



SOUTHERN RHODESIA.

REPORT

of the

Commission appointed to enquire into the possible prevalence and origin of cases of Silicosis and other industrial Pneumonoconioses in the industries of the Colony of Southern Rhodesia, and of Pulmonary Tuberculosis in such industries.

**Presented to the Legislative Assembly,
1938.**

**Printed for the Government Stationery Office by the
Rhodesian Printing and Publishing Co., Ltd., Salisbury.**

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CHAPTER VI.

INVESTIGATIONS AT ASBESTON MINES AND AT THE
WANKUF COAL MINE.

Asbestos.—The asbestos mines visited by the Commission were the Shabanie Mine, district Bulawayo, and the Mashaba Mine, district Victoria.

The term asbestos is applied to a group of minerals which have a finely fibrous structure. The most important varieties are chrysotile or "white asbestos," which is a fibrous serpentine and is a hydrated silicate of magnesium with little iron, and crocidolite or "blue asbestos," which is a silicate of iron with smaller amounts of magnesium.

Chrysotile is the variety mined at Shabanie and Mashaba.

According to Hall its average composition is: SiO_2 , 40.49 per cent.; Al_2O_3 , 1.27 per cent.; Fe_2O_3 , and FeO , 2.53 per cent.; MgO , 41.41 per cent. and H_2O , 14.06 per cent.

It contains practically no free silica.

Chrysotile has a longer and more flexible fibre than the blue variety of asbestos. The country rock is serpentine.

Asbestosis.—The recognition of the occurrence of a serious form of pulmonary fibrosis amongst asbestos workers is of comparatively recent origin. The first recorded fatal case was in 1900, and the use of the term "asbestosis" to denote the specific form of pneumoconiosis resulting from the inhalation of asbestos dust was introduced into medical literature only in 1927. Since then a considerable literature upon the subject has been produced.

The disease has been found and has been studied principally in its association with exposure to the dust of asbestos in the exploitation of that material in manufacturing processes.

On the pathology of the disease the excellent description of Gloyne may be cited.¹ An account of its clinical characters and course and of measures suitable for its prevention has been given by Merewether² and Merewether and Price.³

Asbestos dust is inhaled in the form of shorter or longer fragments of fibres and of small particles.

In its general features asbestosis is quite unlike silicosis. The fibrosis is of a fine diffuse type and the sharply defined nodulation characteristic of silicosis is not found. Ultimately in severe cases the consistence of the lung becomes increased and large areas may show fibrous condensation which is tough rather than hard as in silicosis. The pleurae are thickened and commonly very extensively adherent to the chest wall, the diaphragm and the pericardium.

There is more difficulty in the transport by the agency of "dust cells" of the fibriform particles of asbestos into the substance of the lung than is the case with the minute particles of silicious dust which cause silicosis, and the primary reaction to asbestos dust takes place in the smallest terminal air tubes and ducts and in the air sacs. In time, however, the process extends to the fibrous frame work of the lung and to the pleurae. A unique feature of the primary reaction is the formation of what are termed "asbestos bodies." These are bodies of microscopic size, yellowish brown in colour, elongated and beaded and with bulbous ends, the core of the body being an asbestos fibre.

Regarding the practical clinical significance of these bodies Merewether and Price state:—

"They are found in the sputum within a comparatively short time after exposure to asbestos dust, and in the absence of clinical or radiological evidence of pulmonary fibrosis their presence cannot at present be taken as indicating anything more than previous inhalation of asbestos dust."

- (1) Gloyne, B. R.: *The Morbid Anatomy and Histology of Asbestosis*: Tubercle, July, Aug., Sept., 1922.
- (2) Merewether, E. R. A.: *A Memorandum on Asbestosis*: Tubercle: Nov., Dec., 1922; Jan., 1924.
- (3) Merewether, E. R. A., and Price, C. W.: Report on effects of Asbestos dust on the lungs and Dust suppression in the Asbestos industry. H.M. Stationery Office, London, 1920.

Asbestos bodies may be found in the sputum years after a short exposure.

Clinically the signs of asbestosis are slight in the early stages. The striking symptom is dyspnoea of gradually increasing intensity as the disease progresses. Ultimately the dyspnoea may become extreme. Merewether speaking of such advanced cases, says: "Usually the fatal issue is determined by the onset of some acute infection with which the remaining undamaged lung tissue is quite unable to cope: this is commonly a low grade broncho-pneumonia, but may be a lobar pneumonia, bronchitis, influenza or less often a sub-acute tubercular infection. . . . In the absence of intercurrent infections the fibrosis may progress to an extreme degree . . . and death ensues from slow heart failure."

