

SILICOSIS OF THE WITWATERSRAND GOLD MINES:

INCIDENCE AND PREVALENCE; COMPENSATION; 1902 - 1978.

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"I've witnessed some terrible scenes. I've been a nurse for years, but I must confess all the awful things one sees in life are mere details to those we see on the Rand. I've known great strong men reduced to mere skeletons, gasping, praying and begging of us to get them breath."

Silicosis is an incurable non-infectious occupational disease. It is one of the pneumoconioses, a generic group of lung diseases associated with dusty occupations. Silicosis is caused by continuous inhalation of microscopic particles of free silica (quartz) dust measuring from one to three microns in diameter (a micron is equivalent to 0,0001 centimetres). If these particles penetrate to the deep lung tissue, over a period of time they cause fibrosis. This means they produce an excess of scar tissue in the form of concentric nodules around the tiny lymph, air and blood vessels and thereby cause permanent damage to the lung tissue. If these nodules enlarge and proliferate to an excessive degree, the exchange of gases in the lungs is seriously impaired, and a heart condition - cor pulmonale - becomes the cause of death of the silicotic victim.

Workers are at risk of contracting silicosis in numerous occupations where quartz dust is encountered, including sand-blasting, tunnelling, the manufacture of abrasives and monumental masonry. Silicosis, formerly generally known as miners phthisis, is of crucial importance to the

South African gold mining industry. This is because the matrix in which the gold is embedded contains 60 to 80 per cent quartz; and in certain dust-producing mining processes quartz dust has been measured in high concentrations of 40 per cent.

In the early days of the Witwatersrand gold mining industry - established in 1886 - the incidence, prevalence and mortality from silicosis exacted a heavy toll of the health and lives, particularly of white miners, the majority of whom were of overseas origin. It has often been suggested that silicosis, which emerged as a serious problem on the Witwatersrand mines after the Anglo-Boer War, had its origins from 1892, with the opening of the deep level mines and the introduction of machine-drills in underground dead-end development tunnels lacking ventilation. These solid steel machine-drills were used without jets of water or atomisers, and produced much finer dust in greater concentrations than the earlier hand-held hammer-drills. However it is arguable that development work in the outcrop mines (and other occupations in outcrop and deep level mines) exposed miners to the risk of contracting silicosis in a simple or chronic form. In the absence of X-ray apparatus the disease which was slow developing, was not diagnosed until it had progressed to an advanced stage in miners or considerably older age than of machine-drillers. The latter contracted chronic silicosis in a rapidly developing acute form, or complicated silicosis, known as progressive massive fibrosis, which can be caused by excess concentrations of dust in the lungs.

The Miners' Phthisis Commission of 1902 to 1903 (Milner's Commission) calculated that the average working life of a Witwatersrand machine-driller was seven years, and that the average life-span of a Witwatersrand miner was thirty-seven years, in contrast to gold miners in Australia who on average lived to fifty years. The commissioners also deplored the unsanitary underground conditions as being conducive to contracting infectious diseases. Although it was known that tuberculosis

frequently accompanied silicosis (until the 1930's many medical authorities still believed that silicosis was a form of tuberculosis) it was not yet understood that when tuberculosis is super-imposed on simple silicosis the disease becomes complicated (progressive massive fibrosis ensues) with probable death within two years.

Milner's Commission made numerous general recommendations for the suppression of dust underground and the improvement of ventilation, but new regulations were perfunctory, ineffective and remained largely a dead letter. One of the greatest hazards was promiscuous blasting. Any miner could return to the working place immediately after blasting, while the air was still vitiated with dust and gases, especially nitrous dioxide given off by dynamite. Nitrous dioxide suppresses the defense mechanisms of the respiratory tract and thereby facilitates the penetration of silica dust to the lungs. In 1919 promiscuous blasting ceased with the introduction of the compulsory single-shift day.

Two further commissions of 1907 and 1911 concluded that the prevalence of silicosis - that is the overall number of cases - had not diminished since 1903. Using X-ray equipment the 1911 'Medical Commission' estimated the prevalence of silicosis at 32 per cent, considered the figure of 23 per cent, calculated in 1903, as an underestimation, because many miners had died overseas, and forecast that unless mining conditions improved the prevalence would increase.

