**Report of the Royal Commissioner on Pulmonary Diseases amongst Miners, together with Appendices and Minutes of evidence, Perth, 4th October, 1910.**

1910.

WESTERN AUSTRALIA.



# REPORT

OF THE

# ROYAL COMMISSIONER

ON

# PULMONARY DISEASES AMONGST MINERS,

TOGETHER WITH

# APPENDICES

AND

# MINUTES OF EVIDENCE.



Perth, 4th October, 1910.

*Presented to both Houses of Parliament by His Excellency's Command.*

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1910.

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# COMMISSION

WESTERN AUSTRALIA, TO WIT. } By His Excellency SIR GERALD STRICKLAND, Count della Catena, Knight Commander of the Most Distinguished Order of St. Michael and St. George, Governor in and over the State of Western Australia and its Dependencies, etc., etc., etc.

G. STRICKLAND, Governor.

[L.S.]

1660/09.

To John Howard Lidgett Cumpston, Esq., M.D., B.S., D.P.H.

WHEREAS it is desirable that a Commissioner should be appointed to investigate and report on—

(*a.*) The prevalence amongst miners of pulmonary diseases;

(*b.*) The nature of such diseases; and

(c.) The extent to which they are associated with or consequent on mining:

Such inquiry to be preliminary to the *personnel* and scope of the Commission being extended with a view to recommending means for minimising and preventing the occurrence of such diseases: Now therefore I, Sir Gerald Strickland, Governor as aforesaid, do hereby appoint by these presents you, the said John Howard Lidgett Cumpston, a Commissioner to investigate and report accordingly: And I declare this Commission to be a Royal Commission within the meaning of "The Royal Commissioners' Powers Act, 1902": And I do hereby desire and request that you do, as soon as the same can conveniently be done (using all diligence), report to me in writing your proceedings and the result of your inquiries.

Given at Perth, this 2nd day of March, 1910.

By His Excellency's Command,

J. D. CONNOLLY,

Colonial Secretary.

GOD SAVE THE KING ! ! !

# REPORT.

*To His Excellency Sir Gerald Strickland, Count della Catena, Knight Commander of the Most Distinguished Order of Saint Michael and Saint George, Governor in and over the State of Western Australia and its Dependencies, etc., etc., etc.*

MAY IT PLEASE YOUR EXCELLENCY,—

In accordance with the Commission issued to me on the second day of March, 1910, I have now the honour to submit my report upon the prevalence of diseases of the lungs amongst miners, the nature of such diseases, and the extent to which they are associated with or consequent on mining.

2. In order to obtain the information necessary for the compilation of a report upon these questions, I have visited the principal mining centres between Meekatharra at the Northern extreme and Norseman at the Southern extreme.

3. Formal evidence has been taken from a number of witnesses. These witnesses consisted chiefly of medical men, officials of labour organisations, and inspectors appointed by the Mines Department. The evidence tendered by these witnesses is included as an Appendix to this Report.

4. An opportunity of tendering evidence was afforded to any other persons who might have information which they desired to bring before the Commission, but such opportunity was in no single instance taken advantage of.

5. It was thought preferable to limit the scope of this Report to observations made personally by myself.

6. The Report is divided into three sections: (1) Statistical, consisting of a study of the prevalence of lung diseases amongst miners during the past ten years; (2) The results obtained in the examination of two thousand and fifty men engaged in the mining industry in this State—of those two thousand and fifty men, eighteen hundred and five were actually at work and were examined under conditions as nearly as possible identical with the actual conditions under which they carried on their work; (3) Experimental. This section describes the results obtained in a very limited number of experiments performed with the object of elucidating the pathological changes in the lungs of small animals produced by the continued inhalation of mineral dust.

7. *Post mortem* examinations.—At the outset of this inquiry the hope was entertained that opportunities would be forthcoming for examining after death the lungs of some miners; such opportunities, however, did not present themselves. The lungs of two men only were available. One of these was not a miner; and I was able to see the other specimen only through the courtesy of Dr. Mitchell, who very kindly preserved portion of the lungs from a man killed in a mining accident.

8. The study of statistics for the past ten years makes clear the following principal conclusions:—

(a.) Lung diseases, in the ten years under review, have been, considered as a group, distinctly more prevalent amongst miners than amongst males over fifteen years of age generally; and while this is true of lung diseases considered as a group, it is true also of the principal individual diseases of this group.

(b.) Tuberculosis of the lungs has been steadily on the increase amongst miners during the period, and pneumonia has been as steadily on the decline.

(c.) An important factor in producing an excess for miners in the group, "Other Respiratory Diseases," has been fibrosis of the lung.

(d.) At all ages between 25 and 60 the percentage of deaths in each age-group is higher amongst miners than amongst the general population.