An established asbestosis is a serious disease. Like other pneumoconioses the duration of exposure prior to the development of the disease is related to the average concentration of dust in the air breathed. "Particulars of the cases" of industrial asbestosis which have occurred in England "seem to show that with high concentrations of dust the minimum period of time which must elapse between the commencement of exposure and the production of a serious degree of asbestosis is approximately seven years." A few cases have, however, occurred with exposure of less than five years.

The radiographic appearances in asbestosis are in conformity with the pathological characters of the disease and differ in important respects from those seen in silicosis.

In the initial stages of "abnormal increase in striation" the appearances in the lung fields are finer and more reticular than those seen in exposure to siliceous dust and become associated with a fine ground glass stippled appearance particularly in the lower half of the lung fields, and later with a shaggy outline of the heart and diaphragm shadows and sometimes of the lateral peripheral margins of the lung fields.

It is recognised that appearances of an abnormal increase in the striation are of greater pathological significance in persons exposed to the dust of asbestos than in those exposed to siliceous dust.

The Shabanie Mines.—Exploitation of the asbestos deposits in the Shabanie area began in 1916 to 1917 and the present Shabanie mines are a group of several originally separate properties. There are four mines in the group and the ore mined is now over one and half million tons per year. Until recently most of the ore was mined by quarrying but in latter years underground mining has been contributing a larger proportion of the ore than formerly. The maximum vertical depth reached underground is 700 feet. A special "cut and fill" method of stoping is used. Waste sorting is carried out in the stopes. The latter are about 35 feet wide by anything up to a 100 feet long. The broken ore is wetted in the stopes and quarries and is hand cobbled in these situations.

It then passes to the four primary mills or "rock plants" and undergoes successive crushings and sortings.

It is then dried and subjected to further successive crushings and screenings, the loose fibres of asbestos being lifted off by air suction after each crushing and passed to settling boxes until the economic limit of fibre crushing is reached.

Further grading and separation from foreign material is performed in the grading mill in order to effect a final grading of the asbestos in terms of length of fibre.

It will be noted that in his report on dust conditions Mr. Patterson states that on this mine relatively low dust numbers were found. In the quarries and underground workings the number of particles ranged from 75 particles per cubic centimetre to 880. The highest numbers were found in the two samples taken in the crushing and grading mills. In these the number of acicular particles reached 15 per cent., most being under 5 microns in length.

Six samples of settled dust on ledges or other surfaces in the sorting and treatment sections of two "rock plants" and in the central grading mill were

obtained by Major Lightfoot, who reports that the minerals detected were chrysotile fibre, serpentine, carbonate, iron ore, and possibly talc. The proportion of very fine fibres was very small and generally the chrysotile was in the form of coarse fibres. This applies also to the other constituents with the exception of iron ore particles and to a certain extent carbonate.

The mills are spacious and airy, and it is everywhere evident that great care has been taken by the management to prevent the dissemination of dust. In the sorting room there is no visible dust and very little is visible in the crushing and grading departments.

The general conditions on the mine are extremely good and the medical service is highly efficient, the hospital accommodation is of an exceptional standard, and an X-ray unit is installed in the hospital.

The mine employed in 1937 an average of 186 Europeans. At present 26 are employed in the mills, 14 in quarries and 58 underground.

The native complement was distributed as follows:—

<i>Underground 2,235, viz.—</i>		<i>Surface 3,262, viz.—</i>	
Machine drillers	183	Mills	1,446
Hammer boys	81	Other surface	1,816
Trammers and Lashers	1,684	(36 per cent. of the natives working in the mills are employed on sorting)	
Other underground	287		

Some 36 per cent. of the natives were Southern Rhodesian natives.

The Commission examined only such European and native employees as had been employed solely at Shabanie and these were in each case grouped separately according as employment was in the mills or in quarries and underground.

Europeans employed in Mills.—Twenty Europeans were examined who had been employed solely in the crushing and grading mills at the Shabanie mines. Fifteen of these men had been employed for less than three years six months.

In none of these 15 cases were there appearances of an "abnormal increase in striation." In four there was a slightly increased striation of infective type indicative of a slight former tuberculous infection. Three of these men were of the spare physical type associated with that condition, one stated that tuberculosis had been suspected in his boyhood, and he was somewhat bronchitic. But in no case could any abnormality be found which could be related to inhalation of asbestos dust.

