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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
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STRUCTURE AND EXPERIENCE IN THE MAKING OF APARTHEID

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TITLE: MINING DISASTER IN INSTALMENTS : The completion of the foundations for the modern health and safety system on the Witwatersrand gold mines 1930 -1939

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1. Health and Safety on the Mines (1901-1930)

> The development of the Gold Mining industry along the Witwatersrand at the end of the nineteenth century had a dramatic impact on patterns of sickness and health within Southern Africa. The high health costs associated with gold mining and related industries along the Rand were passed on directly to the Black workers and to the families of those workers who chose to settle along the Rand at the turn of the century, through the provision of wages which failed to cover the cost of food and housing, and the creation of working conditions which were marked by long hours and near absence of concern for sanitation and safety measures. (6)

In the first year after the ending of the South African War, in 1903, the mortality rate for disease was 79,8 per 1 000. By 1910 the figure had been halved to 34,21 per 1 000 for disease. (7) This decrease has largely been seen to be the result of the reconstruction that occurred on the mines after the war. Production, which had ceased during the war, was vital to the rebuilding of the Transvaal and after the war relied heavily on a quick influx of a vast amount of labour initially to start, and later maintain production. This labour was poorly fed, housed and clothed thus leading to such catastrophic death rates on the mines during the initial period. By 1910 many of the mines were constructing, or had constructed, "better" accommodation along the guidelines laid out in the 1905 ordinance. (8) Unfortunately it is often difficult to establish a complete breakdown of what people were dying from. However one can establish, for example, that 60 % of the miners who died on 1903, died due to pulmonary related diseases (pneumonia and tuberculosis). (9) Mining accidents throughout the first decade, while relatively high, was a far smaller killer compared with disease. The death rate for accidents in 1910, for example, for Black miners was 4,20 per 1 000. (10)

Over the following twenty years the mortality rates for both disease and accidents steadily decreased. By 1930 the mortality for disease was 9,53 per 1 000 and 3,18 for accidents. (11) Reasons for the dramatic drop in mortality from disease would include the heightened awareness amongst both the industry and the State of the necessity for ensuring the health and safety of the work force. Numerous Government commissions, the establishment of standing committees on phthisis and tuberculosis, and the Gorgas report all brought the harsh realities of working and living conditions on the mines into the public eye. (12) The recruiting ban on tropical miners in 1913 who were particularly susceptable to pulmonary diseases, also played a major role in ensuring that the disease mortality rate decreased. (13) More importantly this period witnessed the laying of the foundations of the health system: The establishment in 1921 of the Mine Medical Officers Association provided a forum for mine doctors to share medical experiences, and legislation in 1925 stipulated that all mines had to employ a full time medical doctor. Finally of major importance was the establishment, coincidently also in 1921, of the State's Department of Health. Under its jurisdiction fell the task of inspecting mine compounds and hospitals and recording the incidence of disease.

But while the process of decreasing the mortality rate from disease had been put into motion, one cannot deny that the figure in 1930 was still too high. Roughly translated a mortality rate from disease of 9,53 per 1 000 is equivalent to 2185 miners dying during that year, added to which about 990 died from accidents and one arrives at the figure of approximately 9 miners dying a day. (14) What the rest of the paper sets out to do is to note how increased mining profits and competition from other sectors forced the mining industry to introduce more stringent health and safety measures.

2. Political Economy of the 1930's

The effect on the gold mining industry of South Africa abandoning the gold standard in December, 1932, cannot be overemphasised. The early 1930's had seen the gold industry struggling for survival, a direct result of the Wall Street Crash in 1929. (15) As the table below illustrates the industry's profit margin literally doubled in the space of a year as the gold price rose.

Year	Working Profit per ton (based on realised value of gold)
1930	8 s 5 d
1931	8 1
1932	8 0
1933	15 9
1934	15 0
1935	14 8
1936	13 3
1937	12 6
1938	11 9
1939	12 2
1940	14 9 (16)

