

Research Article

THE HISTORY AND HEALTH OF A NINETEENTH-CENTURY MIGRANT MINE-WORKER POPULATION FROM KIMBERLEY, SOUTH AFRICA

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ABSTRACT

Trenching by the Sol Plaatje municipality in Kimberley, South Africa, accidentally intersected 145 unmarked graves outside the fenced Gladstone Cemetery in 2003. The McGregor Museum was responsible for recovering the disturbed material. This paper describes the archaeological findings and demographic composition of the human remains excavated at the site and discusses briefly the pathological changes observed in the skeletons. One hundred and seven skeletons were exhumed from 15 graves along the trench. Remains from a minimum number of 26 individuals were also rescued from another site where material dug out of the trench had been dumped. All skeletal remains were analysed using standard anthropometric techniques, and visually examined for signs of pathology and trauma. Archaeological evidence as well as palaeopathological indications suggested that the skeletal remains were most likely those of migrant mine workers who died between 1897 and 1900, with the majority of the population consisting of young male individuals (n = 77, 20–49 years of age at the time of death) of low socio-economic status. The prevalence of infectious diseases (treponemal disease (8%), non-specific osteomyelitis (1%) and tuberculosis (1%)) observed in the sample, most likely reflects the pre-antibiotic era from which these individuals came as well as the overcrowded and unhygienic living conditions to which they were exposed on a daily basis. Cranial and long bone fractures (26.2%) observed are testimony to the high levels of interpersonal violence and hazardous mining environment described in archival documents, and other pathological lesions such as myositis ossificans (8%), spondylolysis (9%), Schmorl's nodes (31%) and enthesophytes are indicative of the physical demands associated with mining activities. These results give substance to contemporary reports on the appalling conditions and hazards to which migrant workers were exposed when selling their labour on the mines in the late 19th century.

Keywords: Kimberley, migrant labour, mining, palaeopathology, skeletal analysis.

INTRODUCTION

Kimberley came into existence after the discovery of diamonds in what is today the Northern Cape Province of South Africa. The first diggings on the 'Diamond Fields', in 1870, were along the banks of the nearby Vaal River and at a few 'dry diggings' dotted around the region of Kimberley. New finds would spark a rush as diggers scrambled to stake out

claims, one of the most famous being the 'New Rush' when Colesberg Kopje – now Kimberley Mine – was discovered. In time it was realised that the gems being recovered in the vicinity of and at Colesberg Kopje were located in diamondiferous kimberlite pipes which could be mined to great depths. Open-cast mining resulted in the famous 'Big Hole' and other similarly deep excavations, but shafts were soon being sunk to retrieve kimberlite even deeper. Kimberley became the hub of industrialisation in South Africa, transforming the country's agrarian economy into one increasingly dependent on its mineral wealth. The demand for 'black' labour in the mines drew workers on an unprecedented scale from throughout the subcontinent.

By the end of the 19th century the 2000 or so men who at first had mined on Colesberg Kopje had burgeoned into a population of 41 000, numbering 14 500 Europeans and 26 500 'black' persons (Stoney 1900a). The efforts of many individual prospectors and claim-holders had been swallowed up as companies amalgamated, with De Beers Consolidated Mines Ltd establishing a monopoly by the end of the 1880s.

Apart from the 'Native Locations', several closed labour compounds for housing 'black' mine workers were established in the Kimberley district from the mid-1880s (Leary 1891; Roberts 1976; Worger 1987). The compounds were developed to improve security and limit the theft of diamonds, while enhancing productivity by restricting and controlling the movements of workers. Although intended to provide adequate shelter and nutrition, the living conditions in the compounds were in fact poor (Leary 1891; Barnes 1895; Jochelson 2001).

Disease and death was an everyday occurrence from the outset on the Diamond Fields. Thousands of people were digging in extremely dry surroundings, without proper housing, no natural water sources and no proper arrangements for waste disposal. Drs Otto, Dyer and Matthews were the first doctors to arrive at the fields in 1871 (Booth 1929; Kretsmar 1973). Kimberley's first hospitals attracted trained doctors who were assisted by the women and nurses of the Community of St. Michael and All Angels, headed by Sister Henrietta Stockdale (Booth 1929; Kretsmar 1973; Swanepoel 2003). In 1882 the amalgamation of the Diggers Central Hospital and the Carnarvon Hospital gave rise to the Kimberley Hospital (Booth 1929), which was at the time the largest regular hospital in the Cape and the best training school for nurses in the country

