McCulloch, J. (2003): Asbestos Mining and Occupational Disease in Southern Rhodesia/Zimbabwe, 1915-98. – Hist. Workshop J.,(56):131-152, 2 Abb.

Asbestos Mining and Occupational Disease in Southern Rhodesia/Zimbabwe, 1915–98

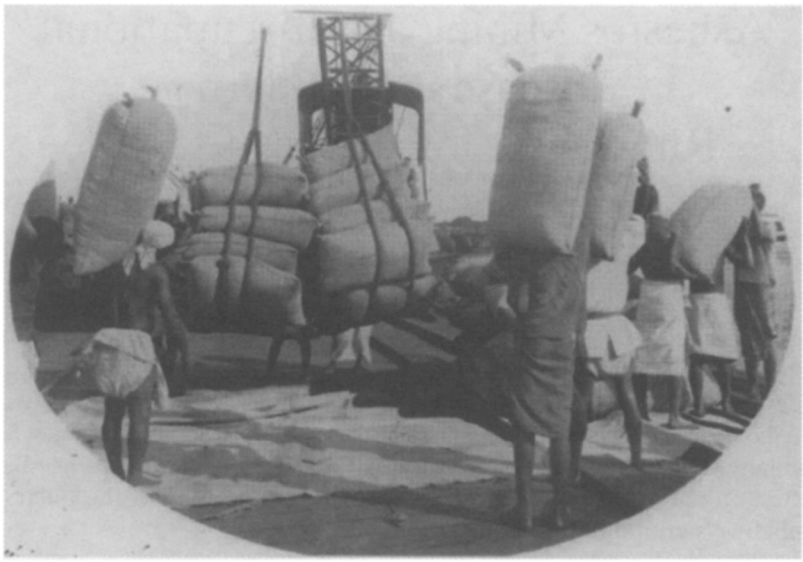
by Jock McCulloch

Mining has been one of the mainstays of southern African economies for over a century. Its importance in shaping the region's relative prosperity has made the industry an important topic of historical research. Zimbabwe is no exception. But while there is a rich literature on the gold mines which originally drew white settlers to the territory in the 1890s, little has been written on the asbestos mines which today constitute one of the pillars of Zimbabwe's crumbling economy.

To the touch, a piece of raw asbestos feels like rock yet surprisingly it is possible to tease apart individual strands with one's bare fingers. When placed under a microscope, each fibre can be seen to consist of thousands of fine threads which can be subdivided almost infinitely until molecular dimensions are achieved. This remarkable quality helps explain the wide commercial appeal of asbestos. The same attributes create serious health problems for those who mine it and who manufacture or use asbestos-based products.

Asbestos was mined and used sporadically in parts of Europe and Asia for more than three thousand years but it was not until the revolution in manufacturing and transport which occurred at the end of the nineteenth century that its remarkable versatility was fully exploited. Asbestos affords protection against corrosion, acids, alkalis, electricity, vibration, frost, and vermin. It can be woven, sprayed and mixed with other materials. Above all, its resistance to high temperatures makes it invaluable in any process involving the conversion or preservation of heat. The most common form of asbestos is the serpentine group to which chrysotile, or white asbestos, belongs.[1] This mineral, which was used mainly as insulation and in bonded cement sheeting, began to be mined in what was then Southern Rhodesia in 1915. It continues to be mined today.

In May 1995 the Chase Manhattan Bank launched a suit in a New York court for $US185 million in damages against the British asbestos company Turner & Newall (T&N). The claim was for the removal of asbestos insulation from the bank's Wall Street headquarters. Chase argued that T&N was aware that its products were unsafe when the insulation was installed and therefore was liable for the costs of removal. At its peak in the 1970s T&N was the dominant asbestos manufacturer in Britain accounting for around half of that country's output. T&N also dominated chrysotile-asbestos mining in Southern Africa, where its investments were concentrated at



Zimbabwe National Archive.

Asbestos being shipped from the port of Beira, Mozambique, 1929.

Zimbabwe National Archive.

Balmain mine. Mashaba. 1920s

Havelock mine in Swaziland and at Shabanie and Gaths (Mashaba) mines in Southern Rhodesia. Those mines, which were crucial to T&N's global success, produced high-quality chrysotile or white asbestos. The company monopolized the industry to such an extent that the history of asbestos mining in Southern Rhodesia/Zimbabwe is largely the history of T&N.

The Chase Manhattan suit failed but it opened up public access to T&N's archives. Those records, which run to over a million pages, give an inside account of work conditions and occupational disease among the company's British workforce. Geoffrey Tweedale's *Magic Mineral to Killer Dust*, which is based on the T&N papers, identifies the numerous ways in which that company and its subsidiaries failed to comply with occupational-health regulations in the UK, failed to warn employees of the dangers they faced, fought hard to frustrate legitimate claims for compensation, suppressed evidence of the link between asbestos and the most lethal of the asbestos-related diseases, mesothelioma, and sought to corrupt the research process through the Asbestosis Research Council.[2] The archive, which includes in-house correspondence about the operation of T&N's mines, suggests that the company's record in Africa was even worse.

There is no secondary literature on the asbestos mines and the holdings in Zimbabwe's National Archives on the industry's history are incomplete. They are also unreliable. The Departments of Mines and Health, whose duty it was to inspect the mines and ensure that owners complied with occupational-health legislation, lacked the material resources and political will to meet their obligations and the records they have left are seriously compromised. To some extent historians working on occupational-health often face such circumstances. However, in this instance other factors are at work which render the history opaque. The gaps in the archival record widen between 1965 and 1980, the Unilateral Declaration of Independence period, when the industry was clothed in secrecy and even basic records are unavailable. That happens to be the period when production levels peaked and disease rates among miners were probably at their height. Over the past twenty years T&N has been plagued by litigation which has further politicized the archival trail thereby increasing the gaps in the record. Taken together those circumstances have discouraged anyone from working on the history. Fortuitously, some asbestos litigation has as a by-product opened up public access to company documentation of a kind rarely available to historians. In the case of T&N's archive the correspondence from the late 1970s about Shabanie, Gaths and Havelock mines offers a unique record of the company's behaviour. Much of that material is about occupational disease and reveals management's determination to continue to mine asbestos despite the risk to T&N's African workforce.[3] The picture given in the correspondence of conditions in the mines could not be further removed from the company's public pronouncements nor from that available in the public record.

Turner & Newall did no research into occupational health at Shabanie

or Gaths and as late as 1987 its consultant physician, Dr Peter Elmes, commented that there was simply no data on the incidence of disease.[4] Therefore to gauge what those rates may have been it is necessary to extrapolate from the group's other operations. From 1978 T&N commissioned a number of surveys at Havelock where the fibre and the plant were much the same as at Shabanie and the rates of asbestos-related disease were probably similar. The first survey of 271 workers at Havelock found 23% of employees had asbestosis, a debilitating fibrosis of the lung, while the incidence among mill workers was 54%. In addition 17% of workers had chronic bronchitis and other chest disorders, including pneumonia and tuberculosis, were also common.[5] Those results need to be put into context. In 1978 the rate of asbestosis at T&N's Quebec mines was 5%.[6] A follow-up study at Havelock found two cases of asbestosis in miners' wives.[7] Presumably the women, who had no occupational exposure, contracted the disease from the dust pouring out of the mill and from the massive tailings or waste dumps which surrounded the mine.