Table I : Working profit per ton for years 1930-1940

Despite increased Government taxation on the greater profits the industry was in a position to open a whole new gold field, the West Wits line, as well as to undertake further developments on existing mines. Yudelman has stressed the importance of the increase in gold price and argues that "The modern South African State finally came of age after the gold price increase of 1932-1934, but the foundations of adulthood had been laid between 1907 and 1924". (17) The modern South African State that arose not only consisted of a buoyant gold mining industry but it was now also made up of a growing commercial agricultural sector and a nascent manufacturing industry. The latter two sectors, according to Yudelman, had the mining industry to thank for their development because " since Union in 1910 and before, the mining industry was regarded by the State as both a wasting resource and as the milch cow of the economy, and it was treated as such whenever possible." (18) Thus State subsidy, based on mining taxes, had helped in the development of both commercial agriculture and the manufacturing industry. Ironically the development of these two

sectors was to create a major labour crisis for the mining industry. The economic collapse of the African Black reserves, a major labour source for the mines, coupled to the fact that the manufacturing industry was in a better position to offer more attractive jobs heightened the scarcity of migrant labour throughout this period. (19) Of course labour shortages were a relative concept throughout the 1930's. The period witnessed an increase in recruited labour from 202 118 in 1930 to 351 826 by 1940. (20) Thus while the labour shortage was largely solved, many mines throughout the 1930's complained constantly that they did not have a full mining complement. (21)

While the gold mining industry was experiencing a "vintage" period, the Pact Government followed by the Fusion Government was increasing both the landlessness of the majority of the population and the repression of the people. (22) With the collapse of the ICU and the relative inactivity of other radical political groups, the 1930's were very quiet on the organised resistance front.

Thus the 1930's saw increased profits for the mining industry but it also saw increased competition from other sectors on the labour market. While reluctant to increase wages, the mining industry was forced to improve working and living conditions so as to continue to attract labour. The following sections examine this in more detail.

3. The Relationship between State and Mining Industry

Yudelman suggests that by the 1930's the relationship between State and mining industry was a symbiotic one. In this section however it will be noted that in the area of health the relationship in the early '30's was not yet symbiotic though by the latter half it could be classified as such. Symbiosis, of course, normally has positive connotations whereas in this case the type of symbiosis that developed was in the best interests of the State and the mining industry but it was clearly not in the best interests of the workers. The issue of health was, of course, potentially an area for much antagonism between the State and the mining industry. Packard and Kennedy have shown how in previous decades the mining compound was seen as a potential health risk to White urban dwellers and therefore the State passed regulations and instituted inspections to ensure that compounds did not become hazardous. (23) But expenditure on the health and safety of workers was costly and not always welcomed by the mining companies.

The formation of the Public Health Department in 1921 provided the Government with the necessary infrastructure to implement health regulations. During the late 1920's and 1930's a zealous mine medical officer, Dr Cluver, was appointed by the State to mastermind the workers health on the gold mines. Picking up on the Gorgas report Cluver championed the desirability of a centralized health system for the whole gold mining industry. Cluver's argument was based on the principle that centralisation "would not only effect much greater efficiency, thereby preventing much avoidable morbidity and mortality, but would also prevent much economic loss resulting at present from lack of co-ordination and conservation of effort. (24)

Further argument was that according to the inspector's reports there was a vast disparity between mining hospitals. Some were very efficient while there were others where "no thought appears to have been expended on the health and general welfare of the natives". (25) Centralisation, according to Cluver, would eliminate such disparity. Finally Cluver noted that centralisation would allow for better co-ordination of medical research.

Cluver's argument had few supporters in the mining industry. The industry argued that the independence of the mining groups, not to mention the cost of implementing a centralised system would prevent the industry from implementing such a plan. The Chamber's response to such suggestions were usually quite forceful, as the following indicates:

> The Government had once suggested that the Chamber should undertake the health supervision of the mine natives, but the suggestion was not only turned down, but one might say almost indignantly repudiated by the Chamber. (26)

There was also a certain amount of antagonism over the question of inspectors' reports. Dr Cluver had working under him a number of inspectors whose duty it was to inspect the conditions on the compounds. Inspections ranged from examining ration schedules to conditions in hospitals to underground sanitation. In 1929 a series of very critical reports led Mitchel, the Secretary for Public Health, to write to the General Manager of the Chamber of Mines drawing the latter's attention to the fact that a number of mines were "disgraceful from a sanitary point of view." Furthermore Mitchel pointed out that a number of mines were systematically contravening the regulations concerning food rations. He informed the Chamber that the department had two methods of dealing with these problems. The first, which Mitchel stated he was reticent to use, would be to fine the offending mine. The second method, which Mitchel personally preferred, was to advise the offending mine of the transgression and ask it to improve its standards. Mitchel concluded by stating that "It is fully recognised that very great and creditable improvements in hygiene have been effected on the mines since 1911, but the investigations carried out by Dr Cluver indicate that further improvements are possible and that continuous and detailed supervision of the health conditions on certain mines is essential and must be carried out, if not on the lines suggested by this department, then on the lines suggested by your commitee." (27) Thus on the one hand the state was critical of the health conditions on many of the mining companies, but on the other its relationship with the industry was such that it never once prosecuted a mine for transgressing the health legislation.