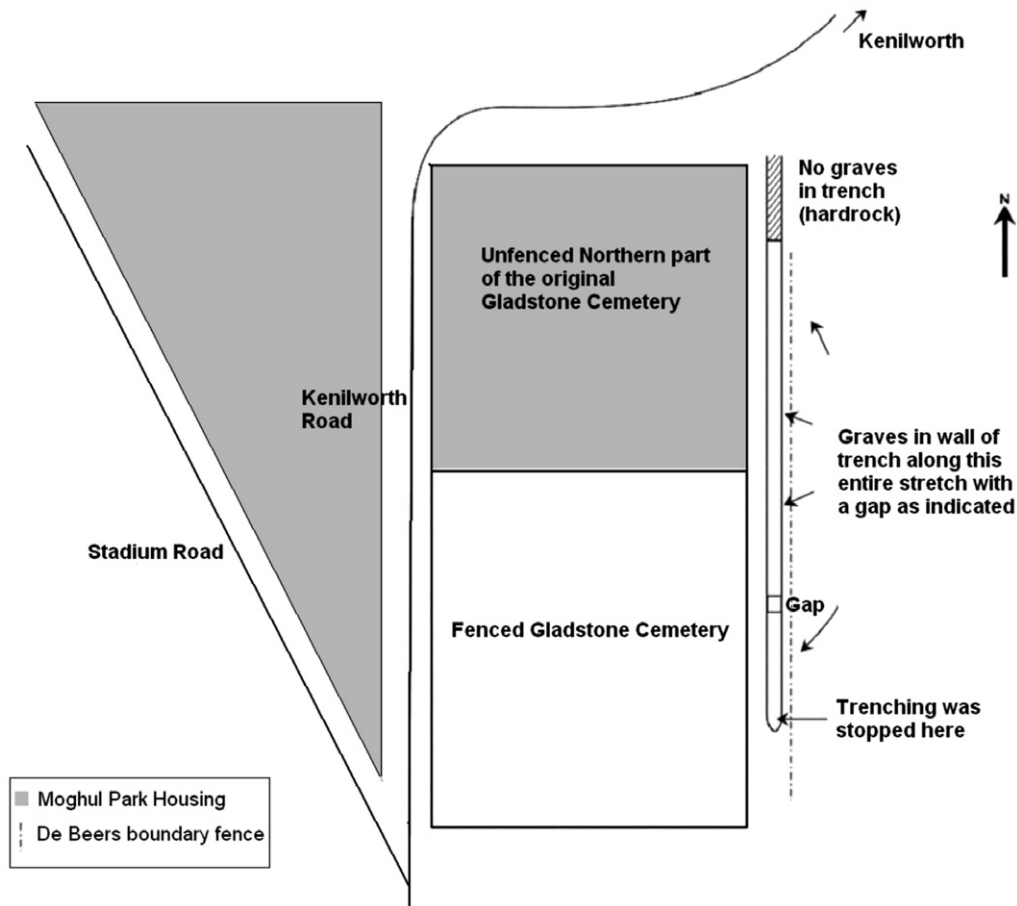


FIG. 1. Map indicating the fenced as well as the northern built-over sections of the Gladstone Cemetery and the trench which uncovered the human remains accessed in this study (modified from van der Merwe et al. 2009b)

(Kretsmar 1973). By the late 1890s, Kimberley Hospital had a 'Native surgical ward' and a special ward for 'black' women and children. Together with the compound hospitals it was responsible for the migrant workers and paupers who fell ill (Cape of Good Hope Votes and Proceedings of Parliament 1898; Cape of Good Hope Votes and Proceedings of Parliament 1899; Cape of Good Hope Votes and Proceedings of Parliament 1900). Hospital records indicate that between 1897 and 1899, 7853 patients were admitted to Kimberley Hospital, of whom 5368 were 'black'. Of those who were treated, 1144 died (*ibid*).

During this period the most frequently treated disease was 'zymotic diseases', which resulted in 34.8% of admissions and 48.1% of deaths. 'Zymotic diseases' was a term given to describe any contagious disease. A total of 977 patients were admitted for dietetic diseases, which probably included scurvy, and 52 (5.3%) died as a result thereof (*ibid*). 'Constitutional diseases', which most likely referred to inherited disorders, diseases of the respiratory system and diseases of bones and joints, were also observed. Injury and violence (as it was termed in historical documents) brought 893 patients to the hospital in the abovementioned three years, of whom 40 died (*ibid*). Although it is unclear precisely how the different diseases were categorised, it seems that the main causes of death in the last three years of the 19th century were tuberculosis, pneumonia, scurvy, syphilis, diarrhoea, mining accidents and interpersonal violence (Cape of Good Hope Votes and Proceedings of Parliament 1898; Stoney 1900b; Cape of Good Hope Votes and Proceedings of Parliament 1900).

Paupers who died in the Kimberley or other surrounding compound hospitals were buried in the Gladstone Cemetery. Use of this cemetery began informally, prior to its official

proclamation in March 1883, by which time half the ground had "for some time past [been] devoted to native interments" – by then numbering approximately 1500 graves (Manager of Vooruitzigt Estate 1883, cited in Swanepoel 2003). Some of the early registers were lost in a fire but one surviving register indicated that nearly 5000 'black' burials took place between 24 June 1887 and 28 November 1892, while another 611 'black' burials were recorded for the period between February and June 1900. These were mainly paupers' burials. At least some of these individuals were buried without coffins for lack of funds and were transferred to the grave wrapped only in blankets or coverlets (Swanepoel 2003).

In 1897, the cemetery was enlarged along its eastern border with an extra strip of land donated by De Beers. The cemetery was closed in mid-1900, and opened again in April 1902 for 'European' interments only. Decades later the visible cemetery was fenced, with those areas containing unmarked graves going unnoticed and falling outside of the new boundary. Municipal records confirm that in 1883 the cemetery measured some 7.2 ha; that it was enlarged by the addition of a strip of land in 1897; but the extent of the demarcated cemetery in 1998 was only some 3.6 ha. The original cemetery was nearly double its present size, and it has since been partly built over at its northern end (Morris 2003).

It was exactly in the strip of land given by the De Beers Company, right up against the mining area fence, but outside of the presently demarcated cemetery, where trenching by the Sol Plaatje municipality, in 2003, accidentally intersected 145 unmarked graves (see Fig. 1). Acting on information received, staff of the McGregor Museum in Kimberley intervened to halt the trenching, and alerted the South African Heritage

Resources Agency (SAHRA). There had been no prior impact assessment. Archaeologists of the McGregor Museum and community helpers spent the next several months investigating the damaged graves.

The purpose of this paper is firstly to describe the archaeological findings and demographic composition of the remains excavated from outside of the present Gladstone Cemetery, and secondly to summarise and briefly discuss the health status and diseases present in the skeletons of this 19th century mining community, based on palaeopathological observations. This paper will serve as a broad overview of the Gladstone site and what was found there. Reference will be made throughout the paper to other publications dealing with the detailed analyses of pathological lesions observed in this sample.

MATERIALS AND METHODS

A permit for excavation of a sample of the damaged graves was granted to the McGregor Museum in Kimberley by SAHRA (permit 80/03/04/004/51). Since the proposed storm-water drain was diverted away from its original route (continued trenching was likely to have doubled the impact), it was not necessary to exhume all of the 145 graves exposed by the trench: 15 were chosen for detailed investigation, including all instances where skeletons had been left exposed by the trenching and with a view to assessing variation along the length of the disturbance. Once the salvage was completed the trench and excavated graves were re-filled with sand. The permit also provided for temporary storage of the human and artefact remains excavated from the site at the Museum. As was required by SAHRA, regular public meetings and press briefings were held in order to inform the community and public at large of the progress being made with the study.

Information on the disturbance and the preliminary findings were disseminated broadly via various media to the citizens of Kimberley and beyond. Responses by people claiming knowledge of the cemetery were sporadic and essentially irrelevant. Not in a single instance was any direct link with the graves in question asserted (Morris *et al.* 2004).