To be profitable Zimbabwe's mines had to run at full capacity but the limitations of the plant meant that the more ore that was put through the mills the higher the levels of dust and the higher the incidence of disease.[8] In March 1981 T&N compiled a report on dust at a number of its overseas subsidiaries to see which of those operations were in excess of then-current UK regulations of two fibres per millilitre (f/ml). At Havelock most of the mill complex was well above that figure and there were serious problems at Shabanie and Mashaba.[9] The report noted that it would be difficult to achieve better results. In the case of Havelock the only solution was to build a new mill which would have cost a million pounds while at Shabanie and Mashaba T&N's advisers doubted there was any technology which could make the mills safe. Zimbabwe achieved majority rule in 1980 and T&N was soon in conflict with the new government. S. Gibbs, one of T&N's senior officers, wrote to the company's general manager C. Newton in August 1982:

> Public access to the information that we have regarding (work conditions) at Shabanie and Mashaba Mines could explode a bomb that would wreck T&N without any assistance from the Zimbabwe government and that we may find ourselves under considerable pressure from our shareholders to withdraw from Zimbabwe.[10]

In 1982 a new mill at Shabanie was opened but it made little difference. Dr Peter Elmes who visited Shabanie in September 1985 noted, 'Under existing conditions, and as the (Zimbabwean) authorities adopt international hygiene standards, this mine is likely to be closed because of the continued dusty conditions in the mill and the manifest x rays changes in the older workers'.[11]

The comments by Gibbs and Dr Elmes, which were never intended for

public scrutiny, give an account of work conditions at the mines that contradict T&N's statements to shareholders and the British public. They also contradict the documentation available from regulatory authorities in Southern Rhodesia and the testimony of medical officers who worked at Shabanie.

MINING ASBESTOS

Zimbabwe's asbestos deposits are extensive but the fibre grade is generally poor except at Shabanie and Mashaba, which lie in the country's south east.[12] Chrysolite fibre was exhibited at Bulawayo in 1906 but there was no commercial interest in the mineral and it was not until 1915 that the claims held by the Rhodesian and General Asbestos Company were originally staked and mining began.[13] In 1919 the Nil Desperandum mine was taken over by the African Asbestos Mining Company Ltd, a subsidiary of Turner Brothers Asbestos Ltd, the forerunner of T&N.[14] Most mining was done by hand and before the completion of the rail extension to Shurugwi asbestos was moved by teams of oxen.[15] The milling of asbestos requires large quantities of fuel to run turbines and machinery, and so those mines far from the rail line struggled.[16] The industry's profitability depended upon cheap labour, and expenditure on accommodation, food, and medical care was kept to a minium. The same was true of occupational-health and safety measures.

Over the decade to 1926 a larger mine was gradually formed at Shabanie from what were originally four separate claims. Shabanie is part of the town of Zvishavane; fifty kilometres north east is Mashava where Gaths is found. The present mine site has been worked continuously for more than sixty years and fibre from Shabanie is railed to ports in South Africa and Mozambique from where it is exported to more than fifty countries. Today Shabanie is the largest underground asbestos mine in the world, with the capacity to process 250,000 tons of ore a month.[17]

Zvishavane has always been a company town and in contrast to other small towns in Zimbabwe there is more employment and less poverty. A job at the mine is highly valued and the main street is crowded with hotels and small shops. The mine and the town are surrounded by hills as in a bowl and in summer the temperatures are oppressive. The Shabanie mill, which dominates the landscape, is probably the largest building in Zimbabwe; its construction was certainly the most expensive project undertaken by the private sector. The town is also surrounded by thirteen tailings dumps, the biggest of which are hundreds of feet in height. They encroach on the high-density townships and in some places run to within fifty metres of domestic dwellings. The heaps, which have accumulated over the mine's lifetime, contain friable asbestos which during the dry season becomes airborne.

The chrysotile from Shabanie and Gaths varies in length from a fraction of an inch up to two inches, and has a low iron content. A notable feature

of Zimbabwe's mines is the high-quantity spinning fibres they produce. They are ideal for pressure pipes and long-span cement sheeting.[18] The fibre quality enabled the mines to overcome their isolation from world markets and their relatively small size which put the local industry at a disadvantage against Canadian and USSR producers. The industry is now concentrated into the hands of a single company, African Resources Ltd. In 1998 asbestos was Zimbabwe's third or fourth foreign-exchange earner and together the mines brought in around one billion Zimbabwe dollars.[19] Since the land crisis and the resulting collapse of the tobacco and tourist industries, asbestos is probably Zimbabwe's major export.

When production began in 1915 the ore was extracted by open-cast methods. Mining was done in stopes (benches) where the rock was broken apart, and cobbed or processed by hand. To preserve its physical characteristics asbestos is milled dry which means that milling always creates dust. After arriving at the mill the ore was fed into primary crushers, then crushed and sorted.[20] The ore was then crushed again, and the fibre lifted off by suction in a process that generated large amounts of airborne fibre. Because the ore body inclines into the earth, over time it was necessary to remove an ever increasing overburden. Mining first went underground at Shabanie in the early 1940s and over the following decades there was a mixture of strip mining and shafts.[21] The last of the quarries closed in the 1980s.

Southern Rhodesian producers were often forced to respond to movements in the Canadian and Soviet industries which during the 1920s began to sell their short fibre at below cost.[22] To meet that challenge in 1929 T&N reorganized its mining operations by acquiring a controlling share in the Rhodesian and General Asbestos Corporation. Its strategy was to reduce costs and improve fibre quality.[23] The problem of raw materials had plagued the company for more than thirty years with output fluctuating between periods of scarcity and over-supply. T&N hoped at last to overcome that problem with its greatly increased capacity in Africa. The strategy was successful in the sense that output rose fourfold, from 8,080 tons in 1924 to 36,015 tons in 1930, putting Southern Rhodesia in second place behind Canada.[24] It also created a virtual monopoly which has survived to the present. Prior to the take-over, the Rhodesian and General Asbestos Corporation, T&N's major competitor, produced over half of the country's fibre.[25] Thirty years later there were nineteen companies mining asbestos, but in terms of volume the industry was dominated by one.[26] Turner & Newall mines produced 75% of Southern Rhodesia's fibre and accounted for 83% of the value of production.[27]

A number of factors shaped the industry's structure. At Shabanie there is a massive ore body which initially lent itself to open-cast mining and encouraged the dominance of a few producers. Other deposits were developed at Filabusi and Pangani, but they were quickly exhausted. Turner & Newall got into the industry early and pegged out claims which were the

best in terms of accessibility and fibre quality.[28] Normally, if a pure chrysotile blend is used in asbestos cement sheets or pipes, the final product will warp when taken from the mould before it is fully cured. To overcome that problem manufacturers used a mixture of crocidolite (blue asbestos) and chrysotile. That was necessary with all white asbestos except for the fibre from Havelock, Cassair in British Columbia and the asbestos from Shabanie and Gaths.[29] The unstable market for asbestos, which saw many small producers fail, discouraged newcomers from entering the industry. They were also discouraged by the large capital outlay needed to establish a mine and break into captive markets. The actual value of the product was a further disincentive: a month's production of gold can be carried in a suitcase whereas asbestos is bulky. That in turn raises problems of storage, transport and packaging, all of which take money to resolve. There was also government patronage including rail links, tax concessions and marketing, which from the 1920s favoured T&N.