The reports of these two commissions and the 1913 general strike (one of the causes of which was the miners' grievance concerning the lack of initiative by the authorities in taking steps to eradicate silicosis) led from 1914 onwards to improvements in the elimination of dust underground. Mechanical ventilation was gradually installed, in 1914 routine dust sampling was introduced, and dust measurement techniques and prophylactic aids

slowly improved. The development of light hollow drills with simultaneous water ejectors continued and in 1921 it was stipulated that no machine-drill could be used on the mines without prior permission of the Department of Mines.

Practical calculations as well as moral considerations led to improvements. By 1914 the Witwatersrand mines, notorious as death traps, no longer attracted itinerant, single overseas miners, as they had in the early palmy days when despite the well-known attendant hazards, miner-contractors hoped to earn, as some had, monthly wages of £90 to £150. Management and the government were obliged to concern themselves with what had by now become a largely permanently settled white mining population.

Of importance was the innovation of 1916, whereby all aspirant white miners—the 'New Rand Miners' — were obliged to undergo a compulsory X-ray and physical examination (followed by periodic medical examinations) before being allowed to work underground. From this time incidence figures for silicosis — the number of cases produced in a single time-span, normally a year, could be calculated. From 1916 to 1930 the prevalence of silicosis for the 'New Rand Miners', who comprised 8 360 (54 per cent) of the white mining force was 42, as compared with the 'Old Rand Miners', a declining population group, amongst whom 321 cases were produced during the period 1928 to 1929.

By 1930, however, the general nature of silicosis in its advanced stages had changed and was far more often complicated than before by the highly dangerous condition, caused by the superimposition of tuberculosis. The increase safeguarding the incidence of co-existent tuberculosis can perhaps be attributed to the fact by 1929 more than 70 per cent of miners were South Africans born, and like African workers who had also been drawn from rural areas, had not yet acquired an urban immunity to tuberculosis.

The incidence and prevalence of tuberculosis amongst Africans is important, because during the period 1902 to 1929, on the few occasions when silicosis amongst

Africans was reported, it was mainly found to be in a form complicated by tuberculosis. From 1902 to 1907 tuberculosis contributed, 18 per cent of the mortality amongst African miners (pneumonia accounting for 40 per cent) at a time when the death rate amongst African miners was very high. For instance, the average death rates from disease amongst African miners in the first and second halves of 1903 were 61,96 and 80,36 per thousand respectively. From 1916 to 1929 the annual incidence of tuberculosis dropped by approximately one-third, possibly because suspected African tuberculosis were referred by the Witwatersrand Native Labour Association (WNLA) or the Mine Medical Doctors to the Miners' Phthisis Medical Bureau for examination. However incidence figures were based only on referred cases and it is probable that many cases remained undiagnosed, and incapacitated Africans returned to die at their kraals.

Intermittency and short periods of service on the mines have usually given us the reasons for the theory as to why the incidence of silicosis is low amongst African miners. However intermittency of service has not yet conclusively been proved to be a valuable safeguard for miners at risk. Also it is highly debateable as to whether periods of service amongst Africans were in many cases as short as has been alleged.

The evidence suggests that Africans spent longer continuous periods working underground in the mines before the Anglo-Boer War than after it. After 1902, despite their shorter contract periods, Africans, especially those from Portuguese East Africa, reindentured several times by 1912, for single periods of eighteen months. It is therefore highly probable that Africans, who from 1897 handled the machine-drills under white supervision, contracted silicosis during the period when the incidence and prevalence of silicosis was at its height. However it may have been misdiagnosed when tuberculosis or pneumonia masked it; and it is also probable that many Africans suffered from or died of undiagnosed silicosis at their kraals, as was alleged by medical authorities in 1903.

The methods of examining recruits also strongly suggest that the official estimates for the incidence and prevalence of silicosis amongst Africans appear to have been underestimated. By 1925, for instance, sixty recruits were stethoscopically examined per hour by a single doctor at the WNLA depot, a method to-day known to be a completely useless diagnostic aid. Only Africans who had worked for five consecutive years and others suspected of having silicosis were sent to the Miners Phthisis Medical Bureau for X-ray examination. Also the policy of repatriating silicotics and tuberculotics after a short period of convalescence, and when they seemed sufficiently fit to travel, probably concealed a higher mortality rate than that conceded be official figures. However even if the incidence of silicosis amongst Africans was underestimated, the evidence indicates that it was considerably lower than that for pneumonia and tuberculosis and certainly lower than the silicosis rate amongst whites. But as late as 1943 a commission reported that the examination, after care and compensation for blacks suffering from lung diseases was a matter of great concern.