Three men had worked in the mills from eight to nine years, none showed more than a moderate increase in striation, which was within normal limits but in one the appearances were suggestive of a slight amount of retention of asbestos dust. He was a man of 28 years of age and of good general nutrition, he was a trifle dusky and complained that his "wind had not been too good for quite a while on climbing or exertion."

One man who had worked for over 10 years showed no radiographic or clinical abnormality.

• One who had worked as a shiftman for five years and as mill manager for 10 years was in very good health, the radiograph showed no abnormal increase in striation.

Five other mill men were examined whose work had not been solely carried on the Shabanie mines and they are therefore not included in this Report.

Europeans employed in Quarries or Underground.—Seven Europeans were examined who had worked in quarries or underground at Shabanie only: 1 for 3 years, 3 from 5 to 9 years, 1 for 11 years and 2 for 17 years. In none of these cases did the radiograph show more than a moderate increase in striation of a simple type. Of 2 with a service of 17 years, 1 was quite healthy and well nourished but was somewhat emphysematous and complained of chronic cough, the second was not of robust type and had an asthmatic history. Neither, however, showed radiographic appearances indicative of asbestosis.

Examination of Natives Employed in the Mills and in Quarrying and Underground Mining at the Shabanie Mines.—The annual turnover of the native complement on the Shabanie mines is about 65 per cent, short service "boys" form the great majority. The average duration of service of natives in the mills is 12 months. The proportion of natives with service of over five years who had worked only on the Shabanie mines is thus not high.

The Commission obtained 197 such natives for examination.

The distribution of these and the results of their examination were as shown in the accompanying Table.

TABLE VII.
RESULTS OF EXAMINATION OF NATIVE EMPLOYEES AT THE
SHABANIE ASBESTOS MINES.

Years of Service.	Number Examined.	Radiographic appearances within normal limits.	Radiographic appearances of abnormal increase in striation.	Radiographic appearances indicative of definite asbestosis.	Radiographic appearances indicative of tuberculosis.
<i>A.—Natives Employed in Mills.</i>					
-5	3	2	1	—	—
5+	87	83	4	—	—
10+	20	18	2	—	—
15+	1	1	—	—	—
20+	—	—	—	—	—
Total	111	104(94)	7(6)	—	—
<i>B.—Natives Employed in Quarries or Underground.</i>					
-5	1	1	—	—	—
5+	19	16	2	—	11
10+	54	52	2	—	—
15+	11	10	1	—	—
20+	1	1	—	—	—
Total	86	80	5(6)	—	11
Combined Total	197	184(94)	12(6)	—	11

The Commission is aware that in persons exposed to asbestos dust appearances of "abnormal increase in striation," if of the type which has been noted in such cases, is of much greater pathological significance than the parallel appearances in persons who have been exposed to silicious dust. The films were, therefore, carefully scrutinized with this consideration in mind.

If the results tabulated above be compared with those shown in Table IV. for natives employed on the thirteen selected gold mines it will be seen that the proportion of cases showing abnormal increase in striation is only rather more than one-third of the corresponding proportion amongst mine natives

in the gold mines. Further, in the seven cases of "abnormal striation," noted amongst the natives employed in the Shabanie mills six were of the "infective" type characteristic of a mild latent or arrested tuberculous infection and the appearances had none of the stigmata of asbestosis. In only one of these seven cases, a mill employee with nine years' service as a sorter, the abnormal increase in striation was of simple type and the appearances were compatible with those of a commencing asbestosis but he had no complaint of cough or shortness of breath. In one or two other cases there was a slight increase of fine striation which was suggestive of slight retention of asbestos dust but no definite case of early asbestosis was found.

The number examined in the critical period of from 5 to 14 years was sufficiently large to have given definitely positive results had these been present. One case of suspected quietly active tuberculosis was detected amongst the underground natives, he had had nine years' service. The sputum, however, was found to be negative for the tubercle bacillus.

There is no doubt that a certain number of definite cases of asbestosis have arisen on the Shabanie mines in the past.

Dr. F. W. Simson, of the Department of Pathology of the South African Institute of Medical Research, Johannesburg, published in 1928 a report on four cases of asbestosis for which the material had been forwarded by Dr. Ireland, the medical officer of the Shabanie mines.

The management of the mines has for many years devoted much attention towards minimising the risk from asbestos dust and the medical officer has been actively attentive to the possibility of the occurrence of cases of asbestosis.