Following the Great Depression the global industry struggled for much of the 1930s and it was only with the outbreak of World War Two that a sustained recovery was achieved. From 1939 the demand for fibre increased so dramatically there was a problem in carrying out maintenance while continuing to run the mills at full capacity.[30] Maintenance problems continued after the war, as did a lack of spare parts. The periodic labour shortages which plagued the industry until the 1960s had little to do with wages which historically have been competitive. In the 1940s the average monthly wages for African asbestos miners were much the same as for gold miners but 20% below those in the coal industry. The average monthly black wage in 1950 was forty shillings and sixpence as against forty-one shillings for gold and sixty-eight shillings and eightpence for coal miners.[31]

The high temperatures, heavy manual labour and the amounts of airborne fibre in the mills and sorting rooms made conditions at Shabanie gruelling. The conveyor belts which took ore to the mills were open and so dust rained down on the men working below. There were no exhaust fans or attempts at dust prevention, as such machinery would have been expensive to install and expensive to operate. An inquiry held in the late 1930s found dust levels in the mine and quarry of up to 800 particles per cubic centimetre, readings which were far in excess of the levels tolerated in British factories.[32] Lindsay Thompson, who spent his childhood at the mine in the 1940s, remembers that the mills were 'very dirty'.[33] Those conditions continued until the 1980s and probably account for the periodic labour shortages.

From the end of World War Two the demand for asbestos especially in the UK and US was strong and the mines were able to find a market for their fibre. The value of asbestos produced in 1956 in Rhodesia was eight and a half million pounds, which for the first time surpassed that of gold.[34] The mines were highly profitable and during the 1950s and 1960s T&N consistently paid high dividends to investors. In 1955, for example, the

company issued a dividend of 25% to its shareholders.[35] The profitability of the mines was dependent upon labour and the mines had no difficulty in attracting workers.

THE UDI PERIOD, 1965–1979

The global demand for asbestos during the 1960s saw new mines open in Canada and output from the USSR reach 1.5 million metric tons per annum.[36] New deposits were also developed in Kazakhstan and Brazil. Despite the buoyant market the industry remained vulnerable to overproduction and smaller mining companies suffered from the sharp fluctuations in price. A fall in the US steel industry in 1962, for example, affected chrome and asbestos exports, and the sale of Southern Rhodesian fibre fell by 16%.[37]

On the eve of the Unilateral Declaration of Independence (UDI) in 1965, the mines employed 696 Europeans and 7,587 Africans, and exported fibre to more than thirty countries.[38] With UDI an embargo was imposed on the import of Southern Rhodesian fibre into Britain, forcing T&N to buy from outside sources. The company was also denied access to the dividends and cash flows from the mines.[39] However, the sale of Rhodesian fibre was unaffected. The Barberton mill in South Africa was a T&N operation and so Shabanie fibre was shipped south and simply repackaged as South African asbestos.[40] Ironically, UDI was the golden age of the mines and saw record levels of production. In 1970 output had risen to 187,000 tons and it continued to rise steadily until 1979 when it peaked at 259,000 tons.[41] The high output was achieved with antiquated machinery that almost certainly resulted in higher rates of asbestos-related disease.

Edward Mutikani is an underground worker who started at Shabanie in 1963. It was his first job, and he thought the mine a good place to work because there was job security, and employees were well looked after.[42] He started in the CG mill loading fibre bags on to trucks. He was too young to push a wheelbarrow full of fibre to the mill and so he was transferred to work on the compressors. In those days the fibre was packed by hand into hessian bags. There was a great deal of dust and no one warned him about the risk.[43] He worked hard but the pay was good. Some days he began work at six in the morning and did not finish until seven at night. He was very young and like the other workers he lived at the mine. The rations were good and there were beans, fish and meat. His basic rate of pay was three shillings and fourpence a day and there was plenty of overtime. Accommodation was free and he could afford to buy clothes and food.

Mota Chipinge began work at Shabanie in November 1958 at the age of nineteen and has never worked anywhere else.[44] He came from the Shabanie area and his village is close to the town. It was easy to get a job with T&N at that time, and the money was good. The rates of pay were the same for married and single workers: underground workers, three pounds

ten shillings; and for surface workers three pounds per month. Chipinge was given no training and on his first day he went underground where he was assigned to a 'boss boy'. He worked on a load haul and what he remembers most about the first day was the dark. There were many workers at that time and it was hard labour. Miners used a wheelbarrow, shovels and picks and it was dusty. Using the underground cars, they had to complete thirty cars on a shift or they did not get paid and got only rations. There was nothing they could do.[45] It was dangerous underground and there were a lot of rock falls when they were doing draw point work. There was plenty of dust but they were not told that it was dangerous.[46] The married men got mealy meal, relish and a dry ration while the single men got good meals cooked for them at the canteen. The accommodation was very bad for single men and there were four men in bunk beds in one room. The married men had houses with three rooms.

Turner & Newall could not expatriate the profits accumulated during UDI so it decided to invest in a new mill.[47] The construction of the present Shabanie mill, which is the largest and most modern in Africa, began in 1977 and it was commissioned in 1982. The treatment plant has sixteen main floors and gravity is used to convey the ore which is moved up and down the various floors numerous times during processing. Milling is mechanized from the point at which the ore enters the mill. Feeding is done automatically and the processed asbestos is packed into staflene bags, which are then palletized for transportation. The new mill replaced three existing mills and it is so large that it has a greater capacity than the mine, a rarity in the minerals industry. With the exception of the control room, the entire plant was designed and built locally, thereby giving a boost to the UDI economy.[48] The sheer size of the mill says much about the importance of asbestos to the national economy; it also suggests why there has been so little public debate about the industry. Although Zimbabwe is a member of the International Labour Organisation and a party to its conventions, there are no government-sponsored programmes to inform the public or labour about the hazards of asbestos.

The mill presents an image of large investment and high technology. The command room, which controls the entire plant, is akin to the kind of rooms you find in hydro-electric stations: there is a wall of coloured flashing lights and one man sitting behind a console who directs the entire operation. The effect could not be further removed from the old mills with workers unable to see more than a few feet, their hair, faces and clothes saturated with fibre. In the bagging section there are no leaking socks, or men blowing fibre from the floor with compressed air. Despite those improvements, there have been constant problems in controlling the dust and in maintaining the integrity of dust chutes and pipes. The cause is the host-ore dunite, a form of serpentine, which is extremely abrasive and tears machinery apart.[49] In the 1950s and 1960s galvanized sheeting was used to seal punctured ducting; when that failed the mines tried ceramics but they were too heavy. From

1996 Shabanie has used 2mm steel plating and still it wears out in a matter of weeks.[50]

In the 1960s and 1970s Shabanie was a town of black labourers and white artisans but with the transition to majority rule the mine lost half of its white workforce.[51] Answers to the question how much changed at independence in 1980 depend upon who you talk to. Those blacks who for the first time had access to apprenticeships and middle-management positions saw an extraordinary change. The houses in which they lived, their wages, their status within the company and their relations with the still predominantly-white management all changed dramatically. Those in unskilled jobs saw little difference.