Local community members claimed that the graves were those of “*Skotse soldate*” – Scottish soldiers – until indications to the contrary were pointed out (e.g. the absence of evidence of coffins and the occurrence of glass beads, iron and copper bangles, and copper earrings associated with male skeletons). This underscored a crucial role for archaeology in elucidating the identity of buried individuals, and it problematised the *a priori* presumption that communities would be reliable informants in all instances. An understanding emerged, however, of the way that these graves could represent part of the collective experience of Kimberley’s underclass in the late 19th century, and a growing sense of responsibility amongst community members was palpable. Their involvement was an integral part of every stage of the ensuing investigation, with several public meetings being held to report on findings and proposals and to seek guidance or approval for successive interventions. Of significance was the drawing in of 14 unemployed members of the public from across the city to participate in the salvage. Where they lacked relevant skills they were given basic training in archaeological methods. Team members brought their own particular perspectives to the investigation and contributed to communication (informed by their experience of newly learned procedures and archaeological objectives) with the many visitors to the site. A core group of five community participants continue to be employed by the Museum, one of them currently pursuing an academic interest in archaeology.

During the archaeological investigations two sites were involved: firstly, the 180 m-long trench itself, where the burials were disturbed, and secondly, a diamond washing plant halfway between the cemetery and Kenilworth village, where material dug out of the trench had been dumped in heaps before being bull-dozed to fill hollows or for processing in the diamond screening operation. Exhumation of selected graves in the trench began in May 2003. It was clear that trenching had seriously damaged and displaced remains from the upper part of at least seven graves.

The dump-site was divided into ten sectors and screened accordingly (see Fig. 2), resulting in the salvage of a large number of bones. Work there was called off in June, when it was considered that most of the retrievable human remains had been recovered.

Following excavation, all skeletal material and associated artefacts were taken to the McGregor Museum for temporary storage in anticipation of further analysis. Traditional healers were given an opportunity to perform a cleansing rite at the museum.

All skeletal remains excavated from the trench were analysed. In most cases the skeletons were complete and preservation was excellent. Standard anthropomorphic techniques such as cranial and pelvic morphology and discriminant functions were used to determine the sex of adult individuals. Age estimation in adults was done by assessing the morphological changes to the sternal ends of the ribs and pubic symphyses, the degree of cranial suture closure and dental development. In juvenile individuals the stages of dental eruption and closure of epiphyseal growth plates were assessed in order to estimate the age at death (De Villiers 1968; Krogman & İşcan 1986; Asala 2001; Hillson 1998; Oettlé & Steyn 2000; Scheuer & Black 2000; Franklin *et al.* 2005).

All skeletons were visually examined for signs of pathology and trauma. Lesions were compared to standard palaeopathological texts and photographs such as can be found in the publications of Steinbock (1976), Mann and Murphy (1990), Roberts and Manchester (1995), Larsen (1997), Aufderheide and Rodríguez-Martín (1998) and Ortner (2003). Diagnoses were made wherever possible. X-ray investigations were not included in the analyses of the remains due to time and financial constraints.

The remains recovered from the dumpsite near Kenilworth were analysed separately using techniques described for commingled remains by Ubelaker (2002), Byrd and Adams (2003) and L’Abbé (2005a). Although some bones were damaged by the ground-moving machinery, the majority were well preserved and intact. All skeletal elements were counted, taking left and right sides into account. Pair matching and articulation were done where possible and the minimum number of individuals represented by the remains recovered from the dump site was determined. Since these single skeletal elements may, in fact, not represent new individuals but merely parts of incomplete skeletons excavated from the trench, they were not taken into account in the demographic and palaeopathological analyses of this study.

RESULTS

ARCHAEOLOGICAL FINDINGS

In general there was a consistency in burial pattern, although aspects varied from grave to grave. While two of the fifteen graves investigated each contained but a single inhumation (which were also two of the only three coffin burials found), and one contained two individuals, the remainder had