Thus at one level the relationship was symbiotic, but on the ground it was far from it. The Mines' Medical Officers' Association treated Cluver's reports with hostility, as the comment below shows:

> "We have again had to contend with the annual criticism from the Union Department of Health in regard to hygienic conditions on the mines ... While this association is only too willing (as far as is in its powers) to give effect to any of the

> Department's recommendations which may be of practical benefit, it holds very strongly that Government officials cannot adequately comprehend conditions on the mines from a few cursory visits to us and the analysis of figures in Pretoria." (28)

The doctors on the mines were caught up in a very complex contradiction, on the one hand they were the employees of the mining companies and thus were acutely aware of what health expenses cost the mines; and on the other hand they realised that poor conditions and inadaquately fitted hospitals cost lives. Though they rejected the idea of a centralised health system on the grounds that it would affect their independence many wanted to see greater control placed over the mine managers by the Chamber. Many of the mines' doctors felt that mine managers should undergo some form of training in sanitation and hygiene as many of the doctors had noticed that "hygiene in the companies was found to depend very much on the enthusiasm and competence of the individual compound managers, many of them are conscientious and enthusiastic about health matters, but not infrequently the compound manager appears to consider that his policing duties are much more important than sanitary supervision... A certificate in mining hygiene should be a necessary qualification for an aspirant compound manager". (29) While never legislated, the acquiring of hygiene principles by mine managers was encouraged by all the mining groups by the end of the decade. A further development in the area of health and safety was that by 1939 all the mines were engaged in instructing Black miners in the principles of First Aid, although the First Aid Campaigns were controversial. Lankton has noted how in North America "Safety First quickly came to wear a punitive rather than a protective demeanour. It arrived when men already felt they were watched and pressed too hard in the name of efficiency and productivity. Instead of alleviating conflict between labour and management, Safety First campaigns became another source of irritation." (30)

So while the mining companies never bowed to the State's wish of a centralised health system, by the end of the decade the mine companies had laid the foundations for a centralised health policy. Furthermore whereas the relationship between the public health department and the mine doctors at the beginning of the decade did not mirror the symbiosis that characterised the rest of the relationship between State and mining industry; by the end of the decade symbiosis on all levels had been achieved. Before examining how symbiosis led to the decreasing of mortality rates by the end of decade, let us return to the question of workers' response to the foundation of the health system being laid.

4. Workers and Hospitals

> As one (doctor) told me not so long ago, they do not want to be "Kaffirdoctors" permanently. (31)

Daubenton had noted how many of the doctors involved in mine medicine found it very boring. Over a six year period, he noted that 30 % of the doctors left, largely because they were unstimulated by the narrow range of medical and surgical patients they came across (32). With a doctor to patient ratio of, on average, 1 to 6 747 Black miners doctors probably felt exhausted as well. (33) Thus many injured or ill miners came across uninterested doctors, added to which if confined to hospital they were placed on the much disliked milk diet and often made to do "light duty" without receiving any pay. Miners who missed a shift due to illness or injury were not compensated. Because of this many miners attempted to avoid detection when ill or injured so as not to be confined to hospital. But by 1930 many of the mines had established a method of utilising compound police to observe both miners returning from the shift or miners in the compound for signs of illness or injury. Those found to be in such a state were then taken to the hospital. In previous decades mining companies complained of the reluctance of Black miners to utilise the hospitals, but by the 1930's miners were certainly utilising the hospitals. For example in 1933 the Rand Mines group recorded that out of a workforce of 87 493; 21 918 disease cases were treated, and 32 601 accident cases were treated for a total of 54 519 cases, i.e. 62 % of the workforce were treated on average. In the following section the question of incidence will be discussed, but the point here is that a considerable number of workers by the 1930's were utilising the health system. (34)

But, as was mentioned earlier, the mining companies had to create the conditions to attract labour. Certainly both miner and mine company were aware of this phenomena by the 1930's. Mine medical officers had noted that on the Witwatersrand "there seems to be a definite parallel between a big percentage of voluntaries and low resiratory morbidity". (35) Thus implying that mines with the best health and safety records were the most popular. Some mine doctors even suggested that instead of examining statistics about labour shortages and disease incidence, "the shortest way to solve our problem was to go and ask the boys themselves why they prefer one mine above the other." (36) Unfortunately for all parties concerned the doctors never asked the miners, and the doctors were left to speculate.