The size of the workforce has fallen consistently over the past thirty years. In the mid 1970s the mines began to use front-end loaders and introduce what is called haul, load and dump mining. Before the new technology Shabanie and Gaths had 12,000 men: the current number for the industry as a whole is 6,500.[52] A second wave of retrenchments accompanied the South East Asian economic crisis of the late 1990s when demand fell suddenly.[53] The ethnic composition of the workforce has also changed. When Lindsay Thompson joined Shabanie in 1965 most employees were Shangaans from Mozambique and migrant workers from Malawi. By the late 1990s there were only three non-nationals on the payroll and under 50% of employees were of foreign descent.[54] As at March 1998 Shabanie had a total work force of 3,750. Of those, 2,200 were engaged in mining, there were 675 at the mill and the balance in human resources and management.[55] About one half were members of the Associated Mineworkers Union of Zimbabwe.

The underground workings are dark, noisy and hot. There is a great deal of water which in places is shin deep and the day I went down the mine the air was heavy with the smell of diesel fumes and explosives. It is also a dangerous environment with miners using front-end loaders, skips, and small trucks in confined spaces. There are four types of work in the mine: drilling and preparing the face for excavation, removing the ore and transporting it to the surface, maintenance, and the transport of labour. Teams are continually employed to secure the fragile ceilings, which are set with metal mesh and iron braces. There is also constant work servicing rail lines, drilling machines, and lifts, and removing the water and sludge which accumulate in the drives. The mine uses huge quantities of electricity for the haulage of men, ore and materials. Power is also needed for lighting, ventilation, and cooling.

The mine goes down over six-hundred metres into hard rock. There are as many as 200 kilometres of tunnels which are five metres wide and up to four metres high. The workings are a maze of tunnels which in places branch off in three or more directions into abandoned drives. Although there is little dust visible in the tunnels I saw some miners wearing linen masks while others had wound their shirts over their mouths. I saw no

respirators. Like most developing countries, Zimbabwe has no specific legislation on asbestos, and the industry falls under the general regulations on pneumoconiosis which covers all forms of mining.[56] In 1985 the maximum permissible limit of chrysotile dust in workplaces was set at two fibres per millilitre over a four-hour period but whether those levels have been reached is known only to T&N and its successor African Resources. What is most impressive about the mine is the scale of the operation and the high levels of skill of even those men, such as jackhammer operators, who are classified as unskilled or semi-skilled workers. The cost of producing fibre is divided between maintenance, which accounts for twenty per cent of the total, and production, which accounts for the rest. In 1998 it cost about $Z280 to produce a ton of ore. Electricity was about $Z56 per ton of ore mined, stores or materials cost about $Z114 per ton, and labour about $Z110.[57] After independence, production levels began to fall as global markets contracted. There were also sharp rises in the cost of spare parts which cut into the industry's profitability. The current economic crisis triggered by the seizure of white farms has seen a further decline in the industry, which is now operating well below its peak of the late 1970s.

Shabanie mine is a masculine world of male wage labour and during my stay I saw only one woman labourer, who was employed in the bagging section at Brittle Mill. Women are not hired as apprentices nor are they employed as artisans. Their work, however, is crucial to the maintenance of the mining community. The colonial economy set a precedent for a division between temporary urban labour and permanent rural residency. Men worked in towns or at mine compounds under six or twelve-month contracts while women and children remained in rural areas. Remnants of that system have survived.[58]

A job at Shabanie provides a house but not a home. The house in which a miner and his family lives belongs to the company and if he leaves the mine's employ the house is lost. For that reason it is common for a woman to spend a good part of each year in her husband's village maintaining a communal home, preparing the ground for planting, tending animals and harvesting crops. The schools at Zvishavane are better equipped and more accessible than village schools and so children tend to remain with their father while their mother is absent. It is a complex system which is important in sustaining ceremonial life and identity. A married woman's success will depend upon her maternal skills with her children, her social skills with her in-laws and her commercial skills with the land.

Since joining Shabanie in 1963 Edward Mutikani's wife Miriam has spent much of her time in their home village maintaining their plot of land and their place within the local community. She returns to Shabanie at the end of each month. If they lived in the village their children would have to walk miles to school and so they stay with their father and attend the mine school. While their father is at work the oldest child looks after the younger ones. At retirement Edward and Miriam Mutikani will return home. Those

who have no such ties face the dismal prospect of becoming squatters.[59] There has been a squatter camp close to the mine since the 1960s which is home to migrant labourers who have no place to go.[60] They live a bleak existence in makeshift shelters and from time to time they are joined by men who have retired or lost their jobs.

DUST AND DISEASE

Mines are dangerous places and as required under the mines legislation, since the 1920s, there has been a hospital at Shabanie to care for injured workers. During the colonial period accidents were common, and it was usual for the regulatory authorities to lay the blame for fatalities at the door of labour. In 1926, over seven-hundred miners died from infectious disease and accidents, but according to the Department of Mines: 'The greater majority of these fatalities are due to unavoidable danger inherent to the work or the carelessness, ignorance or disobedience of the person involved'.[61] The worst mining accident during 1928 was at Shabanie where sixteen men were drowned in the quarry after water flowed down the protecting drains, flooding the mine. Tropical storms are a feature of the region yet according to the Department: 'No blame can be attached to the mine management, which made protection amply adequate for any storm which could be expected'.[62] As late as 1950 the Department acknowledged there was a major problem with sickness and accidents which were running at a rate of 74% of the number employed but made no criticism of management.[63] In theory such events should have been relatively simple to prevent but cost-cutting regimes were so entrenched and so severe that men continued to die.[64] Occupational disease, especially the type of insidious injury arising from exposure to asbestos, was much more difficult to prevent.

From 1915, when mining began, until the late 1930s, there was no mention of asbestosis in official correspondence. After two decades of studied silence, in 1938 a government commission into pneumonoconiosis was held in Salisbury. It focused upon silicosis on gold mines but the commission did visit Shabanie and Mashaba and ten pages of its final report was on asbestos.[65] The commission was well informed about the dangers of airborne fibre and noted, for example: 'Asbestos dust is a dangerous dust with insidious and long delayed effects, and all possible steps should be taken by the management, particularly in respect to the milling operations, to perfect the measures which have been adopted to prevent exposure to it'.[66] The context for the commission was the 1930 Merewether and Price report on the UK industry and the subsequent legislation governing dust emissions in British factories.[67] There was also the research by G. F. Slade from that same year carried out at T&N's New Amianthus mine in the eastern Transvaal.[68] Slade worked as a medical officer at New Amianthus and between 1926 and 1930 he conducted what was probably the first study

of respiratory disease among asbestos miners. The mill worked twenty-four hours a day, seven days a week and Slade noted that it was so choked with dust 'as to render indistinguishable objects at a distance of a few yards'.[69] Slade found evidence of asbestos-related disease in 70% of mill workers. His results were potentially disastrous for T&N which was already subject to dust regulations in its British factories. Yet nothing was done to improve work practices at the mine. The study did, however, end Slade's career. Having completed his thesis, Slade left T&N's employ almost immediately. He never published the results of his research, and never again worked in the field of occupational health. Dr Louis Irvine, a specialist from Johannesburg who chaired the 1938 commission, should have been aware of Slade's work, but it was not cited in the final report.