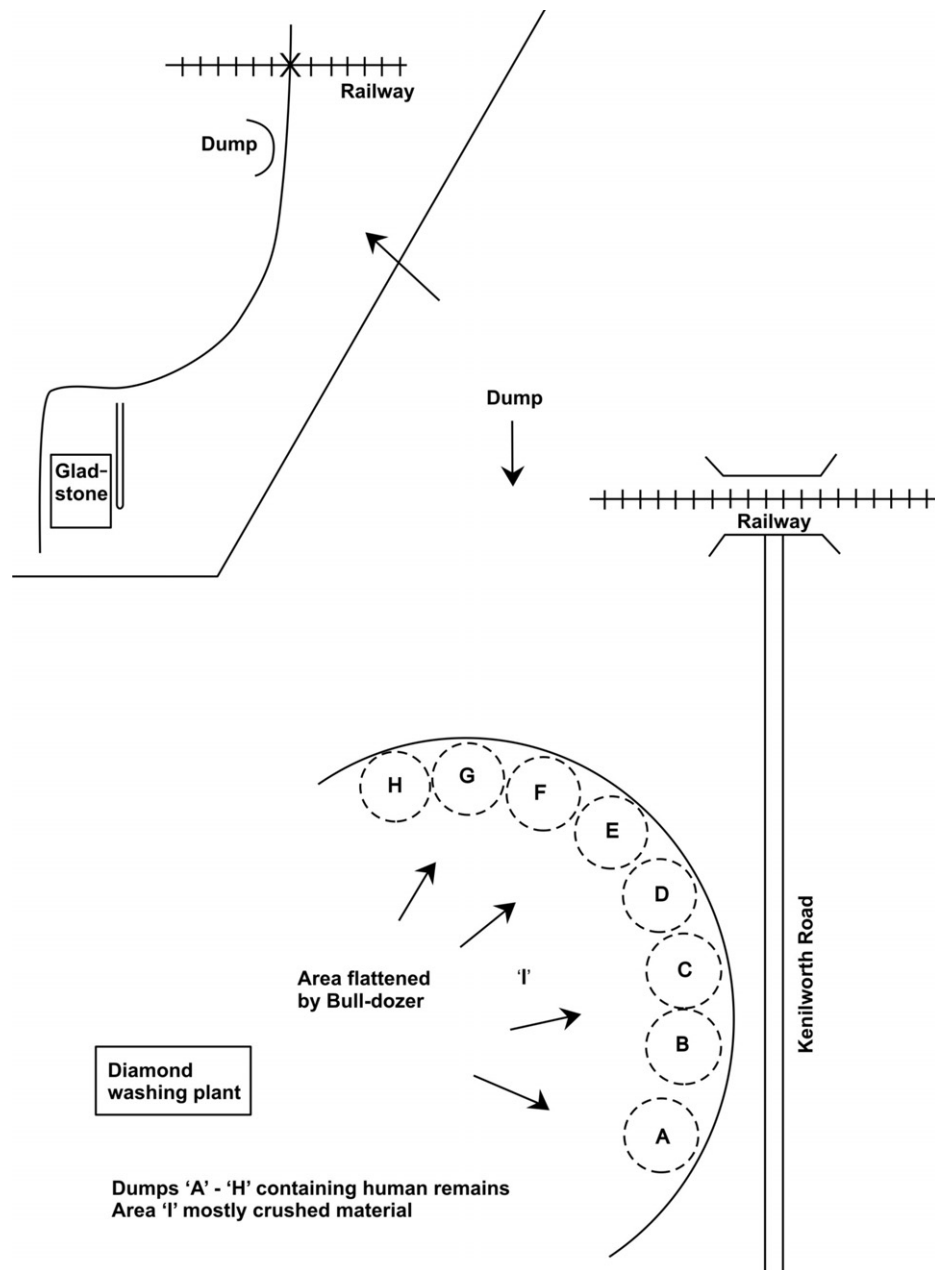


FIG. 2. Map indicating the location of the dump site (top left corner) as well as the different areas of excavation A–H.

between 5 and 14 skeletons each. Within the graves, some individuals had been laid out on their backs with some decorum, occasionally two side by side, separated from successive inhumations by a layer of grave-fill. In other instances, however, skeletons were found face-down, on their sides, squeezed into corners, or crammed in one on top of another (see Fig. 3). In one case a corpse had been placed on its back with legs flexed upwards from the pelvis against the end wall of the grave, making room for another body that was jammed up against the other end of the pit. It was clear that several of the burial events within these graves had involved multiple simultaneous interments. While in almost all instances bodies were aligned with heads to the west, one individual was found facing the other way. The variability in the number of skeletons per grave may be a reflection of the fluctuating yet high daily 'pauper' mortality rates in Kimberley at the time, where it would appear that perhaps a grave a day was provided for these burials. 'Native interments' at Gladstone Cemetery in 1883 averaged 4.5 per diem (Swanepoel 2003).

It is difficult to conceive of any attendant burial rite, and in

many cases it could hardly be said a 'laying to rest' had taken place: there appears to have been scant regard for the dignity of the dead and one would wonder to what extent any living relatives would have been informed of these deaths.

In striking contrast to the somewhat haphazard disposal of corpses within the graves was the formal regularity of the graves themselves, quite precisely dug in rows, orientated east–west and to a depth of some 2 m. The sides tapered slightly outwards towards the base. Earlier there was anxiety about certain Kimberley burials having been too close together and "of a depth totally inadequate" (reported in the *Diamond News* in March 1879), but altogether more systematic cemetery management was clearly in place by the 1890s. Even so, in some cases, these Gladstone graves were filled to within half a metre of the surface – hence the disturbance of remains when trenching eventually brought the unmarked graves to light. A final indignity was that as the earth and any slight mounds settled and subsided, aggravated by the flow of waste water from the adjacent mining property (Swanepoel 2003), trash from the ash heap, including discarded broken bottles and flattened tins,



FIG. 3. One of the 15 graves excavated from the trench. It is clear in this photo that little attention was given to burial practices with three individuals being visible in this grave: the first on its right side, the second lying face down, and the third on his back against the grave wall to his right.

was dumped as fill to form a stratigraphic veneer over the graves. It is small wonder that when the cemetery was later re-fenced this portion of the burial ground was excluded.

A markedly small percentage of the interments that were investigated were in coffins ($n = 3$) so that, it appears, by far the greater proportion of corpses brought to this part of the cemetery would have arrived wrapped only in hessian sacking (partially preserved in a few cases) or other fabric. There were

limited indications of clothing in the graves, with buttons, parts of leather shoes (with metal eyelets) and belt buckles being found in only a few instances.

Grave goods were predominantly in the form of personal ornaments comprising glass beads, copper and iron beads, twisted copper and iron bangles (worn on wrists, arms, ankles or as necklaces), together with copper earrings. The only grave goods of an explicitly religious nature were a clutch of objects probably from a bag (traces of which had disintegrated) clearly representing *ditaola*, i.e. animal bones, shells and buttons, used for traditional African divining. All of these personal objects point to rural connections.

Evidence of medical interventions was encountered repeatedly during the archaeological phase of the investigation. This included bandaging on limbs and several instances of amputations. In one case part of an amputated limb (wrapped in dressings) was found inside a coffin belonging to another individual. There was also evidence of postmortem examination procedures such as craniotomies, known to have been carried out by pathologists in Kimberley from the 1880s. It seemed possible that the majority, if not all, of those individuals buried in this part of the cemetery had come from a hospital context.

DEMOGRAPHY

Skeletal elements salvaged from the dump site about a kilometre away, to which the trench contents were taken, represented a minimum number of 26 individuals comprising 17 males, 5 females and 4 persons of unknown sex (see Table 1). It is important to consider that some of the remains excavated from the dumpsite may belong to an individual who was partly exhumed from the trench and is therefore already accounted for. Thus, although remains from the dump represent at least 26 individuals, it cannot be assumed that these bones increase the sample size of the skeletal population in general. The main focus of this study fell on the persons excavated from the trench and only these will be discussed further.

The 15 graves that were exhumed yielded 107 *in situ* skeletons and included 86 males, 15 females and 6 individuals of unknown sex. Almost all individuals excavated from the trench were between 20 and 49 years of age (see Table 2), matching the high mortality rate reported in archival documents for people aged between 15 and 45 years in Kimberley at that time (Stoney 1900a,b). One foetus, two infants and 13 juveniles between 11 and 19 years were the only non-adults observed in this study. Fifty-two individuals were between 20 and 34 years of age. Twenty-five persons were estimated to have been between 35 and 49 years of age at the time of death and only four individuals were estimated to have been older than 50 years. Due to the fragmentary condition of some of the remains investigated in this study, eight individuals could only be described as being adult and two were of unknown age.