During the period 1911 to 1925 a number of acts were passed dealing with compensation for silicotics of all races, the majority of which have been precedents for the legislation of to-day. It is still the function of the Department of Mines to list 'controlled' mines (in 1925 they were called 'scheduled mines' where mineworkers are considered to be at rest. Also each mine is obliged to contribute a levy per surface or underground mineworker considered to be at risk to the compensation fund; and such levies vary from mine to mine according to the incidence of silicosis contracted there. Mine workers at risk now include all those who spend more than fifteen minutes underground per shift.

With the introduction of compensation for tuberculosis in 1916 another precedent was established. If it is believed that any form of minework (in particular underground work)

is responsible for a worker contracting a disease, the disease will become compensable. It used to be thought that chronic bronchitis and emphysema were integral to silicosis. To-day, however, they are listed as a separate compensable disease called Chronic Obstructive Lung (Airways) Disease - COLD. COLD is a complication of chronic bronchitis and/or emphysema which causes an obstruction to lung function or breathing and is diagnosed by lung function tests. In COLD the patient has no difficulty inhaling air, but on exhalation the obstruction is clearly shown because he has literally to squeeze the breath from his lungs. While other non-related mining factors, including cigarette smoking and environmental pollution undoubtedly are important cause/s of COLD, it was made a compensable disease in 1973, because it was believed that inhalation of mine dust over a long period of time might contribute to the condition. Finally, a rare disease, (six cases were diagnosed in 1974) systemic sclerosis was made compensable in 1974. It is a condition in which a diffuse rash spreads on the skin and internal organs including the lungs.

In assessing compensation awards the degree of disability has always been a determining factor allowing for variation in awards. In 1912 differing compensation was awarded to silicotics who had the disease in its primary or secondary stages, and in 1919 an additional ante-primary stage was instituted. To-day the application of this principle is by any standards a flexible one. For compensation awards in the first degree there must be pneumoconiosis or any other disablement of the cardio-respiratory organs between 20 and 50 per cent, while second-degree awards are granted if silicosis (or other forms of pneumoconiosis) are co-existent with tuberculosis, or cardio-respiratory disablement is between 50 and 75 per cent.

The compulsory X-ray and medical examination of white and black miners (those who had five years continuous service) introduced in 1916 and 1925 respectively has continued.

Today every mineworker whose job is considered at risk is obliged to have a certificate of fitness renewable every year (or second year) for whites and every six months for Africans. Only white workers are examined at the Medical Bureau. Mine Medical Officers examine Africans and if they suspect patients of having compensable diseases they send case histories and X-rays to the Bureau for investigation by the Certification Committee.

Once an African is certified as having a compensable disease, he is immediately repatriated and is not allowed to work again on a 'controlled' mine. Compensation is paid to him by the relevant black affairs authority from compensation fund for Africans, either in a lump sum or in monthly instalments at the discretion of the official. In contrast, white miners certified in the first degree receive compensation, but may continue working until they have second-degree disablement, whereupon they receive additional compensation, but have their certificates of fitness removed. Similarly a recovered white tuberculous, after receiving compensation, (unlike the earlier days) may return to the mines provided he performs no risk work.

However the huge differences in compensation awards accorded whites and Africans, a precedent set in 1912, are of great importance to concerned persons interested in eliminating racial inequalities. In 1912 whites who had primary and secondary stage silicosis received £96 and £400 respectively, while Africans in the same categories received £1 to £30, and £30 to £50. In 1919 with the introduction of the ante-primary stage of silicosis the following (simplified) schedule was applied:

- (a) That compensation is twelve times monthly earnings, for earnings up to £29 - 3s - 3d. This category applied to Africans, and coloureds and Indians, as white underground miners did not earn less than £30 per month.

- (b) That compensation, is six times monthly earnings, for earnings of £29 - 3s - 4d to £37 - 9s - 11d. This category applied to this underground miners.
- (c) That compensation is three times monthly earnings, for earnings exceeding £37 - 10s - 0d. This category applied to white officials.

In primary-stage silicosis and tuberculosis the same categories were applied with an additional 50 per cent for each category. In secondary-stage silicosis whites received annual life pensions awarded on a monthly basis. African did not receive pensions, but a lump sum based on category (a) but increased by 100 per cent.