The commission examined a group of twenty Europeans employed in supervisory roles along with nearly 200 black miners and found little evidence of striation.[70] Dr Ireland, the senior medical officer at Shabanie, who had worked for the Rhodesian and General Asbestos (RGA) group for over sixteen years, told the commission that there had been only two cases of asbestosis at the mines between 1932 and 1938.[71] Ireland claimed that conditions were good and when necessary respirators were used. Given the stifling summer temperatures at Shabanie his statement was probably untrue.[72] The inquiry found dust levels in the grading mills of up to 800 particles per cubic centimetre, yet concluded that the mill was spacious and airy.[73] No cases of asbestosis were detected among African workers at Mashaba (Gaths) although the Commission did note: 'The Mashaba mill is old fashioned and there is a good deal of visible dust in the air. Steps should be taken by the management to improve the control of dust in the mill'.[74]

The high dust counts were incompatible with the finding that disease was rare and undermined the credibility of the entire report. The commission relied upon the RGA and its medical officers for most of its information and the surveys carried out at Gaths and Shabanie were at best cursory. Whites never did the most hazardous jobs such as sorting or cobbing, and if white workers were healthy that was no indication that a mine was safe. The report's main limitation lay in the presence of so many migrant workers. The annual turnover of labour at Shabani was 65% which meant that the burden of disease was exported to adjacent colonies. Following the inquiry, no pressure was put on the industry to reduce dust levels. On the contrary, the department's annual report for 1938 praised the conditions at Shabanie and Mashaba and declared there was unlikely to be any disease.[75] That optimism was soon brought into question by intra-colonial politics.

In the late 1930s, several cases of pneumonoconiosis among white miners were recorded in Southern Rhodesia. Many of the men were married with dependent children and being unable to work it fell to the state to support them.[76] The scale of problems among black miners was far greater. Almost a third of Southern Rhodesia's mine labour force of 23,000 was drawn from Nyasaland, whose administration did not want invalid workers returning

home to become a burden on local medical services.[77] E. J. Waddington, the Governor of Northern Rhodesia, was also concerned about the fate of migrant workers.[78] In 1944 fifty-four Northern Rhodesian men who had mined in Southern Rhodesia died from respiratory disease, but in only one case was compensation paid.[79] In Salisbury the Chamber of Mines was adamant that work conditions were good but that employers were being forced by the lack of local labour to employ sickly migrant workers who became ill the moment they began heavy labour.[80] The state sided with employers.

The mine's inspectorate was limited in terms of its resources, expertise and political will. Where inspectors found evidence of dust it was always excused by reference to worse conditions in the past. Despite such reassurances, in the mid 1950s the Department suddenly acknowledged that silicosis, tuberculosis and asbestosis were a problem. The Department noted the insidious nature of asbestosis and the failure of the smaller mines to provide proper ventilation thereby implying that conditions on the larger mines were safe. It also referred to the large turnover of African labour, which at some mines ran at 100% per annum, a fact that made detection, prevention and compensation difficult.[81] The problem was so serious that in 1957 the levy on industry to fund the Silicosis Board was doubled.[82] There was, however, no initiative to reduce dust.

In 1961 the Government Ventilation Engineer had two assistants to monitor the entire mining industry, and during the first half of that year no dust counts were taken.[83] When inspections recommenced the results were interpreted to the industry's advantage. 'The standard of dust control at asbestos mills', wrote the Chief Inspector of Mines in 1962, 'remained fair to good. Exceptions were generally due to plant modification (inseparable from asbestos milling) and financial stringency'.[84] During 1965 there were sixty-five inspections of asbestos mines and the department noted a steady improvement in ventilation.[85]

The public statements from T&N were equally sanguine. During 1949 T&N's managing director W. W. F. Shepherd made his first post-war visit to Shabanie and Mashaba. On his return he told shareholders: 'Technically and commercially I think we can reasonably claim to lead our field in Africa and the amenities we provide for our personnel both European and African, are unsurpassed, indeed seldom approached by any other mining organisation which I have seen or of which I have heard in that Continent'.[86] In 1960, the year of Sharpeville, T&N's managing director again visited Swaziland and Southern Rhodesia and he later boasted to shareholders that the company was a pioneer in African advancement. From that year the company had to deal with medical research linking asbestos with mesothelioma, the most lethal of the asbestos-related diseases.[87] Amid mounting public concern about the dangers of asbestos in 1966, there was a strike by London dock workers who refused to unload South African crocidolite. T&N shareholders were reassured that although the cause of mesothelioma was not understood, there had been no cases for more than

fifty years at Shabanie or at T&N's factories where asbestos had been used.[88] That was false and for the next two decades T&N's senior management continued to lie to its employees, its shareholders and the British public about the known dangers of asbestos.[89]

ORAL EVIDENCE

The judgements from the regulatory authorities, like the pronouncements from T&N's management, are in sharp contrast to the experience of Shabanie miners. When I asked a number of workers in 1998 if they knew that asbestos is dangerous most laughed at such a naive question. In not one case did their knowledge of risk come from the company for whom each of the men had worked at least twenty years: it came from observing the sickness or death of a fellow worker. When Alais Masaje began working at Shabanie in 1957 he had a full medical examination including a chest x-ray, but he was not told about the risk of airborne fibre. He recalls that there was little dust underground because of the water but that the mills were dirty.[90] The workers were told by people at the hospital some time in the 1970s about the danger but it was never made clear, and Masaje cannot name the illnesses which afflict miners. Mota Chipinge, who has worked at Shabanie since 1958, first heard about the dangers of dust around 1975. Workers got the information from those who were hospitalized: they never heard it from the company.[91] Mining is dangerous, and he thinks that men were more often injured by rock falls or machinery than by lung disease.

John D'Ewes, who started as an apprentice in 1963, worked in the Birthday and Central Grading Mills for more than twenty years. All the mills were dusty with the worst areas being the bagging and cleaning sections.[92] There were no respirators, and D'Ewes knew of three men who developed asbestosis. At one time he had a boss who was particular about respirators but there was little propaganda from management. The mine itself was dirty but there was not much dust underground because of the moisture.[93] Bora Jotham Sibanda who also joined the mine in 1963 has a similar story. He worked in the test plant and in the Brittle and Birthday Mills. The Central Grading Mill was filthy and workers wrapped linen pads over their mouths to keep out the dust.[94] There were few safety clothes and no respirators. He first learnt about the dangers of fibre in 1976 when he was told not to breathe asbestos.

The conventional wisdom among miners is that conditions were very bad in the 1960s and 1970s but improved in the 1980s, and that is the measure by which they judge their present work environment. Their views are tempered by the fact that most workers were migrants who died out of sight. They are also tempered by the wider labour markets in which they compete for work. In the context of Zimbabwe's decaying economy and cash-starved public facilities, those who work at Shabanie are better off than most Zimbabweans. Miners and their families have access to a well-equipped

hospital and well-funded primary schools for their children. They also enjoy the benefits of sports and recreational facilities. But the major attraction has been the subsidized housing which for more than thirty years has drawn labour to the mines. In 1998 low-density houses were rented for $Z2,000 a month on the open market, while the cost to a mine employee for the same property was between $Z40 and $Z65.[95] Firewood and coal were also provided by the company at reduced rates.