PATHOLOGY

A list of all the pathological conditions observed in this sample population can be seen in Table 3. Infectious diseases including treponemal disease, tuberculosis and non-specific

TABLE 1. The number of individuals (n) excavated from the Gladstone Cemetery and Dumpsite, and their sex distribution.

Site	n	Males	%	Females	%	Unknown	%
Dump site	26*	17*	65.4	5*	19.2	4*	15.4
Gladstone Cemetery	107	86	80.3	15	14	6	5.7

*This number represents the minimum number of individuals represented by the skeletal elements recovered from the Dump site.

TABLE 2. Summary of the age distribution of skeletons excavated from the trench at Gladstone Cemetery.

Age in years	<i>n</i>	%	Cumulative %
Antenatal	1	0.9	0.9
0–10	2	1.9	2.8
11–19	13	12.1	14.9
20–34	52	48.6	63.5
35–49	25	23.4	86.9
≥50	4	3.7	90.6
Adult	8	7.5	98.1
Unknown	2	1.9	100.0
Total	107	100	

n = number of individuals.

osteomyelitis were observed in 11 individuals (10.3%). Lesions suggestive of treponematoses were observed in nine skeletons. This condition was mainly characterised by osteomyelitic changes and subperiosteal bone growth on the anterior tibia resulting in sabre-shin tibiae (77.8% of those affected) (Fig. 4). Osteomyelitic changes of the fibula (66.7% of cases) and humerus (in one case) as well as gummatous lesions on the cranial vault (55.6% of cases) were also observed in some individuals. Due to the small sample size of females in this study, no significant difference ($\chi^2 = 2.15$, *P*-value > 0.1) could be found in the prevalence of treponemal infection between males and females.

Non-specific osteomyelitis was observed in only one individual with severe osteomyelitis of the right tibia and fibula (GLD SE11.2). A huge cloaca was present on the medial aspect of the right tibia, with abundant new infectious bone growth on the affected tibia and fibula (see Fig. 5). Evidence of new bone formation was present throughout the affected bones, causing a change in the morphology as well as ankylosis of the proximal and distal joint ends. The infection also spread to the right foot and accordingly, severe infection and bone regeneration was seen on the right talus and calcaneus.

An individual with litic changes to the lumbar vertebrae, left patella and right olecranon process was diagnosed with possible tuberculosis (GLD N8.3).

Healed scurvy was diagnosed in 16 individuals (15%), comprising 13 males and three females. This diagnosis was based on the presence of ossified subperiosteal haematomas on weight-bearing bones (mostly bilateral) and periodontal disease in the absence of poor dental health. Some of these individuals also displayed widespread subperiosteal bone

TABLE 3. The frequency of skeletal pathologies observed in the Gladstone sample.

Pathological condition	<i>n</i>	Number affected	%
Infectious diseases			
Treponemal disease	107	9	8.4
Tuberculosis	107	1	0.9
Non-specific osteomyelitis	107	1	0.9
Metabolic and nutritional disorders			
Scurvy	107	16	15.0
Trauma			
Fractures	107	28	26.2
Myositis ossificans	107	9	8.4
Amputations	107	6	5.6
Spondylolysis	82	7	8.5
Longstanding subluxation	107	2	1.9
Congenital abnormalities			
Spina bifida	87	3	3.4
Craniostenosis	84	2	2.4
Degenerative disorders			
Schmörl's nodes	87	27	31.0
Degenerative joint changes	107	24	22.4
Vertebral osteophytosis	87	13	14.9
Non-specific indicators of pathology			
Cribriform orbitalia	82	9	11.0

n = number of individuals assessed

apposition (most likely associated with slight healed/ossified subperiosteal bleeding). Although all of the above-mentioned bone lesions may also be indicative of other diseases when viewed separately, the skeletal distribution of these lesions was interpreted as possible scurvy. This condition was well documented as being problematic in hospital records and other historical documents during the time period associated with the excavated remains. Further details as well as histological findings associated with the ossified haematomas and scurvy observed in this sample are discussed elsewhere (Van der Merwe *et al.* 2009a,c).

A large number of individuals also presented with traumatic lesions which included myositis ossificans, amputations, spondylolysis, lesions indicative of longstanding subluxation and fractures (see Table 3). Of the aforementioned lesions, healed and perimortem fractures were the most common with 28 individuals (26.2%) being affected. Cranial fractures (see Fig. 6) encompassed 48.8% of all fractures observed. Of special

**FIG. 4.** Possible treponemal involvement of the tibia resulting in a very characteristic sabre-shin in a male between 35 and 50 years of age (GLD N74.7).



FIG. 5. Osteomyelitis of the left tibia with cloaca formation as well as infectious bone changes of the fibula causing widespread new bone formation as well as proximal and distal ankylosis in an adult male (GLD SE11.2).

interest is the occurrence of amputations in this sample population ($n = 6$). These included evidence of healed amputations, amputations done shortly before death as well as separated amputated limbs (Van der Merwe *et al.* 2009b).

Schmörfl's nodes were observed in 27 individuals (31%). All those affected by the condition were younger than 45 years of age with the majority being between 20 and 34 years old.

Although the majority of persons within this sample population included young individuals, several displayed skeletal lesions indicative of joint degeneration. Osteo-arthritic changes¹ were noted in 21 (24.4%) males and three (20%) females. No significant difference ($\chi^2 = 0.13$, P -value > 0.2) in the prevalence of arthritic changes was observed between males and females. These included acetabular (7.5% of 133 acetabulums), sacro-iliac, acromio-clavicular, (7.9%), and temporo-mandibular joint changes.

Vertebral osteophytosis as a result of Degenerative Disc Disease (Maat *et al.* 1995) was noted in 11 (12.7%) males and two (13%) females. There was no significant difference in the frequency between males and females ($\chi^2 = 0.003$, P -value > 0.2). The majority of these osteophytic spurs occurred in individuals older than 35 years of age. It is therefore suggested that these lesions may be the result of normal degenerative changes associated with labour and aging (van der Merwe *et al.* 2006).

Lastly non-specific indicators of health, specifically cribra orbitalia, were observed in nine individuals (11%). This included two (15.3%) females and seven (10.1%) males. Orbits were affected bilaterally in most cases except in two individuals (GLD SE7.8 and GLD N34.4). In both these cases, only the left orbit was affected. No porotic hyperostosis was noted in any of the affected individuals.