In this connection Dr. Ireland has submitted the following statement to the Commission:—

"The subject of asbestosis has, for several years, been of considerable interest to me and as far back as 1926 I submitted my first specimen of lungs removed at autopsy, to the South African Institute for Medical Research for histological investigation. The lungs in this case showed, microscopically, a fibrosis quite distinctive from anything I had previously seen. However, it was not until 1929 that I began to file records of further investigations and by 1932 I had 16 recorded. Between 1922 and 1938 I have had many investigations made and only two of these have shown any pathology relating to asbestosis. Two of my cases submitted in 1926 and 1927 have been the subject of a special publication made by the Institute, in 1928, and published in the British Medical Journal the same year. Of the 16 cases investigated, 10 were negative in every respect, 3 showed 'curious bodies' without signs of a fibrosis attributable to asbestos dust. Five cases were definitely described as pulmonary asbestosis, the first being in 1926, when there was very little concerning the pathology on record, so that no definite conclusions were reached until 1927, when my second case was investigated by the Institute, and when the fibrosis was definitely associated with the presence of asbestos bodies. I have one case on record in which asbestosis was found in conjunction with pulmonary tuberculosis. I shall refer briefly to the reports by the Institute in connection with those specimens in which asbestos bodies were found either with "no fibrosis" or "fibrosis" not attributable to these bodies and those definitely reported as asbestosis.

Case 1, 1926.—An adult male native who had worked for 12 months in an asbestos mill, who died of pulmonary tuberculosis. 'Curious bodies' were found, but they were not associated with the tuberculosis or accompanying fibrosis until 1927. At the time of examination the fibrosis was attributed to silica.

Case 2, 1927.—A case of pneumonia with two years' service in the mill. There was evidence of fibrosis and asbestos bodies were identified. No evidence of tuberculosis. The findings were suggestive of changes resulting in the lungs from a dust occupation.

Case 3, 1929.—There was a well marked uncomplicated pulmonary asbestosis.

Case 4, 1929.—Two months' service. Asbestos bodies were found which had no relation to the fibrosis described as consequent to a chronic bronchitis.

Case 5, 1931.—Five years' service in the mill. Died of pneumonia. Very slight fibrotic changes due to inhalation of asbestos dust. Asbestos bodies were found.

Case 6, 1929.—Asbestos bodies were found but no fibrosis. Had one month's service, dying of abscess of the lung.

Case 7, 1930.—Five months' service, dying of broncho-pneumonia. Asbestos bodies were found in the alveoli, but no signs of fibrosis.

Case 8, 1931.—Died of pneumonia after 21 months' service in the mill. Asbestos bodies were found and a very slight degree of fibrosis. There was surprisingly little reaction in the lung though asbestos bodies were numerous.

Since 1932 I have two further cases to record, viz.:

Case 9, 1937.—Case of generalised tuberculosis. Fifty-eight months' service. Section of lung showed caseating tuberculosis and asbestosis.

Case 10, 1938.—Case of double pneumonia with 27 months' service as a 'boss boy' underground. Reported as tuberculo-silicotic with asbestos bodies in several areas.

It is interesting to note that most investigators state that symptoms of pulmonary asbestosis in Europeans do not become evident before five years of exposure. It would appear rather extraordinary that such advanced pathological changes should become evident in native workers before the appearance of any symptoms. The longest case of exposure on record among our natives was five years and then only slight fibrotic changes were found. My worst cases were of one to two years' exposure. This tends to suggest that some other factor may be influencing the fibrosis. I have no record of any case with *symptoms* in any way suggestive of pulmonary asbestosis.

Reviewing the past 17 years that I have been Medical Officer to the Shahanie Mine, I have no record of any European, showing symptoms or signs characteristic of asbestosis. Two of our longest service mill men still show a clean sheet, clinically and radiologically."

Dr. W. K. Blackie, on his visit to the Shahanie mines on 9th March, obtained from Dr. Ireland the lungs of a native who had just died from tuberculosis and has submitted them to examination.

He reports as follows:—

"*Name:* Gladza. *Class of Mine:* Asbestos. *Nature of Work:* Underground boss boy since 1933. He had, however, previously spent two years on a gold mine.

The microscopic appearances were those of tuberculous broncho-pneumonia with caseation and commencing cavitation. The lung tissue was also examined histologically. For this purpose a series of six blocks were prepared from different areas of the lungs and sections prepared from each block were stained by the following methods: Haemalum and Eosin, Prussian Blue reaction with Carmalum counter-stain, van Gieson and haematoxylin, Gallego, Celestin Blue, Eosin and Light Green.

The salient features of the sections were:—

- (a) Areas of tuberculous broncho-pneumonia.
- (b) The presence of numerous asbestos bodies.
- (c) Black opaque particles probably derived from a brittle element in crude asbestos.
- (d) An absence of diffuse interstitial fibrosis.