Despite the importance of Zimbabwe's mines, little research has been done into occupational health. In 1969 Gelfand and Morton reviewed the cases certified by the Pneumoconiosis Medical Bureau between 1963 and 1967 and found only thirty-nine confirmed cases of asbestosis. On that basis Gelfand concluded there was a very low rate of disease.[96] That judgement was compromised by a number of factors. Physicians in Zimbabwe had little expertise in diagnosing asbestosis and the rigid criteria used for awarding compensation were designed to exclude legitimate claims. There was a lack of data on retired or deceased miners in an industry which was dominated until recently by migrant labour. The cause of death was rarely recorded accurately for rural populations, and the only available data on asbestos exposure had come from employers.

The first independent research into asbestos in Zimbabwe was carried out in the late 1980s by Rabelan Baloyi. He conducted a stratified random sample of 178 black males from Shabanie and 119 from Gaths. All were aged between twenty-seven and sixty-six years with more than ten years' service. Baloyi did chest x-rays and lung-function tests and then estimated exposure levels with data supplied by T&N.[97] He found a loss of vital capacity among 10% of men with more than ten years' exposure.[98] During the sampling period Baloyi saw frequent equipment failures, resulting in leaks and spillages. There was a lack of local exhaust and ventilation in the plants, and the inadequate maintenance often resulted in heavy dust emissions. Most serious of all, the location of schools near the dumps was an obvious hazard to children. Baloyi found that all of the asbestos-related diseases, including lung cancer and mesothelioma, occurred among the Zimbabwe population but due to the lack of data he could not quantify the rates.[99] Baloyi's findings are consistent with the T&N papers and the testimony of miners.

The current medical officer at Shabanie is Greg Matarkis, who despite his Greek-sounding name is Shona. Matarkis is by training a gynaecologist and he began working at Shabanie in 1984.[100] He has a well-paying job, which comes with a house, and he enjoys the luxury of taking private patients. According to Matarkis there have been no cases of asbestosis or mesothelioma during his fifteen years at the mine, the period covered by the T&N archive.[101] Dr Matarkis told me with conviction that asbestosis has not been a problem since the 1960s. Every worker undergoes a chest x-ray and lung-function test before, during and at the end of employment. Workers are told that mineral dust is hazardous and that they should not smoke. Matarkis acknowledges that the mill still has a dust problem but

maintains it is episodic and the company is always within the legal requirements of two fibres per millilitre. He makes much of the distinction between asbestosis and pneumonoconiosis and claims that the main risk facing the miners is not asbestos fibre but dust from the host rock. That distinction, which I term 'the Shabanie variation', was also quoted to me, although in a garbled form, by one of the mine's senior administrators, Norman Dube.[102] Zimbabwe chrysotile is supposedly benign and there is no disease. If there were it would be due to the host ore.

Those features of the mine which made it so attractive to black labour and white artisans during the later colonial period also made life on the mine problematic. The mine compounds were tightly controlled by management through a system of night guards whose job it was to prevent theft and village police who had a more general role in monitoring the compounds and checking the passes of visitors. There were notice-boards at compound entrances and it was necessary to have a pass to enter.[103] A number of the miners I interviewed mentioned the regular medical checks for venereal disease which were a feature of life at Shabanie until 1975. All single women would be examined each week for venereal disease and on pay days the men were also examined.[104] The medicals were done by orderlies supervised by the company doctor: if a man or woman tested positive they were sent to hospital until they recovered. At the time syphilis was common and T&N wanted to keep disease down. The miners and their partners did not like the system but they complied.[105]

Zvishavane is a company town which is dependent upon the salaries, wages and contracts the mine provides. The mine has dealings with every business in Zvishavane and any downturn in the mine has an immediate impact upon the local community. If Shabanie closed, the banks, shops, and hotels would close, as would the hospital and the guest house, all of which are important employers.[106] Zvishavane would become a ghost town and the whole region would be affected. Zimbabwe would also lose one of its few reliable sources of foreign exchange. The mine is so dominant that it is difficult to draw a distinction between the mine's interests and those of the wider community. Every miner I interviewed said it would be a disaster if the mine should close and most wanted their sons to work at Shabanie. The commercial benefits brought by the mine are offset by the conditions of work and the massive tailing dumps which, as Baloyi has shown, pose a threat to the health of every person who lives at Zvishavane. It is in that context that Dr Matarkis and the current management expound the 'Shabanie variation'.

By the late 1980s, T&N was anxious to withdraw from asbestos mining. The company had to deal with a new government in Zimbabwe and it was being threatened in the UK and the USA by a flood of litigation. In 1991, the company sold its remaining interests in Swaziland. Five years later it sold the mines at Shabanie and Mashaba to a Zimbabwean consortium, African Resources Ltd (ARL), a holding company registered in the Virgin Islands,

which purchased Shabani Mashaba Mines (Pvt) Ltd for sixty-million US dollars. It was a massive transaction, with two mines, three mills, over 2,000 housing units at Shabanie alone, hundreds of miles of tunnels, machinery, storage facilities, rolling stock, schools, a hospital and a golf course. The purchase was surprising given the limited amount of indigenous capital in Zimbabwe and the parlous state of the global asbestos industry. With the end of T&N's ownership, there was no guaranteed market for the mine's fibre in Britain, which made the purchase even more of a risk.[107]

The purchase was approved by Zimbabwe's ruling ZANU/PF party as an important step in moving the country beyond the colonial legacy. In terms of its timing and the influence of Robert Mugabe's corrupt government the sale was disturbing. The links between ZANU/PF and the mine became more obvious in October 1998 when the Zimbabwe government extended a guarantee to African Resources of sixty-million US dollars to restructure its short-term debt and provide investment to keep the mines competitive.[108] The guarantee just happened to be the same as the purchase price. The sale saw no new investment in health or safety measures, and work conditions appear to be unchanged from the mid 1980s.

CONCLUSION

From the 1930s, when the issue of pneumoconiosis was first raised, state authorities claimed there was no disease on the mines. That was the opinion of the committee of inquiry of 1938 and it was repeated in the Department of Mines annual reports which often praised the industry for its efforts in making the mines safe. The mining companies and their medical officers have maintained that fiction until the present day.

The ruling orthodoxy about the absence of disease is contradicted by the T&N archive which reveals that work conditions were hazardous and disease common; it is contradicted by what we know of disease at T&N's British factories; it is contradicted by George Slade's research at New Amianthus in 1930 where three-quarters of mill workers had asbestosis; it is contradicted by the protests from the colonial administrations of Nyasaland and Northern Rhodesia in the 1940s about occupational disease among migrant labourers, and it is contradicted by the testimony of current miners.

The T&N archive tells us that conditions at the mines remained hazardous after 1982 when the new mill came on stream, thereby suggesting they were worse before that date. The worst period for dust and disease was probably the years between 1950 and 1980, when T&N managed to increase output using outdated and fatigued plant. Part of that period is covered by UDI, a time when state regulation was most feeble. The archive also tells us that the company knew far more about the risks of disease than either its employees or the regulatory authorities, and that it chose to keep that knowledge to itself. It also chose to deceive its shareholders about conditions in Africa. Such behaviour raises a number of interlinking questions. Why were

the mines so hazardous and what explains T&N's conduct? Why did medical officers like Dr Ireland and his successors claim there was no disease and what explains the behaviour of the regulatory authorities?

