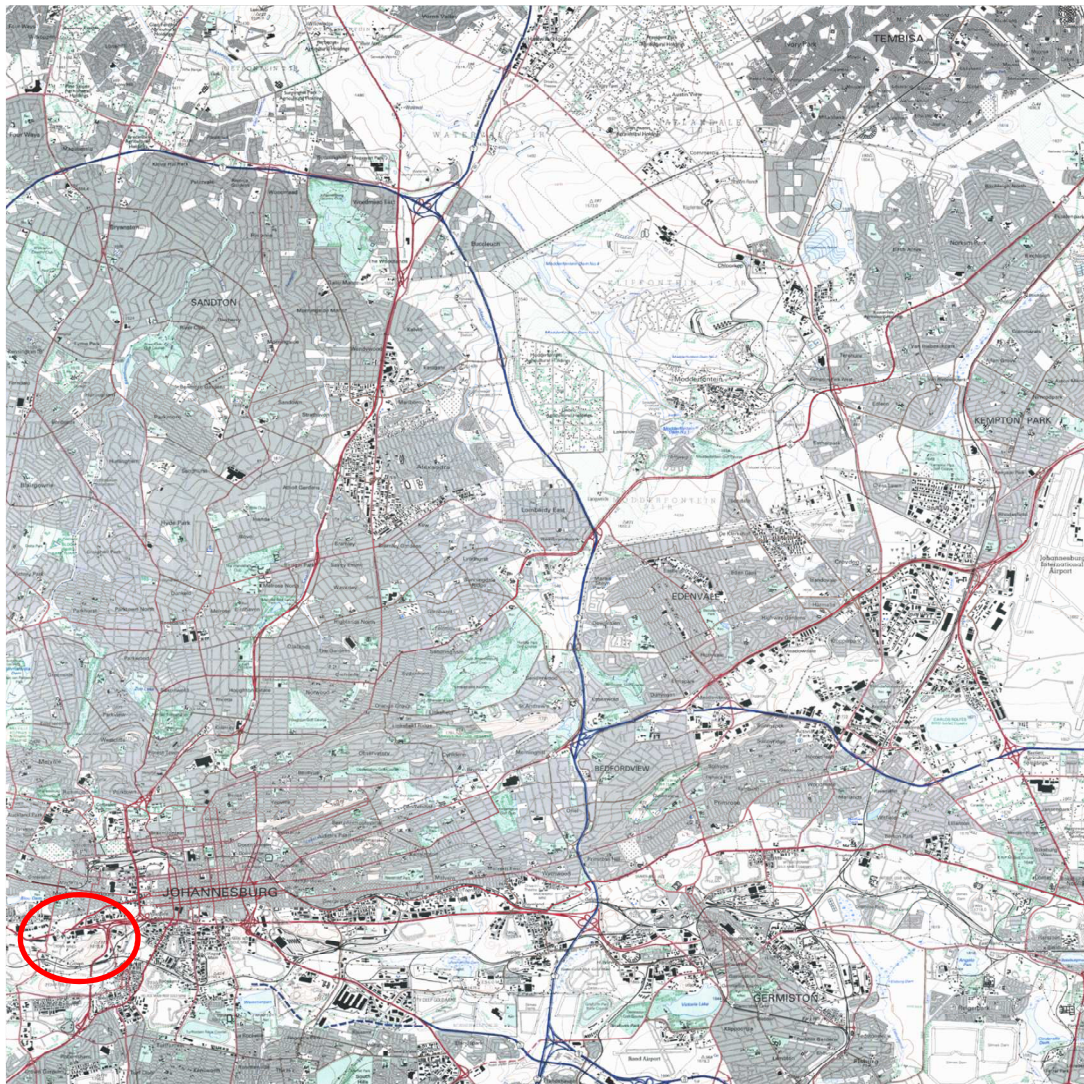


**APPLICATION FOR PERMIT:  
ARCHAEOLOGICAL AND PALAEOONTOLOGICAL SITES AND METERORITES**

**Details of site:**

1:50 000 Map – Site is located at bottom left hand corner of map sheet (encircled by red)



**Nature of site:**

The old Crown Mine miner's cemetery is located approximately 4km south of Johannesburg, on the property of a recycling demolition and construction waste company called Stones and Stones (S26.13.26.5, E27.59.56.7) and until recently this site was covered by a mine dump. Due to a number of exposed human skeletons the site was reported to the South African Police Service who treated it as a potential forensic case, however, upon closer inspection the site was identified as an older

archaeological site and was reported to SAHRA. A thorough archaeological examination of the site dated the site between the late nineteenth century and the early twentieth century. Additionally the location and context of the site also appears to be associated with early gold mining.

Approximately 146 exposed human skeletons were removed from the site and are temporarily stored at AVBOB, Johannesburg. During the exhumation of these skeletons every attempt was made to describe the age-at-death, sex, stature and ancestry of the individuals represented at the Crown Mine cemetery.

### **Purpose of application:**

Apart from the ±146 human skeletons already removed from the Crown Mines, it is currently estimated that there could be as many as 650 additional bodies buried that will have to be exhumed. This cemetery could have been one of the largest cemeteries in Johannesburg in the early twentieth century (pers. comm. Anton Pelsler), however, memory of this site and its graves seems to have been lost over the years with none of the bodies claimed thus far. Although the exposed skeletons have been exhumed from the cemetery, nothing is being done about the removal of the remaining skeletons as funds have run out and no support from government has been forthcoming. The continuous removal and reburial of these bodies are of cardinal importance as the remaining human skeletons have begun to erode out of the ground. This poses the potential risk of the skeletal remains being washed out of the grave-pits into the lower tree border, just below the cemetery. Additionally the continuous erosion of the grave pits is exposing more and more human bones rendering the remains vulnerable to human scavenging and trade. This has the potential to cause human skeletal remains from the Crown Mine cemetery to be sold and used as traditional medicine or muti. Thus, future efforts to exhume and rebury all the skeletal remains from the Crown Mine Cemetery are imperative!