Today the same discrepancies in compensation awards are still very marked. For first-degree awards whites receive a lump sum of R12 000 in contrast to the lumpsum of R1 000 accorded Africans; and in second-degree awards each racial group receives R18 000 and R1 200 respectively. Finally whites receive R5 000 for tuberculosis in contrast to Africans who receive R600.

None of the sources consulted provide the principles on which compensation awards are based, nor the rationale for the differences in awards accorded the separate racial groups. Although there has been a strong correlation between awards granted coloureds and Indians, and whites - the former have since not been allowed to receive amounts exceeding 50 per cent of those awarded to whites, since 1914 - there does not seem to be a similar correlation between blacks and whites, based either on cash earnings or compensation awards. In addition, the varying categories of degrees of disablement for silicosis have made it impossible to compare compensation awards of the past directly with those of the present for silicosis.

However from 1916 to 1978 tuberculosis has always been compensated as a separate disease and it is therefore the only constant which can be used to measure and analyse disparities in compensation awards. In 1919 compensation

based on the 1919 table cited above Africans and whites with tuberculosis was a minimum of £47-6s.8d and £270 respectively. The following table illustrates the ratios of white; black earnings and white: black compensation awards in 1921 and 1973.

Table I

Average Annual Wages and Salaries on Gold Mines in Rands

<u>Year</u>	<u>White</u>	<u>Non-White</u> (99% are Black)	<u>Ratio White:Black</u>
1973	5 724	341	16,8 : 1
1974	6 762	545	12,4 : 1
1975	7 607	906	8,4 : 1
1976	8 449	1 072	7,9 : 1
1977	9 319	1 197	7,8 : 1

The following Table II indicates the rise of wages for African novices:

Table II

Starting Monthly Cash Wages (African novices) in Rands

<u>Effective Date</u>	<u>Underground</u>	<u>Surface</u>
June 1971	10,92	8,84
1972	13,00	9,88
1973	-	-
1974	-	-
June 1975	57,20	36,40
June 1976	65,00	40,30
Aug 1977	68,90	42,90
July 1978	76,70	50,70

<u>Year</u>	<u>Blacks</u> (low/ave monthly cashwage)	<u>Whites</u> (low/ave monthly cashwage)	<u>White:Black</u> (underground cash earning)	<u>White:Black</u> (compensation awards)
1921	£2-16s-0d	£30-0s-0d	10,7:1	5,9:1
1973	R32-00	R330-00	10,3:1	8,3:1

Thus while the ratio of White : Black cash earnings was lower in 1973 than in 1921, the ratio of White : Black compensation payments increased.

Since 1973 there has been a marked decrease in the ratio of White : Black average cash earnings on the mines. For all mineworkers on gold mines (underground and surface) the ratio of White : Black cash earnings fell from 16,8 : 1 in 1973, to 7,8 : 1 in 1977. This is shown in the following Table II.

Between 1971 and 1976 white mining wages were approximately doubled while those for Africans quadrupled. The wage increase in average African earnings per month before August 1977, that is for the year 1976 to 1977, was R102,40, whilst for the year 1978 they increased to R115. But compensation payments for Africans have not been readjusted in proportion to the substantial increase in African cash wages.

However, since 1977 Africans have worked for shorter average periods. This has induced management to encourage Africans to return more frequently and to engage in mining on a full-time basis. If this should occur then readjustment in all compensation awards will be virtually necessary. Recently it has been suggested that mining does not increase the risk of tuberculosis.

It is claimed by some authorities that tuberculosis is not a mining disease at all, and that the industry is being forced 'to pay for its past sins' (which have) 'long since ceased to be the case.' This is attributed partly to the strict protective procedures adopted by the mines in examination and vaccination of patients. Other authorities however, maintain that there may be good reason for retaining tuberculosis as a compensable disease on the mines. This argument hinges on the fact that stress - an important factor amongst migrant labourers - may be a cause of tuberculosis. If stress is proven to be one of the causes of tuberculosis, the mines may play an important role in creating conditions for its production. Because the co-existence of tuberculosis with silicosis is a dangerous lung condition, and is still prevalent amongst Africans (as shown in Table V below) and until it is conclusively proved that there is no incidence of this highly infectious disease on the mines, it would seem that the continuation of compensation for tuberculosis is necessary. In addition, the Medical Bureau for Occupational Diseases stated in its 1973-1974 report that tuberculosis, despite intensive efforts by the Mine Medical Officers to control it, 'continues to be a predominant reason for certification, for which a solution does not yet appear to be in sight'.