DISCUSSION

The burial pattern observed and the grave goods found with the skeletons, together with the demographic composition of the excavated sample, are all consistent with this having been a migrant worker population.

The grave goods, described above, clearly reflect rural African connections and constitute an important archaeological indicator that the population in question was likely to have consisted of migrant labourers. Comparing these finds with grave goods recovered from a small number of documented 1870s African interments in the Transvaal Road area of Kimberley suggested a marked contrast: these earlier graves contain a wide range of probably locally purchased items such as pipes, enamel ware and buttoned clothing, reflecting a more open socio-economic context for migrant workers in Kimberley in the pre-compound era. The picture emerging from the 1890s interments at Gladstone Cemetery suggests a situation of greater restriction, with migrants having limited access to the kinds of goods available outside the compounds.

By far, the majority of individuals within this study were male, with only a few females and three children. These findings match the historical documents which state that the majority of those working on the mines were migrant workers and predominantly male (Stoney 1900a; McNish 1970; Worger 1987; Jochelson 2001). Men left their families at distant rural homes and came to Kimberley – initially on a voluntary basis with the expectation of a financial benefit and the opportunity to purchase a firearm. After the mid-1880s, however, they were being forced to sell their labour at reduced rates since conquest had deprived 'black' societies of a viable agricultural base and ways had to be found to pay hut taxes which had been imposed

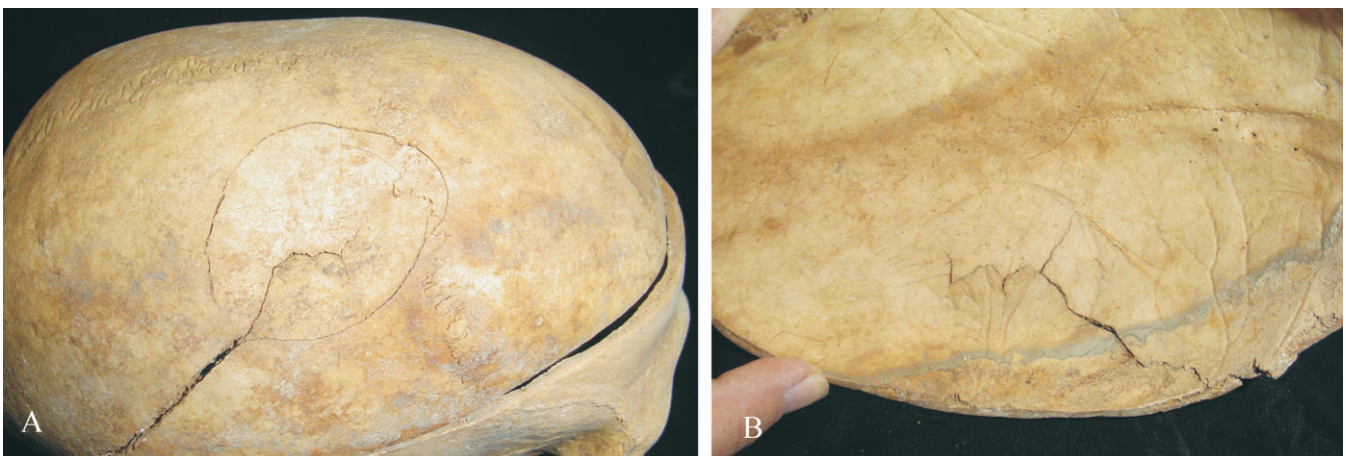


FIG. 6. An example of perimortem blunt force trauma to the right parietal bone observed in a male 30–45 years of age at the time of death (GLD N74.6).

(Williams 1902; McNish 1970; Worger 1987). Contemporary records show that, in the mid-1880s, more than two thirds of the workers being recruited for the Kimberley mines were from Pedi and Tsonga speaking areas of northeastern South Africa and adjacent Mozambique, with smaller numbers coming from rural Sotho-, Zulu-speaking and other African farming communities. Unfortunately, statistics on the place of origin of workers for the period after 1885 appear not to be available (Worger 1987: 109) and, while one might surmise that the earlier pattern will have persisted to a large degree, this remains a question for ongoing investigation.

It is clear that while the sex distribution within this skeletal sample does not represent a normal population distribution, it accords well with the known population profile of Kimberley at the end of the 19th century. Neither female labour nor the employment of sick and emaciated men was allowed in the mines and therefore, the majority of individuals working in Kimberley were young healthy male adults when they entered the mines (Williams 1902). This demographic profile was reflected in a census held in 1898, which showed that 65% of the 'black' individuals within Kimberley were aged between 15 and 45 years (Stoney 1900a).

The high death rate of 'black' labourers between 30 and 45 years of age, apparent in the skeletal remains examined, was well documented in archived reports from the Officer of Health (Stoney 1900a). These reports ascribed the high mortality rate to mining accidents associated with shaft blasting, the poor living conditions of the workers, as well as their increased susceptibility to 'Western diseases' (Stoney 1900a).

Unhealthy living conditions, the unusual gender distribution encouraging the spread of venereal diseases, as well as the absence of antibiotics at the time, combine to explain why tertiary stages of syphilis could be observed in this skeletal population (Harries 1994). Although skin lesions associated with syphilis were commonly treated with mercury during the 19th century, intervention with penicillin was only implemented around 1941. Hence, treponematoses could develop to its tertiary phase, not often seen in modern populations with access to antibiotics (Ortner 2003).

The prevalence of skeletal involvement during treponemal infection has been shown to vary greatly. Some authors have found that 1% of patients displayed skeletal lesions, whereas others reported up to 20% of infected individuals showing bone alterations (Ortner 2003). Accordingly, care should be taken when reconstructing the prevalence of treponematoses in the Gladstone population since the occurrence of skeletal indications of syphilis might not be representative of the true prevalence of the disease within the living population. It should also be borne in mind that since the graves in question are seemingly associated with a hospital context, the population sample is biased.