One of the most intriguing questions about Shabanie is how T&N managed to gain the compliance of medical officers to such dangerous work practices. Mine physicians were in an ambiguous position in having an ethical commitment to their patients while representing the interests of their employers. To a degree they stood between the state, the law and industry. They were members of small and often isolated communities and if they broke ranks, as did George Slade in 1930, they stood to lose their jobs. Dr Ireland, like his successors at Shabanie, claimed there was no asbestosis, which as the T&N archives show was untrue. There were 'rules of the game' and we can only guess as to how those rules were conveyed to newcomers. The rules which were embodied in a series of practices had a supporting story which is currently the 'Shabanie variation'. In the past it was 'the careless worker' story which was used by the Department of Mines to explain the frightful death rates on the gold mines. Behind each story lay a trade-off between commercial advantage and occupational disease.

The regulatory authorities colluded with T&N and in contrast to the situation in South Africa, where conscientious mines inspectors protested at work conditions, in Southern Rhodesia there were no dissonant voices.[109] That collusion had precedents in the handling of the pneumonia and scurvy pandemics on the gold mines which in the period from 1910 to 1930 killed up to 30,000 men.

It easy to explain why the mines were so hazardous. The apartheid-style labour system meant there were no trade unions or vigilant regulatory authorities to constrain the behaviour of employers. We know that because of cost-cutting measures Southern Rhodesia's gold mines were among the most dangerous in the world, and that similar work conditions prevailed at Shabanie and Gaths. There were also precedents at T&N's British factories where occupational disease was rife. In addition, the host ore at Shabanie posed technical problems which T&N never managed to resolve. Perhaps dust levels could have been reduced if sufficient money had been spent, but that ran counter to the ethos which has ruled the mines throughout their history. We know from T&N's annual reports that its Africa mines were vital to the company's global success. The mines were so profitable because they were so dangerous.

NOTES AND REFERENCES

This article was written while I was a visiting research fellow at the Faculty of History of Science, Medicine and Technology, Johns Hopkins University, Baltimore. My thanks go to the Faculty chair Randall Packard. Unless otherwise indicated all archival materials cited are from the National Archives of Zimbabwe, Harare. The references to the T&N Papers refer to the archive held at the School of Business History, Manchester Metropolitan University, Manchester.

1 Of the six types of asbestos, namely chrysotile, crocidolite, amosite, anthophyllite, tremolite and actinolite, only three have been mined on a large scale. Over 90% of asbestos used in the twentieth century was chrysotile.

2 See Geoffrey Tweedale, *Magic Mineral to Killer Dust: Turner & Newall and the Asbestos Hazard*, Oxford, 2000.

3 Asbestos causes three major diseases; asbestosis, which is a fibrosis of the lung and is dose related; lung cancer which is indistinguishable from the cancer suffered by cigarette smokers; and mesothelioma, a primary cancer of the lining of the lung or the abdominal cavity, which can result from trivial exposure.

4 Letter, Dr P. Elmes to Brian Lincoln, 15 April 1987, T&N Papers reel 301 frame 1535.

5 Report Havelock Asbestos Survey, Dr J. Allardice, 29 Nov. 1978, T&N Papers 068/448-50.

6 Memo: H. Hardie to S. Gibbs and C. Newton, 3 Sept. 1980, T&N Papers 068/368.

7 Memo: Asbestos Workers Survey at Havelock, Dr J. Allardice, 17 Dec. 1979, T&N Papers 068/930-1.

8 Visit to Shabanie and Gaths Mines, March 1987, Dr P. Elmes, 14 April 1987, T&N Papers 0301/1537-1540.

9 Asbestos Dust levels in Overseas Companies, Executive Committee Meeting, March 1981, T&N Papers 285/0591.

10 Memo: from S. Gibbs to C. Newton, 10 August 1982, T&N Papers 021/274.

11 Report on visit to Shabanie Mine by Dr Elmes, 19 Sept. 1985, T&N Papers 228/2951.

12 During the colonial period Shabani was the town, and Shabanie the mine. At independence in 1980 the town was renamed Zvishavane. Throughout I have used the name Shabanie for the mine and Zvishavane for the town.

13 N. H. Wilson, *Notes on the Mining Industry of Southern Rhodesia*, Salisbury, Government Printer, 1932, p. 47.

14 Wilson, *Notes*, p. 47.

15 *Shabanie Mine*, Harare, Shabanie & Mashaba Mines (Pvt), Ltd (pamphlet [1985]).

16 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1929*, Salisbury, Government Printer, 1930, p. 7.

17 Interview with Lindsay Thompson, manager, Shabanie mine, Zvishavane, 11 March 1998.

18 In 1958 Shabanie produced almost 300 tons of such fibre while Canada, with a total output of over one million tons, produced less than one thousand tons. *Report of the Chief Government Mining Engineer and Chief Inspector of Mines on Mines for the year 1958*, Salisbury, Government Printer, 1959, p. 1.

19 Interview, Thompson.

20 'Investigations of the Asbestos Mines', in *Report of the Commission to Study Silicosis and other Industrial Pneumonoconiosis*, Salisbury, Government Printer, 1938, p. 82.

21 *Shabanie Mine*, Salisbury, Turner and Newall, 1975, (pamphlet), p. 2; and Interview, Thompson.

22 In 1961 Southern Rhodesia had 6% of the world's market, Canada had 50% and the USSR 25%. *Report of the Chief Government Mining Engineer and Chief Inspector of Mines on Mines for the year 1960*, Salisbury, Government Printer, 1961, p. 2.

23 *Turner & Newall Annual Report*, Sept. 1930, p. 5.

24 Wilson, *Notes*, p. 40.

25 Ian Phimister, 'History of Mining in Southern Rhodesia to 1953', doctoral thesis, University of Rhodesia, 1975, p. 148.

26 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1956*, Salisbury, Government Printer, 1957, p. 10.

27 *Report of the Chief Government Mining Engineer and Chief Inspector of Mines on Mines for the year 1958*, Salisbury, Government Printer, 1959, p. 1.

28 Interview, Thompson.

29 Interview with Pat Hart, CEO of Gefco, Braamfontein, Johannesburg, 6 July 2001.

30 *Turner & Newall Annual Report*, Sept. 1948, p. 17.

31 'Chief Government Mining Engineer Annual Report for the year 1949', in *Departmental Reports: Mining Engineer, 1936–1952*, Southern Rhodesia, pp.11–12.

32 'Investigations of the Asbestos Mines', in *Report of the Commission to Study Silicosis and other Industrial Pneumonocisois*, Salisbury, Government Printer, 1938, p. 82.

33 Interview, Thompson.

34 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1956*, Salisbury, Government Printer, 1957, p. 4.

35 See *Turner & Newall Annual Report*, 30 Sept. 1955.

36 *Report of the Chief Government Mining Engineer and Chief Inspector of Mines on Mines for the year 1962*, Salisbury, Government Printer, 1963, p. 16.

37 *Report of the Chief Government Mining Engineer and Chief Inspector of Mines on Mines for the year 1962*, Salisbury, Government Printer, 1963, p. 1.

38 *Report of the Secretary for Mines and Lands, 1964*, in *Annual Reports 1964–1970*, in *Departmental Reports*, Southern Rhodesia, p. 55.

39 *Turner & Newall Annual Report*, 30 Sept. 1966, p. 3.