The principle on which less compensation is awarded black silicotics may be because of the belief that their intermittent service renders them less liable to contract the disease than full-time White miners. However, this theory has not been proved or disproved. Experiments undertaken with animals have also shown that short but concentrated periods of high dust exposure may cause the disease to develop far sooner in such cases than in others, who have had average amounts of dust exposure, the total of which is the same

as the former, but over a very lengthy period of time. As Africans today are subjected to these short periods of very high dust concentration, they may, in fact, contract the disease in a far shorter time than whites.

It is very difficult to find figures for the incidence of silicosis on the gold mines. This is because the tables concerning the gold mining industry in the Reports of the Medical Bureau for Occupational Diseases only show new certifications, without indicating whether they are for silicosis alone. Therefore one does not know whether new certifications are for cardio-pulmonary disability or for any of the compensable diseases, including silicosis.

The tables providing incidence figures for silicosis are equally unsatisfactory. This is because the figures include all cases of silicosis, a number of which have been contracted in occupations other than mining. For instance in 1973 seventy cases alone were contracted in occupations. The mortality tables for silicosis in the Reports of the Medical Bureau for Occupational Diseases throw no light on this question either. This is because compensation is often awarded in many post mortem cases, when a man has not been certified in life. If one or several silicotic nodules are found, visible only with a microscope, and impossible, while the man was alive, to detect by radiography, he is certified as a silicotic and his dependents are awarded compensation in the first degree. What is important is that these microscopic nodules cause no discomfort or disability during life, and are as harmless as a healed scar on the skin. In addition, if on autopsy these harmless minute silicotic scars are found together with a microscopic lesion of tuberculosis (one which is latent and could have remained quiescent for years) the deceased will be certified and his dependants awarded compensation in the second degree.

The Reports of the Medical Bureau for Occupational Diseases reflect the following incidence of silicosis in all occupations in the first degree, in new cases for white and coloureds.

TABLE IV

<u>Year</u>	<u>Whites and Coloureds in first degree</u>
1973-1974	72
1974-1975	163
1975-1976	153
1976-1977	164

In the case of Africans, the degrees of silicosis are not noted, but an additional table shows silicosis together with tuberculosis.

TABLE V

<u>Year</u>	<u>Silicosis</u>	<u>Silicosis and Tuberculosis</u>
1973-1974	no table provided	
1974-1975	557	976
1975-1976	589	1 186
1976-1977	801	1 299

Also of interest is the average number of years served by whites and coloureds in the gold-mining industry before being certified, (in any way in the first degree.

TABLE VI

AVERAGE NO. OF YEARS

1973-1974	25
1974-1975	24,9
1975-1976	22,8
1976-1977	25,0

One must therefore, on the basis of this table, in particular, conclude, as does the Medical Bureau of

Occupational Diseases, that 'Pneumoconiosis is neither so common nor so serious a disease now as it was 40 years ago'; or, as has been more optimistically stated, the incidence of the disease is now 'minimal' amongst the workers of the gold mining industry. While the problem of silicosis in gold mining has to a very large extent been solved - the Chamber of Mines spends R70 000 000 per annum alone on ventilation - COLD is now of growing concern to the authorities and doctors. When COLD was originally introduced as a separate compensable disease, it was thought that its incidence was caused by long-term dust exposure and was therefore common to miners of long service. It was, therefore, also believed to be relatively uncommon amongst Africans. It is a disease difficult to diagnose by clinical examination or X-rays, and has to be performed by lung function tests, the equipment for which is of an excellent standard both on the mines and at the Bureau.

Since the introduction of COLD as a compensable disease, preliminary epidemiological tests have been performed by the National Research Institute for Occupational Diseases. Doubt now exists as to whether it is caused by dust exposure; and it is believed that it may be the result of underground atmospheric pollution. Also there is growing concern about its prevalence amongst young African males. His prevalence was discovered as a result of post mortem examinations of young Africans who had died from accidental causes. While alive they had expressed no discomfort from the disease nor had they exhibited clinical symptoms of COLD on medical examination. Control of this disease will now have to become an important research area for dust control engineers, pathologists, epidemiologists and experts in the field of environmental pollution.

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