The asbestos bodies were scattered singly and in clumps throughout the sections. There was a general tendency, however, for the bodies to be congregated in greatest concentration in relation to the tuberculous

lesions. It is generally stated that the pulmonary reaction to asbestos bodies takes the form of a diffuse interstitial fibrosis. In order to demonstrate this feature in the material examined special fibrous tissue stains were employed. These brought out foci of mild fibro-cellular reactions in relation to aggregates of pigmented cells, with areas of peribronchial and septal fibrosis, but it is noteworthy that the diffuse interstitial fibrosis of pulmonary asbestosis was not demonstrated.

Thus it may be said that in the material examined there appeared to be no direct relationship between the fibrous tissue changes in the lungs and the presence of asbestos bodies."

The Commission is in agreement with the view that unless a significant degree of fibrosis has been produced by the inhalation of asbestos dust the presence of asbestos bodies in a tuberculous lung does not provide evidence that the onset of tuberculous infection has been facilitated by exposure to asbestos dust.

It would, however, note that one of the cases described in Dr. Ireland's statement in which definite asbestosis was found to be associated with pulmonary tuberculosis occurred as late as 1937 in a native with four years and ten months' service.

While, therefore, taking the evidence provided by Mr. Patterson's dust studies and by the investigation of the Commission together with that supplied by Dr. Ireland, the Commission is of opinion that no significant number of cases of asbestosis is likely to be produced under the occupational conditions which have been developed under the present management, it appears to be possible that occasional cases may arise. Asbestos dust is a dangerous dust with insidious and delayed effects, and all possible steps should be taken by the management, particularly in respect of milling operations, to perfect the measures which have been adopted to prevent exposure to it.

As already stated, the Commission is also of opinion that the measures recommended for the detection of cases of silicosis and tuberculosis on gold mines should be applied to the detection of cases of tuberculosis and possible cases of asbestosis or silicosis on asbestos mines.

*The Mashaba Mine (Gath's Group).—*This mine is in the Victoria district. It is under the same group control as the Shabanie Mines but is a much smaller proposition. The mineralogical characters of the rocks exploited are the same as at Shabanie, the ore is recovered by quarrying, the only work done underground is tramping to the ore-bins on the first level.

The mine employs 14 Europeans of whom three are employed in the mill and four in the quarry, the remainder being employed on other surface work.

Four hundred and fifty natives are employed in the quarry and 60 in the mill.

Examination of Europeans.—Only seven Europeans who had worked only on asbestos mines were available for examination and four of these had been employed for a few months only. The results in these cases were negative.

Of the remaining three, two with services of 4 years and three months and 14 years, respectively, in the quarry were healthy and well nourished and showed no radiographic abnormality. The third with 12 years' service in the mill had some amount of emphysema and bronchitis. He was, however, of the obese pyknic physical type in which that condition is apt to develop in later middle life: he was 59 years of age. His radiograph showed no definite indications of asbestosis.

In one European underground employee who had had 14 years in the Mashaba quarry, but had previously had nine years' underground service on the Witwatersrand with three years on machine drilling, a well marked degree of simple silicosis was detected. He was in good condition and fit for ordinary work.

Examination of Native Employees. Fifty three natives who had worked only on asbestos mines were submitted to examination with the following result:—

TABLE VIII.

RESULTS OF EXAMINATION OF NATIVE EMPLOYEES OF THE
MASHABA ASBESTOS MINE

Years of Service.	Number Examined	Radiographic appearance within normal limits	Radiographic appearance of abnormal increase in striation	Radiographic appearance indicative of definite asbestosis	Radiographic appearance indicative of tuberculosis
<i>A.—Natives Employed in Mill.</i>					
-5	15	15	—	—	—
5+	11	11	—	—	—
10+	2	2	—	—	—
15+	3	3	—	—	—
Total	31	31	—	—	—
<i>B.—Natives Employed in Quarry.</i>					
-5	2	2	—	—	—
5+	9	9	—	—	—
10+	5	5	—	—	—
15+	6	5	—	—	11
Total	22	21	—	—	11
Combined Total	53	52	—	—	11

Five additional cases were examined who had worked in Southern Rhodesian gold mines as well as in asbestos mines. Of these one showed a slight degree of silicosis; he had worked for eight years in the Mashaba quarry and seven years in gold mines; one showed active tuberculosis, he had worked for 15 years as a hammer boy in Mashaba quarry and eight years in gold mines.

The results shown in Table VIII. for the natives who had worked solely in asbestos mines and the conclusions to be drawn correspond at all points with those found in the Shabanie mines. No case of definite asbestosis was detected either in the mill employees or the quarry workers, although 16 had worked in one or other for over 10 years up to a limit of 19 years.