40 Interview with Christian Heili and Stephanos Steyn, Shabanie mine, Zvishavane, 10 July 1998.

41 Table 12.1: 'Mineral Production' in *Monthly Digest of Statistics*, Central Statistical Office, Harare, 2002, p. 41.

42 Interview with Edward Mutikani, Shabanie mine, Zvishavane 8 July 1998.

43 Interview, Mutikani.

44 Interview with Mota Chipinge, Shabanie mine, Zvishavane, 7 July 1998.

45 Interview, Chipinge.

46 Interview, Chipinge.

47 Interview, Thompson.

48 Interview with John D'Ewes, Shabanie Mine, Zvishavane, 9 July 1998.

49 Interview, Thompson.

50 Interview, Thompson.

51 Interview, Heili and Steyn.

52 Interview, Thompson.

53 Interview with Wellington Matemba, Senior Community Services Officer, Shabanie Mine, Zvishavane, 6 July 1998.

54 Interview, Thompson.

55 Interview, Thompson.

56 Rabelan Baloyi, 'Exposure to Asbestos Among Chrysotile Miners, Millers and Mine Residents and Asbestosis in Zimbabwe', doctoral thesis, Institute of Occupational Health, University of Kuopio, Helsinki, 1989, p. 3.

57 Interview Heili and Steyn.

58 See V. N. Muzvidziwa, 'Masvingo's double-rooted Female Heads of Households', *Zambezia* 24: 2, 1997, pp. 97–124; and C. Mutambirwa and D. Potts, 'Rural-Urban Linkages in Contemporary Harare: Why Migrants Need their land', *Journal of African Studies* 16: 4, 1990, pp. 677–98.

59 Interview, Mutikani.

60 Interview Bernard Zhou, Shabanie mine, Zvishavane, 8 July 1998.

61 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1926*, Salisbury, Government Printer, 1927, p. 4.

62 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1928*, Salisbury, Government Printer, 1929, p. 8.

63 'Chief Government Mining Engineer Annual Report for the year 1950', in *Departmental Reports: Mining Engineer, 1936–1952*, Southern Rhodesia, p. 12.

64 For the history of the mining industry, see Phimister. 'History of Mining'; and Charles van Onselen, *Chibaro: African Mine Labour in Southern Rhodesia*, Johannesburg, 1980.

65 See 'Investigations of the Asbestos Mines', chap. 6, in *Report of the Commission to Study Silicosis and other Industrial Pneumonocosiosis*, Salisbury, Government Printer, 1938, pp. 81–90.

66 'Investigations of the Asbestos Mines', p. 87.

67 See E. R. A. Merewether and C. W. Price, *Report on the Effects of Asbestos Dust on the Lungs and Dust Suppression in the Asbestos Industry: Part I Occurrence of Pulmonary Fibrosis and other Pulmonary Affliction in Asbestos Workers: Part II: Processes Giving Rise to Dust and Method for its Suppression*, London, HMSO, 1930.

68 See G. F. Slade, 'The Incidence of Respiratory Disability in Workers Employed in Asbestos Mining with Special Reference to the Type of Disability Caused by the Inhalation of Asbestos Dust', MD thesis, University of the Witwatersrand, 1930, p. 23(a).

69 Slade, 'Respiratory Disability', p. 23 (b).

70 'Investigations of the Asbestos Mines', p. 85.
71 'Investigations of the Asbestos Mines', p. 85.
72 Appendix 11; Dr Ireland, 'Asbestosis: Rhodesian and General Asbestos Corporation Ltd.', in 'Investigations of the Asbestos Mines', p. 93.
73 'Investigations of the Asbestos Mines', p. 82.
74 'Investigations of the Asbestos Mines', p. 88.
75 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1938*, Salisbury, Government Printer, 1939, pp. 7–8.
76 Letter from the Minister for Internal Affairs to the Prime Minister, 11/12/1939, Prime Minister's Office S 482 337/39.
77 Letter from the Secretariat, Zomba, Nyasaland to the Secretary, Nyasaland, Northern and Southern Rhodesia Inter-territorial Conference, Salisbury, 10/3/1942, Prime Minister's Office S 482 337/39.
78 Letter from E. J. Waddington, Governor of Northern Rhodesia to the Governor, Southern Rhodesia, 14/10/1944, Prime Minister's Office S 482 337/39.
79 Letter from E. J. Waddington, Governor of Northern Rhodesia to the Governor, Southern Rhodesia, 18/8/1945, Prime Minister's Office S 482 337/39.
80 See for example, Memo from the Chamber of Mines of Rhodesia to the Prime Minister, 7/1/1944, Prime Minister's Office S 482 76/43.
81 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1956*, Salisbury, Government Printer, 1957, p. 7.
82 *Report of the Secretary, Department of Mines and Public Works on Mines for the year 1957*, Salisbury, Government Printer, 1958, p. 4.
83 *Report of the Chief Government Mining Engineer and Chief Inspector of Mines on Mines for the year 1961*, Salisbury, Government Printer, 1962, p. 30.
84 *Report of the Chief Government Mining Engineer and Chief Inspector of Mines on Mines for the year 1962*, Salisbury, Government Printer, 1963, p. 42.
85 *Report of the Secretary for Mines and Lands 1965*, in *Annual Reports 1964–1970*, in *Departmental Reports, Southern Rhodesia*, p. 19.
86 *Turner & Newall Annual Report*, 30 Sept. 1949, p. 17.
87 For an account of the discovery of mesothelioma on South Africa's asbestos fields, see Jock McCulloch, *Asbestos Blues: Labour, Capital, Physicians and the State*, Oxford, 2002.
88 *Turner & Newall Annual Report*, 30 Sept. 1966, pp. 6–7.
89 See Tweedale, *Magic Mineral*; and Ronald Johnston and Arthur McIvor, *Lethal Work: a History of the Asbestos Tragedy in Scotland*, East Linton, 2000.
90 Interview with Alais Masaje, Shabanie mine, Zvishavane, 7 July 1998.
91 Interview, Chipinge.
92 Interview, D'Ewes.
93 Interview, D'Ewes.
94 Interview with Bora Jotham Sibanda, Shabanie mine, Zvishavane, 9 July 1998.
95 Interview with Wellington Matemba, Shabanie mine, Zvishavane, 7 July 1998.
96 M. Gelfand and S. A. Morton, 'Asbestosis in Rhodesia', *Central African Medical Journal* 15, 1969, p. 206.
97 Baloyi, *Exposure to Asbestos*, pp. 47–8.
98 Baloyi, *Exposure to Asbestos*, p. 71.
99 Baloyi, *Exposure to Asbestos*, p. 65.
100 Interview with Dr Greg Matarkis, Shabanie mine, Zvishavane, 9 July 1998.
101 Interview, Thompson.
102 Interview with Norman Dube, Shabanie mine, Zvishavane, 7 July 1998.
103 Interview, Chipinge.
104 Interview, Chipinge.
105 Interview, Chipinge.
106 Interview, Matemba.
107 For that reason today the mine keeps no stockpiles of fibre. Interview, Heili and Steyn.
108 'Government Guarantees US$60M Shabanie/Mashava Loan', *Zimbabwe Independent*, 2–8 Oct. 1998.
109 For a history of the state inspectorate on South Africa's asbestos fields, see McCulloch, *Asbestos Blues*, pp. 117–41.