During the biological analyses of the initial human skeletons removed, very little information pertaining to age-at-death, sex, ancestry, stature, trauma, pathology, etc. could be collected due to the poor preservation of the bones. In such circumstances where the preservation of bone hampers conventional quantitative and qualitative skeletal analysis other methods such as histology has been used with success to obtain more information. However, before any such histological analyses can be conducted a general understanding of the overall histological and microstructural preservation of the bone is needed. Therefore the aim of this study is to determine the preservation of the bone microstructure to determine if the histological structure of bone can be used during future examinations of the age-at-death, pathology, etc. for the skeletons exhumed at the Crown Mine Cemetery. Through understanding the post-mortem (after death) alterations of bone one can

establish whether histology can be used to estimate the age-at-death of the individual and possibly describe any pathology that may be present. A chemical analysis can also be done to assess the chemical nature of the bone to give a better understanding of the potential effects of the mine dump soil on the bone microstructure.

Please find attached the project proposal as approved by the University of the Witwatersrand for additional information.

### **Nature of activities:**

Approximately 50 of the 146 poorly preserved human skeletons, that have already been exhumed from the Crown Mine Cemetery will be utilised in this study. Each of these skeletons has been placed in its own coffin and is currently in safekeeping at AVBOB, Johannesburg for later re-interment.

A small transverse portion of bone of about 5cm will be removed from the midshaft of a long bone using a small hacksaw. The removal of these sections will not cause any additional damage to the bones as the exhumed skeletons are very poorly preserved and mainly consist of broken and fragmented sections. The sections will be dehydrated and embedded in an epoxy resin (Biodur E12, catalyst E1) and sectioned to 30-60µm using a microtome. Histological sections will be prepared and viewed using normal light microscopy and polarized light microscopy. Sections will be stained using various stains to assess if staining can potentially enhance the visual appearance of the microstructure of archaeological bone. Pictures will be taken of the histological appearance of bone and the preservation or diagenetic alteration (changes after death) thereof will be described according to stipulations by Hackett (1981), Garland (1989), Jans (2005) and Hedges and colleagues (1995) and will include the following:

1. Microscopic Focal Destructions will be identified as described by Hackett (1981) (Figure 1):
  - a. Linear longitudinal tunnels
  - b. Budded tunnels
  - c. Lamellate tunnels
  - d. Wedl tunnels
2. Inclusions and/or infiltrations as described by Garland (1989)
3. Microfissures

Using histology the extent of microfissuring will also be determined by using the cracking index developed by Jans (2005) where the number of cracked versus non-cracked osteons will be counted in five microscopic field views which will provide a rough cracking percentage.

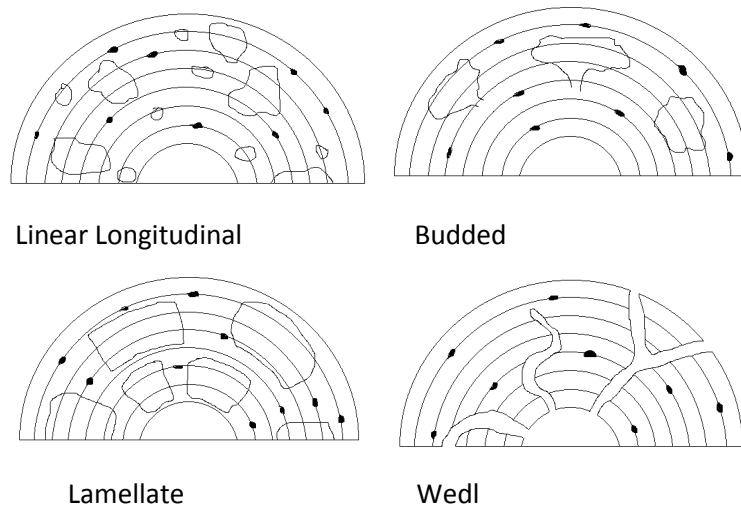


Figure 1: Diagrams of four types of tunnels (Redrawn from Hackett 1981)

4. Birefringence (polarized microscopy)

Birefringence on the other hand will be assessed using the Oxford Histological Index (OHI) developed by Hedges and colleagues (1995) which follows the guidelines found in [Table 1](#). The bone tissue of each histological skeletal section will be classified into indices to describe the histological destruction in more detail.

Table 1: The Oxford Histological Index values assigned to summarize the degree of diagenetic change (Taken from Hedges et al. 1995).

Index	Approximate % of intact bone	Description
0	<5	No original features identifiable, other than Haversian canals
1	<15	Small areas of well preserved bone present, or some lamellar structure preserved by pattern of destructive foci
2	<33	Clear lamellate structure preserved between destructive foci
3	>67	Clear preservation of some osteocyte lacunae
4	>85	Only minor amounts of destructive foci, otherwise generally well preserved
5	>95	Very well preserved, virtually indistinguishable from fresh bone

Please find attached the project proposal as approved by the University of the Witwatersrand for additional information.

By assessing the histological preservation of bone, future efforts can be made to use bone histology to estimate age-at-death, trauma and possibly pathology from the skeletal remains found buried at the Crown Mine Cemetery. This will allow for a better understanding of the individuals buried at the Crown Mine Cemetery and the circumstance surrounding the health status and possibly the death of these individuals.

Future efforts will include the chemical analyses of the bones exhumed at the Crown Mines to explore the chemical nature of the poorly preserved bone to gain a better understanding of the potential effects of the mine dump soil on the bone macro- an microstructure.