Skeletal lesions suggesting treponemal infection were observed in 9.3% of individuals within this population. The frequency is not necessarily higher than that observed in other populations, such as in skeletal samples from the Mariana Islands (10.5%), Guam (6.6%), the Dominican Republic (8.8%) and Metaponto (17.3%), but it is extremely high when compared to other South African populations, where only single isolated cases have been reported (Henneberg & Henneberg 1993; Douglas *et al.* 1997; Pietruszewsky *et al.* 1997; Rothschild *et al.* 2001; Steyn *et al.* 2003). The high prevalence in the Gladstone sample does correlate, however, with the incidence of syphilis as reflected in contemporary documents in late 19th century Kimberley (Jochelson 2001). Although no clear numbers were stated, it was reported by the Senior House

Surgeon in 1899 that "syphilis is playing havoc among the coloured races" (Cape of Good Hope Votes and Proceedings of Parliament, 1900: 42). One may therefore assume that many individuals were affected by the condition (Jochelson 2001).

Another infectious disease which was reported to have spread rapidly among the migrant labourers was tuberculosis, or phthisis, as it was referred to in archival documents (Collins 1982; Packard 1989; Meyer *et al.* 2002). There are no reports of any occurrence of tuberculosis in South Africa prior to 1652 and it is suggested that the disease was introduced during European colonisation, rapidly breaking out and spreading among the indigenous societies (Donald 2001). According to the Officer of Health, a higher susceptibility amongst migrant workers to contract this condition was the reason for the epidemic, but the overcrowded living conditions in the compounds and locations in Kimberley definitely spurred the spread of the disease (Stoney 1900a; Packard 1989). As was indicated by archival documents, huts in the locations were crowded together, with at least six individuals per hut, while in the compounds, several individuals shared a shed (Stoney 1900b; Packard 1989). With people living in such close quarters the prevailing conditions were conducive to the spread of any infectious disease, not only tuberculosis. Another factor predisposing labour migrants to infection was their generally poor health induced by exhaustion from long working hours and limited nutritional resources (Harries 1994; Packard 1989).

Taking into consideration that skeletal lesions resulting from tuberculosis develop in only 5–7% of individuals infected by the disease, the prevalence of tuberculosis in this sample population correlates well with its frequency as described in the living migrant worker population in Kimberley (Steinbock 1976; Santos & Roberts 2001).

It should be kept in mind, though, that the terminology used in archival documents is sometimes ambiguous. The term phthisis is also given to lung diseases induced by the constant inhalation of microscopic particles of dust generated by shovelling, drilling and blasting, but according to the Oxford Medical Dictionary (2004), it is a former name for tuberculosis (Harries 1994; Packard 1989). Nevertheless, the inhalation of dust particles also leads to fibrosis, the symptoms of which may be mistaken for those of tuberculosis. This condition is extremely prevalent in individuals working in underground mines, and it could be expected to have occurred in Kimberley where shafts for underground mining had begun to be sunk by 1885 (Turrell 1987; Harries 1994; Packard 1989).

The unavailability of antibiotic treatment in this period resulted not only in the observed skeletal lesions associated with treponematoses and tuberculosis in this population, but also in advanced osteomyelitis for which the treatment in the late 19th century involved amputation. Non-specific osteomyelitis is considered to be more prevalent in rural environments with poor sanitation. In Kimberley, in the late 19th century, notoriously bad conditions were reported even from Kimberley Hospital, specifically in its pauper wards.

According to reports, the 'Native Medical Ward' was in an appalling state in 1897 (Medical Officer of Health 1897). It was described as being "low, hot, badly lighted and badly ventilated, and worst of all there [was] a scullery opening into it" (Cape of Good Hope Votes and Proceedings of Parliament, 1898).

Although only one case of non-specific osteomyelitis was observed, it is possible that some of the osteomyelitis cases admitted to hospital were treated by amputation. In some of the amputated limbs observed, clear signs of infection were present. If all the amputations observed in this population

were indeed the result of infection, the prevalence of osteomyelitis would increase to 6.5%, possibly more representative of the true frequency of the condition. It should, however, be kept in mind that some of the amputations may have been the result of untreatable crushing injuries, as may be expected in a hazardous mining environment, without time for a secondary infection to develop (van der Merwe *et al.* 2009b).

The high frequency of skeletal lesions suggestive of healed scurvy also correlates well with contemporary reports. Increased levels of scurvy can be expected in a population following a diet of mainly maize meal and occasional coarse meat, which was the only food supplied by the employers and compounds (Harries 1994). Food could be purchased from company stores but was costly (Worger 1987). The potential for scurvy would have been exacerbated by the regular consumption of home-made beer and alcohol, as reported. Opportunities to cultivate supplementary foods such as vegetables and fruits with vitamin C were limited by the harsh environment and restrictions in the compounds (Van der Merwe *et al.* 2009a,c).

Nearly one third of individuals in the study population had at least one fracture ($n = 28$) and of these 20 were cranial fractures. This extremely high frequency of cranial fractures is suggestive of high levels of interpersonal violence (Jurmain & Bellifemine 1997; Standen & Arriaza 2000). Cultural differences amongst migrant workers, competition for resources, and overindulgence in alcohol, must have caused friction between labourers or between themselves and their employers (Harries 1994; Turrell 1987; Worger 1987). The frequency of lesions suggesting interpersonal violence is in accord with historical documentation of violence and disputes in the workplace (Worger 1987; Harries 1994, Van der Merwe *et al.* 2009b). The hazardous mining environment should also be considered when interpreting fractures in this sample (Van der Merwe *et al.* 2009b). There is often no sure way to distinguish blunt force cranial fractures, as evidence of violent conflict, from cranial fractures resulting from mining accidents such as a rock fall. Therefore the latter as a cause for the observed cranial fractures, also well documented in archival sources, cannot be discounted.

Injuries resulting from rock falls, mud rushes and mine shaft accidents, and the like, were a regular occurrence in Kimberley (Knight 1978; Turrell 1987; Harries 1994). The high prevalence of long bone fractures, spondylolysis and long-standing subluxation of the shoulder observed in this population most likely relate to these kinds of injuries, and is testimony of the hazards and strenuous demands of daily work in the mines (Van der Merwe *et al.* 2009b).

Fortunately, medical care was available to treat most of these injuries, infections and nutritional diseases. Apart from documentation which clearly describes the treatment of patients in the Kimberley and compound hospitals, the presence of well-healed and reduced fractures and surgical amputations observed in the population provides testimony to this fact (Cape of Good Hope Votes and Proceedings of Parliament 1898; Cape of Good Hope Votes and Proceedings of Parliament 1899).