A final example of workers' attitudes towards health policy was illustrated by the lack of use of the change house in the 1930's. Built at the mine shaft, the change house was meant to provide space for miners to change from wet work clothes to dry ones before walking back to the compound. Doctors thoughout the decades after the South African War had stressed the need for these to be made compulsory. But according to a doctor in the 1930's as few as 20 % of the miners were utilising this facility. Miners, it would appear, were too tired to want to change before walking back to the compound; furthermore the fear of having ones wet clothing stolen dissuaded the miners from using these. Instead of establishing the full reason why the miners did not use the change house mine managers instead concluded that "we cannot close our eyes to the fact that the boys do not know how to look after themselves and how to obtain full benefits from what is done for them" (37) Thus in this instance the mine

from what is done for them". (37) Thus in this instance the mine managers continued to attempt to enforce the use of the change

houses, while the miners for decades continued to resist the use of them.

5. Disease and Accident Patterns

> It is not easy to distinguish between a disease and an accident, or between a disease that was caused by working in the pit and one that was aggravated by it; and it is certainly unwise to place too much faith in contemporary diagnosis and explanation ... Any certainty is probably misleading and any confidence almost certainly misplaced." (38)

Benson was of course referring to statistics that were produced by the British coal mining industry. Questioning the gold mining industry's statistics is not unique, as early as 1913 Gorgas had questioned the pneumonia mortality figures arguing that they should in fact be much higher. Throughout the ensuing decades a number of cases exist where doctors and various others had questioned the figures. In all the cases people had argued that mortality figures should be higher, simply because if a miner was diagnosed to have an illness that was seen to be terminal, such as tuberculosis, or if they had a serious injury, they were repatriated. Once repatriated no record was kept on whether or not the miner died. Furthermore, the figures one quotes are all from official records, records which only record deaths officially notified. Thus while the figures in the following pages are from official sources and one recognises the problems that are attached to such usage, it is also unavoidable to use such sources.

Before examining a case study, which will help illustrate the disease pattern of the 1930's, mention must be briefly made of the mortality rates for all diseases and mining accidents on the Witwatersrand gold mines. Table II illustrates how the mortality rates for both disease and mining accidents had decreased steadily since 1910. The purpose of the case study is to demonstrate that mortality rates only tell part of the story. Non fatalities from disease and mining accidents obviously affected a far greater number of miners, but people are seldom made aware of this.

Year	No. Employed	Deaths from Mining Accidents	per 1000	Diseases	per 1000
1910	183 793	757	4,20	6 288	34,21
1930	202 118	554	2,60	1 926	9,53
1931	210 238	523	2,36	1 871	8,90
1932	217 774	543	2,37	1 568	7,20
1933	229 696	563	2,31	1 429	6,22
1934	249 200	553	2,05	1 989	7,98
1935	273 218	658	2,20	1 954	7,15
1936	297 441	700	2,16	2 100	7,06
1937	303 087	723	2,20	2 300	7,59
1938	316 862	667	1,94	1 698	5,36
1939	321 400	636	1,83	1 051	3,27
1940	351 826	662	1,74	1 077	3,06

(39)

9.

Table II : Deaths from mining accidents and disease over select years

The above 'mining disasters in instalments' can be broken down further to enable one to also examine the non-fatalities from illness and accidents. To enable one to do this an example has been taken from the Rand Mines group. (40) The Rand Mines group was reputed to have the best health system on the Witwatersrand, largely due to the energetic work of Dr Orenstein, the Chief Medical Officer during the 1930's. Orenstein had been Gorgas' assistant when he had been working on the Panama Canal. Not surprisingly Orenstein had implemented many of Gorgas' recommendations, the most obvious one being to formulate a central health policy for the group. The Rand Mines group employed 36 % of all the Black miners employed on the Witwatersrand Gold Mines. In 1933, the year of the following case study, the Rand Mines group's mortality rate for disease was 7,27 as compared with the Reef's average of 7,98 per 1 000, whilst for accidents the reef's mortality rate was 2,89 per 1 000 and the Rand Mines group's was 3,26. But whilst mortality rates were continuing to drop the incidence of disease and accidents remained high. For all disease the incidence on the Rand Mines group was 250,50 per 1 000 i.e. 25 % of the workforce on average were reputed to have been ill (that is only those who reported to the hospital). The incidence of mining injuries on the Rand Mines group per year was 308,53 per 1 000 i.e. about 30 % of the miners reported an injury. For the mining group this was equivalent to 515 617 shifts being lost in total for 1933; 205 470 shifts were lost due to disease and 310 147 shifts were lost due to accidents. On average for each miner this meant losing 2,53 shifts per year because of illness and 3,54 shifts because of an injury from a mining accident. Thus for the mining company illness and injury contributed to a significant amount of work being lost during the year and for the miner who had escaped death or maiming he would have to spend longer on the mines to complete his contract.