There was one case of suspected tuberculosis in a native who had worked for 13 years in asbestos quarries and 4 years and 10 months in the Mashaba mill. The single specimen of sputum forwarded was, however, negative for the tubercule bacillus.

The Commission was informed that from time to time a few natives had been taken out of the mill for chest complaints, and had their work changed or had been discharged at their own request.

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 this mill.

THE WANKIE COAL MINE.

The Wankie Coal Mine.—There are two collieries in the Wankie coal area. At No. 1 colliery the seam lies 200 feet below the surface and has a thickness of about 10 feet. At No. 2 colliery the seam has a thickness of 20 to 30 feet. The method of mining is pillar and stall.

Mining is entirely in coal and about 6,000 tons are mined daily. From an analysis supplied by the management it appears that the amount of free silica in the coal prior to ignition is of the order of 0.4 per cent.

The mine is well ventilated. Housing, sanitation, medical attention and general care of the natives are of a high standard.

The mine employed in 1937, 137 Europeans on surface and underground and 3,102 natives (average at end of month).

The native complement was distributed as follows (daily average):—

Underground.—Machine drillers, 155, hammer boys, 10; trammers and lashers, 879; other underground, 672.

Surface.—1,351.

Two-thirds of the native complement are Northern Rhodesian natives.

Examination of European Employees.—Clinical and radiographic examinations were made of those European underground employees who had worked solely in coal mines either at Wankie or elsewhere.

Of these there were 11—all were healthy men and were fit for and performing ordinary physical work.

Two only had worked solely at Wankie. The radiograph of one, aged 55, showed some amount of "abnormal increase in striation" associated clinically with chronic bronchitis. He stated, however, that he had had a chronic cough ever since he had been gassed during the war so that his case was not uncomplicated, he had had 26 years' work on the surface crusher station at Wankie.

The second, aged 44, had had 14 years' service as a coal miner at Wankie. He was of "pyknic" type, and getting obese; he had emphysema and slight bronchitis, a condition which persons of this physical type are prone to develop in middle life. His radiograph showed no abnormal increase in striation.

In the remaining nine cases the greater part of their work had been performed elsewhere in Scotland, England and Wales, or in the Union of South Africa.

Two were mine officials and showed no abnormality.

The other seven were long service miners with ages ranging from 41 to 49 and with an underground service of from 23 to 34 years. In six the radiograph showed some amount of abnormal increase in striation suggestive of a minor degree of fibrosis, but in no case was there evidence of nodulation or of areas suggestive of anthraco-silicotic consolidation. In one or two there was some emphysema but all were healthy men fit for and performing ordinary work.

Examination of Native Employees.—The 116 native employees examined had worked only at the Wankie colliery and formed a random sample of those most liable to be exposed to dust, namely:—

Machine and hammer or jack hammer boys, 44; screening, 27; lashing, 40; and others, 5.

The distribution of these 116 natives according to duration of service was as under:—

Duration of Service.	Under 5 years.	5 to 9 years.	10 to 14 years.	15 to 19 years.	20 years and over.
Number examined	—	3	82	21	10
Radiographs showing abnormal increase in striation	—	—	4	1	—
Other abnormalities	—	—	1	—	—

The general physique of these natives was very good.

One native only, included in the group having 10 to 14 years' service, showed significant abnormality. The radiograph showed a well defined dense and moderately extensive opacity placed roughly symmetrically in the sub-apical zone of each lung and extending to the periphery. The appearance suggested bilateral areas of arrested or latent tuberculosis associated with consequent local retention of coal dust. The native was healthy, erect and well nourished and had no complaints. The appearance described is familiar in cases of coal dust retention with possibly slight fibrosis.

With this exception the radiographs of these natives showed no significant abnormality. In five only there was a moderate increase in striation of infective type indicative of slight old arrested tuberculosis but this occurrence in a sample of the size taken was to be expected.

The 10 natives who had had over 20 years' service were all middle aged or elderly. Two showed evidence of very slight old healed tuberculosis but were in good health and fit for ordinary work: one had chronic bronchitis and one slight emphysema.

With the single exception of the case first mentioned there was no indication amongst these natives of any significant abnormality. Many of those in the 10 to 14 and 15 to 19 years' periods of service showed radiographically an "ideal" normal thorax.

The appearances found in this sample of cases leads the Commission to conclude that coal mining at Wankie is not productive of silicosis.