Several other skeletal abnormalities, which would not in themselves have resulted in hospitalisation and therefore would be more representative of the general population health in Kimberley than the abovementioned pathological instances, were also observed during the investigation of this sample. These included lesions indicative of joint degeneration resulting from hard physical labour, as well as nine cases of cribra orbitalia.

The prevalence of Schmörl's nodes as well as of lesions such as myositis ossificans, spondylolysis, and degenerative bone

changes was high considering the young age of individuals within the study sample, and can most likely be ascribed to regular engagement in strenuous physical activities. It may be argued that these lesions were not associated solely with mining activities, but could also have resulted from agricultural and other physical enterprises in which these individuals took part at their rural homes. However, when comparing the prevalence of lesions such as Schmörl's nodes (31% of individuals in the Gladstone sample) with other South African rural populations such as the Venda (2.6%), it becomes evident that the Gladstone skeletal sample was significantly more exposed to its causes than would be a group engaged only in regular rural living (L'Abbé 2005b). Notably, the prevalence of vertebral osteophyte formations (a result of degenerative disc disease) observed in the Gladstone sample (14.9%) was statistically comparable to that occurring in the contemporary mining population sample from Koffiefontein (22.2%) (L'Abbé *et al.* 2003). Taking the age distribution of the Gladstone population into account, it is obvious that factors such as strenuous activities associated with mining, or, to a lesser degree, physical labour associated with a rural lifestyle, are more likely to have influenced degenerative changes observed in this population than naturally occurring degeneration patterns related to aging.

Cribriform orbitalia was observed in 11% of individuals with assessable orbits in the Gladstone skeletal sample. The cause of this condition is still under debate (Steinbock 1976; Stuart-Macadam 1989; Mann & Murphy 1990; Stuart-Macadam 1992). Iron-deficiency, vitamin B₁₂ and folic acid deficiency, haemolytic anaemia, scurvy, malnutrition, chronic gastrointestinal bleeding, ancylostomiasis, osteoporosis as well as infectious diseases have all been implicated in the development of the condition (Mann & Murphy 1990; Thillaud 2008; Walker *et al.* 2009). It has even been suggested that the lesions may be a non-specific trait or the result of post-mortem damage (Thillaud 2008).

The prevalence of cribra orbitalia in the Gladstone population (11% of individuals with orbits) was relatively low in comparison with its frequency in other adult South African skeletal samples such as the Griqua (34.6%), Khoe (36.1%) and the 20th Century 'black' peoples (46.6%) studied by Peckmann (2003) (Griqua $\chi^2 = 11.1$, Khoe $\chi^2 = 11.8$, 'black' peoples $\chi^2 = 14.9$, P -value < 0.05 for all). It should be kept in mind, however, that cribra orbitalia normally develops during rapid childhood growth (Steinbock 1976; Mann & Murphy 1990; Fairgrieve & Molto 2000). Therefore, the frequency of cribra in this population should be interpreted with caution.

The lesions may be the remnants of a childhood condition and are therefore not representative of conditions (be they nutritional, pathological or hereditary factors resulting in haemolytic anaemia) in the Kimberley context at the time these individuals were working there, since this is a migrant worker population. It would indicate, though, that the majority of individuals within the Gladstone population had come from population groups that were relatively well adapted to their environments (Larsen 1997; Wapler *et al.* 2004).

Should it be possible for cribra orbitalia to develop in adults, though, conditions resulting in acquired haemolytic anaemia (e.g. malaria), could be the reason for cribra orbitalia in this population (Harries 1994; Walker *et al.* 2009). It must again be stressed that the majority of individuals within this sample population were most likely migrant workers, and therefore these cribra lesions may rather be representative of the various places from which migrant workers came to labour in the mines.

CONCLUSION

This study has brought together the results of archaeological, archival and palaeopathological analyses to detail the history and health of the individuals whose remains were salvaged and investigated following accidental disturbance.

Both the archaeological evidence and the results of palaeopathological analysis suggested that the skeletal remains were most likely those of migrant mine workers. The cultural objects associated with the skeletons establish preponderantly rural connections. Abnormally high numbers of young adult male individuals, evidently of low socio-economic status, strongly points to a context of labour migrancy.

The burial pattern, with up to 14 individuals per grave, was that of paupers. The evidence in the graves suggested a population of individuals who had been brought to the cemetery from a hospital environment and who were buried with minimal ceremony.

A high frequency of infectious diseases, with specific reference to treponemal disease, was observed. Other infectious diseases observed in the remains from Gladstone included advanced, non-specific osteomyelitis as well as a possible case of tuberculosis. In a pre-antibiotic era, the overcrowded, unhygienic living conditions described in archival documents were clearly a reason why these diseases flourished in Kimberley during the late 19th century.

The high levels of interpersonal violence described in archival documents and the hazardous mining environment in which these individuals worked, were reflected by the high prevalence of cranial and long bone fractures observed in the skeletal sample (Turrell 1987; Harries 1994; Jurmain & Bellifemine 1997; Standen & Arriaza 2000). Fortunately some medical treatment was available in case of injury, as was confirmed by the presence of well-healed and reduced fractures and surgical amputation within this population.

The high prevalence of myositis ossificans, spondylolysis, Schmorl's nodes and degenerative changes observed in this generally young population indicate regular participation in strenuous physical activities. Since these lesions were not in need of hospitalisation, they are more representative of the general population health as a whole and the related physical demands of their daily routines.

These results give substance to contemporary reports on the appalling conditions and hazards to which migrant workers were exposed when selling their labour to the mines in the late 19th century. Migrant workers came on contract, recruited from distant rural areas to meet the demands for labour. In closed compounds and in the mines they were subjected to harsh and restrictive conditions of life and exposed to disease, violence and a hazardous working environment. Many of them would never make the return journey home. The remains of some of these latter individuals were disturbed unwittingly from unmarked, unremembered pauper graves. This study serves to contribute to the recollection and recognition of these anonymous dead whom Kimberley and South Africa had forgotten, foregrounding something of the real cost in human hardship and loss of life against which the wealth of the nation was built.

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NOTES

¹The terms osteo-arthritis changes or arthritic observations are used here to refer to the general degenerative changes observed in synovial joints, without specifying the disease responsible for the change.

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