The disease pattern for the Rand Mines group is illustrated as follows:-

Disease	Incidence	per 1000	Deaths	per 1000
Pneumonia	3 136	24,41	274	3,13
Pulmonary Tuberculosis	238	2,72	43	0,49
Miners Phthisis	61	0,70	7	0,08
Scurvy	69	0,80	0	0
Meningitis	26	0,30	19	0,22

(41)

Table III : Incidence and mortality from specific diseases in Rand Mines Group, 1933

Pneumonia continued to be the major killer in the Rand Mines group, accounting for 31 % of the deaths from disease. During 1933 the Rand Mines group repatriated 1 181 miners for disease; of which 198 were repatriated for tuberculosis, 151 were repatriated for pneumonia and 54 were repatriated for phthisis.

Accidents killed 213 miners in 1933 on the Rand Mines group, but 26 995 occupational injuries were recorded. During the year the group repatriated 655 miners due to mining accidents. No mention is made whether or not the miners repatriated for accidents received any compensation.

In conclusion the above case study shows that while the mortality rate from disease and accident was decreasing, the incidence of both remained very high. Whilst pneumonia remained the major killer on the mines, the repatriation process makes it extremely difficult to know what the "real" mortality rate for all diseases should be. Also of note was the high number of shifts lost which prolonged the miners stay on the mines and consequently cost the mining group extra.

6. The Return of the Tropicals

The return of the tropical miners in November 1933 to the Witwatersrand Gold Mines is in a sense a victory for the mining industry, a victory achieved at a very high cost to the miners themselves. It also demonstrates how successful the symbiotic relationship was for the industry.

In November 1933 the South African Government gave permission for "an experimental batch of 2 000 Natives from North of Latitude 22 degrees South " to be sent to the Witwatersrand Gold Mines. Given special sleeping accommodation, diet and extra clothing, the experiment was seen as successful by both the industry and the State. Only 25 tropical miners had died during the first year and 88 others were repatriated (63 for disease and 25 because of mining accidents). (42) Of course the repatriations tend to make a mockery of the success of the initial stages of the reintroduction of "tropicals" to the mines. The mining industry was thus rewarded by the State with more "tropicals", and by 1937 there were 10 448 tropicals on the gold mines. The Chamber's Annual Report for that year records that "These Natives have proved themselves satisfactory from the efficiency aspect, and their mortality has not been abnormal, the death rate from disease since the commencement of the experiment being 15,28 per 1 000." (43) In other words by the end of 1937 only 160 "tropicals" had died since November 1933. But the industry needed more labour and continued to apply for more "tropicals". By 1939 the mining industry was employing 19 260 "tropicals". Significantly the mortality rate had by 1939 decreased dramatically to 5,27 per 1 000. (44) Thus by 1939 the mining industry was re-employing "tropicals" but unlike in the reconstruction period (1902-1910) when "tropicals"

had little chance of survival, the mining industry was now in a position to offer an improved health and safety system to the "tropicals".

Conclusion

The reintroduction of "tropicals" to the Black labour force on the Witwatersrand gold mines was a test that the State felt the mining industry had successfully passed. It also demonstrates that by 1939 the symbiotic relationship that characterised relations between State and mining industry in so many spheres was now also the mode of operation in the health sphere.