Chrome Working.—The chrome quarries at Selukwe Peak and Railway Block, near Selukwe, were inspected by the Commission but the character of these workings did not suggest that they are at all likely to produce cases of silicosis and no detailed investigation was, therefore, carried out.

Conclusion.—The Commission desires to express its cordial thanks to all Government officials, representatives of the Mining Industry, mine officials, miners and others for their active co-operation in forwarding the investigations conducted in this enquiry.

L. G. IRVINE,
Chairman.

C. W. ROBERTSON,
Member.

W. K. BLACKIE,
Member.

As Advisers:—

A. S. ROME,

B. LIGHTFOOT,

H. S. PATTERSON.

APPENDIX 1.

SILICOSIS IN SOUTHERN RHODESIA.

REPORT BY THE SUB-COMMITTEE APPOINTED BY THE RHODESIA AND
SOUTHERN CHAMBERS OF MINES

The Sub-Committee consisting of one representative from each of the Chambers of Mines in Southern Rhodesia was appointed in May, 1937, to investigate and report as far as possible on the incidence of Silicosis in this country and make recommendations to the Chambers in connection with its prevention and control.

In connection with our investigations all miners on the Cam and Motor and the Globe and Phoenix Mines have been examined both medically and by a radiologist. All X-ray negatives were sent to the Phthisis Bureau in Johannesburg for interpretation.

The result of the examination of 92 men is as follows:—

Suffering from Silicosis	11 (Cam, 4; Globe, 7)
No sign of Silicosis or Tuberculosis	81

An analysis of the careers of the 11 men affected, discloses that:—

1	worked for	16	years on the Rand.
2	" "	14	" " " "
1	" "	11½	" " " "
1	" "	9	" " " "
1	" "	{ 8 years in India	
		{ 4 " " Cornwall	
		{ 1 " " Northern Rhodesia	
2	" "	12	years in coal and iron mines in England
1	" "	{ 10½ years in N England mines	
		{ 1 year on Rand	

Total 9

While it is not proved that these men definitely contracted silicosis outside Rhodesia, it may be stated that it is extremely probable.

Of the remaining two cases, one has worked for 26 years on the Globe and Phoenix Mine and on no other mine, and is suffering from a "moderate degree of silicosis."

The other has only worked on the Globe and Phoenix among the larger mines, and that for a period of 10 years, but he has also worked for 15 years on small mines and quarries. The full period of 25 years has been spent in Southern Rhodesia.

He is also suffering from a "moderate degree of silicosis."

There are, then out of nearly 100 miners examined, only two who have definitely contracted silicosis in Southern Rhodesia.

Of the men examined, it is worthy of note that there are 13 men with underground service of from 16 to 33 years, who so far are not sufferers from silicosis. It should be noted that of these, 11 are on the Cam and Motor, where the position seems more satisfactory than on the Globe and Phoenix, and where 8 of the 11 have worked continuously for 11 years or more.

Conclusions.—While it is proved that silicosis does exist in Southern Rhodesia, the position is not serious.

The conditions under which silicosis sufferers worked in the past have been much improved on, and it appears therefore, that healthy miners may reasonably expect at least 20 years' service before developing silicosis in the slightest degree.

It appears to us that in one case of silicosis, the period before infection might have been lengthened considerably had the man in question been of better physique.

Recommendations. We recommend:—

1. That in the case of the deeper mines, these mines should subject prospective miners and learner miners to a strict medical and X-ray examination, and should only engage those who have satisfactorily passed this examination.

2. That facilities should be granted to the mines by the Government Medical Authorities through which miners and learners can undergo X-ray examinations at any Government Hospital where X-ray apparatus is installed, on payment of a nominal fee by the mine concerned.

3. That failing the appointment of a Government Radiologist qualified to interpret the photographs, the Chambers of Mines enter into an arrangement if possible, with the Phthisis Bureau in Johannesburg under which our photographs can be interpreted for us.

4. That after 10 years' underground mining on the deeper mines, all miners should be examined radiologically once a year.

5. That while the so-called Ante-Primary stage of Silicosis does not cause disability, it is necessary to eliminate the secondary stage sufferer, i.e. the man who may be suffering from tuberculosis as well as silicosis.

6. That although tuberculosis may not be directly traceable to the man's employment, yet should future examination prove any underground employee to be suffering from tuberculosis, as a direct result of silicosis, or from silicosis in the secondary stage, the mines should pay such sufferer a pension of £10 per month to a maximum of £500.

7. That section 163—Mines and Minerals Act, 1935—Clause 1 (a), (b) and (c) should be altered to read "tuberculosis or miners' phthisis with tuberculosis" instead of "miners' phthisis or tuberculosis" as at present.