The 1930's had witnessed a steady decrease of mortality rates from disease and mining accidents, whereas incidence for both continued to remain relatively high. The ensuing decades were never again to witness such decreases in mortality. In 1939 the mortality rate for disease had been 3,27 per 1 000, and 2,53 per 1 000 for mining accidents. By 1949 the mortality rate for disease had only decreased to 3,10 per 1 000 and only to 2,15 per 1 000 for mining accidents. (45) Thus by 1939 the foundations of the health and safety system for the Witwatersrand gold mines had been laid. While changes obviously occurred in the following years, fundamental changes did not. It is only in recent years with the advent of a powerful Black trade union on the mines and the increasing threat from AIDS that the gold mining industry is again being forced to re-assess its health and safety policy on the mines.

End Notes

1. Benson J, "Mining Safety and Miners Compensation in Great Britain, 1950-1900", paper presented at the International Mining History Congress, (Bochum, September 1989)

2. This group includes S Moroney, "Industrial conflict in a labour repressive economy; Black labour on the Transvaal gold mines, 1901-1912", unpublished honours dissertation, (University of the Witwatersrand, 1976); E Katz "Silicosis on the Witwatersrand gold mines with particular reference to the Miners' Phthisis Commission of 1902 to 1903" presented at the History Workshop, University of Witwatersrand, February 1978; L Callinicos, Gold and Workers, 1886-1924, I, Ravan Press, Johannesburg, 1981; H van Asweging, "Miners phthisis and the gold mine workers of the Witwatersrand 1886-1920", paper presented at the SA Historical Association's Conference, Pietermaritzburg, January 1989; R M Packard, "Tuberculosis and the development of industrial health policies on the Witwatersrand", 1902-1932, JSAS, vol. 13 no. 2, January 1987, pp 187-209.

3. D Yudelman, The Emergence of Modern South Africa, (David Philip Cape Town) 1984, has only four references to health issues; while A Jeeves, Migrant Labour in South Africa's Mining Economy, (Witwatersrand University Press Johanessburg) 1985 has slightly more, 18 references to health issues.

4. R M Packard, "Industrial Production, health and disease in Sub-Saharan Africa", Social Science and Medicine, vol. 28, no. 5, 1989, pp 475-496.

5. M Couch "Workers' Health and Safety in the Broken Hill Mining Industry : The Generation of Competing Rationalities", paper presented at the International Mining History Congress, (Bochum, September 1989).

6. Packard, 1987, p 187

7. Figures taken from 1903 Transvaal Chamber of Mines Annual Report and 1910 Transvaal Chamber of Mines Annual Report

8. The Coloured Labourers Health Regulation Ordinance of 1905

9. This figure is compiled from the 1903 Transvaal Chamber of Mines Annual Report

10. Figure taken from the 1910 Transvaal Chamber of Mines Annual Report

11. Figures taken from the 1930 Transvaal Chamber of Mines Annual Report

12. The 1913 Gorgas report was drawn up by Colonel Gorgas, a leading American health administrator who at the time of the report was supervising the health and safety system for workers building the Panama Canal. Gorgas was asked by the Chamber to make recommendations for a health and safety system to be established on the Witwatersrand gold mines.

13. See A Jeeves, pp 227-35, for an excellent discussion on the debate surrounding the banning of "tropical" miners.

14. Figures taken from the 1930 (Transvaal Chamber of Mines Annual Report

15. Much of the evidence to the 1931 Low Grade Ore Commission reflects this pessimism

16. Figures taken from 1940 Chamber of Mines Annual Report

17. D Yudelman, p. 261

18. D Yudelman, p. 259

19. See M Lacey, Working for Boroko, (Raven Press, Johannesburg) 1981 for a discussion on the competition for Black labour.

20. Figures taken from 1940 Transvaal Chamber of Mines Annual Report

21. See the Transvaal Chamber of Mines Annual reports for the period 1930-1939.

22. See M Lacey for details

23. R M Packard 1987 and B Kennedy A Tale of Two Mining Cities (A D Donker, Johannesburg) 1984

24. In 1925 Cluver wrote a report titled the "Desirability of Central Health Control for the whole industry", dated 16/3/1926, Department of Public Health records, State Archives, box 390, 28/5. More recent reports can also be found by Cluver relating to the centralisation issue.

25. Dr Cluver, 1925, as above

26. Proceedings of the Mine Medical Officers Association XV, no. 164, May 1935, p. 80

27. Letter from Mitchell to Chamber of Mines, dated 6/6/1929, Department of Public Health records, State Archives, box 929, 4/702/13A.

28. Minute dated 29/4/1930 of the Mine Medical Officers Association, Mine Medical Officers Association Archives.

29. Minute dated 25/4/1929 of the Mine Medical Officers Association, Mine Medical Officers Association Archives.