We would stress that of these recommendations the most important is the strict medical examination of all men for underground work (*vide* Recommendation 1), and would suggest that this should be brought to the notice of the authorities in charge of the mining side of the Technical School at Bulawayo.

DIGBY V. BURNETT,

Representing THE CHAMBERS OF MINES, SALISBURY
(Incorporated).

G. A. DAVENPORT,

Representing RHODESIA CHAMBER OF MINES.

1st November, 1937.

APPENDIX II.

Shabanie Mine,
RHOODESIAN AND GENERAL ASBESTOS CORPORATION, LTD.

Shabanie Mine,
Shabani,

26th December, 1937.

The Consulting Engineer,
Rhodesian & General Asbestos Corporation, Ltd.,
P.O. Box 1100,
Bulawayo.

Dear Sir,

ASBESTOSIS.

I have pleasure in submitting herewith my report on the subject of asbestosis on the Shabanie Mines.

My service, as Medical Officer to this group of mines, extends for a period of over 16 years. During this I have interested myself in the dust problem in the mills and mine in its relation to pulmonary affections.

On the 10th May, 1932, I submitted a report giving full details of the service and health records of all European millmen who had been subjected to our highest concentrations of dust. I decided to confine myself to this group of employees as in all other occupations on the mine the dust problem appeared negligible. At this stage I came to the conclusion that no genuine case of pulmonary asbestosis or any form of fibrosis of an occupational nature could be ascribed to the asbestos mining industry of Shabani.

Since 1932 I have continued my investigations, clinically and radiologically, in health and disease, and have satisfied myself that there are, at the moment, no indications of asbestosis becoming a menace to the industry in Shabani.

During the present year I have X-rayed all millmen in the service of the mine. These films have been submitted to the scrutiny of Dr. Irvine, Chairman of the Miners' Phthisis Board, Johannesburg, with entirely negative results. It has been my experience that the millmen, in general, have maintained a very high standard of health and in no case has there been any symptomatic indication of a gradually developing fibrosis. Weights have been maintained and in many cases there has been a considerable gain; there has been no dyspnoea or lamtude or other signs of pulmonary involvement. Some of the men with long service have at different times presented themselves at the Miners' Phthisis Board for examination and I am not able to record a single instance where a "Red Ticket" has not been initially granted or withdrawn on re-examination.

During the present year the system of radiologically controlled medical examinations has been extended to underground workers. It is proposed that re-examinations will be conducted at intervals of one year so that in the course of the next few years it will be possible to review the subject from mining as well as mill occupations. It is interesting to note that among our miners we have several with ante-primary silicosis. These men are required to be re-examined every two years either by the Miners' Phthisis Board or by a Medical Officer nominated by the Board or Medical Director of Southern Rhodesia. In no cases have there been any signs of development to a further stage.

In conclusion, I can, without hesitation, say that no anxiety need be entertained in regard to the asbestos mining industry where adequate provision is made for good ventilation and the protection of the millmen by the use of suitable dust filtering respirators as are used on this property.

Yours faithfully,

A. J. IRELAND,
Chief Medical Officer.

APPENDIX III.

SPECIMEN FORM ILLUSTRATING METHOD OF RECORDING INDIVIDUAL
CASE RESULTS IN MASS INVESTIGATION*Explanatory Note:—*

In this form "N.T.," "R.M.F.," and "M.F." indicate respectively the appearances of "Normal Thorax," "Slight increase in linear striation" and "Moderate increase in linear striation."

"M.F.P." indicates a "well marked" and "G.A." ("generalized alborization") a "very well marked increase in linear striation."

"G.A.p.s.M." indicates a "generalized alborization with partial small Mottling" which is the earliest unequivocal radiographic appearance of a definite silicosis.

"G.S.M.," "G.M.M." and "G.L.M." indicate respectively a generalized "small," "medium" or "large" mottling, indicative of a "moderate," "well marked" or "very well marked" degree of nodular silicosis.

"p.inf." indicates, in any of the above types (except the "Normal Thorax"), that the radiograph shows a modification of the type appearances indicative of an arrested or latent infective element.

Appearances of larger diffuse opacities indicative of fibroid consolidation or suggestive of active tuberculosis, if an attempt is made to distinguish these, are also provided for. Such appearances may accompany any of types 1 to 16. Other complications causing diffuse opacity or other abnormality may be noted in the column "Final Classification."

The substantive classification is indicated by a plain stroke, ' ; complicating conditions such as appearance of infection are indicated in brackets, thus [1], so that no case is duplicated.