(e.) The miner has considerably less chance of surviving until the age of 60 years than has the average male over fifteen years of age.

(f.) Considering the average ages at death for miners and for all males over fifteen years of age, the miner has three and a-half years less of life than has the average male over fifteen years of age.

9. The term "Miners' Phthisis" is used in this paragraph for the first and last time in this Report. That term is an inexact one, and its use has led to a great deal of confusion in the past. The term "phthisis" has for centuries been understood to mean tuberculosis of the lungs, which is a condition having its own distinctive pathological features; but when abnormal conditions in the lungs of miners have been under discussion, the term "Miners' Phthisis" has been used with the intention of including indiscriminately both the fibrotic changes due to dust and the granulomatous changes due to the tubercle bacillus. Such a confusion of distinct pathological conditions should not be perpetuated; and therefore throughout this Report, whenever the term "fibrosis" has been used, it is to be clearly understood that that term

includes only the changes produced by dust, and does not in any way refer to changes produced by the tubercle bacillus. Similarly, when the term "tuberculosis" is used it means tuberculosis, and does not include fibrosis. When it has been desired to signify the co-existence of the two conditions, then it has been clearly so stated. It must be emphasised that tuberculosis and fibrosis are two different conditions; different in their essential pathological natures; different, therefore, in their causation; different in the conditions under which they manifest themselves, and demanding entirely distinct consideration in any discussion on the remedial measures to be instituted for them. My investigations have led me to the pronounced conclusion that in Western Australia it is the exception for these two conditions to occur in the same patient.

(The term "fibrosis" has been used in preference to a variety of other terms in common use, as being pathologically the most correct.)

10. The examination of the men engaged in mine work was in each case a complete physical examination of the chest, and the men were stripped to the waist for the purpose. The men examined were divided into four groups:—

(a.) Those actually at work and examined as nearly as possible under working conditions;

(b.) Those brought to notice by the officials of various labour organisations (chiefly advanced cases who felt themselves unable to work by reason of affections of the lungs from which they suffered);

(c.) Miners examined at the Sanatorium;

(d) A few men who, for various reasons, desired to submit themselves for examination.

11. All the deductions made, with the exception of those referring to tuberculosis, have been arrived at as the result of the examination of men included in Group (a). The reason for this course is that Group (a) constitutes what may be termed a "fair average population," whereas each of the others must be regarded as a selected group of cases; and it is, of course, obvious that a study of selected cases will not furnish any evidence which could properly be applied to the whole of the mining population.

12. The examination of the eighteen hundred and five men revealed the following facts:—

(a.) Early fibrosis was present amongst machine miners to the proportion of 33.16 per cent.; amongst non-machine miners to 7.23 per cent.; amongst truckers to 3.1 per cent.; and amongst dry treatment hands to 24.5 per cent.

(b.) Intermediate fibrosis was found amongst machine miners and non-machine miners; late fibrosis was found only amongst machine miners. (It is unnecessary to specify the percentages of intermediate and late fibrosis respectively; the fact of their existence is of sufficient significance);

(c.) Pleurisy was found to be present in men engaged in several different classes of mining;

(d.) Tuberculosis of the lungs was present in a total of 28 cases, i.e., 1.5 per cent., or, if the whole of the men examined (2050—including the selected cases), be considered, this condition was present in 65 cases, which is 3.2 per cent.

(e.) Early fibrosis was most commonly present amongst machine miners and dry treatment men; and amongst those to an important extent;

(f.) Early fibrosis seems to make its appearance most frequently about the second year on machine work.

13. The expression of results in percentages is not of such vital importance as the actual determination that there are in existence certain abnormal conditions, and that those abnormal conditions are present to a serious degree. It is clear that fibrosis of the lungs is present in all its stages amongst miners in Western Australia, and also that the number of cases of early fibrosis is so great as to call for serious consideration.

14. This existence of a high percentage of fibrosis amongst working miners cannot be attributed to the importation of such cases from places outside Western Australia. This aspect has been dealt with, and it is quite clear that the mines of Western Australia can and do produce fibrosis to an important extent; for amongst machine miners fibrosis is present in 25 per cent. of the men, and amongst the dry treatment men in 19 per cent.—these percentages are calculated for those men only who have never worked on mines elsewhere than in Western Australia. Fibrosis of the lungs has been shown in various ways in this Report to be due to the action of dust; and as a general statement based on the results obtained by the experiments—and which may be taken as an indication of the lines upon which remedial measures must be instituted—it may be said that a man suffers from fibrosis to the extent to which he is exposed to the continued inhalation of fine mineral dust—in other words, if there be no dust there will be no fibrosis. The converse is equally true, that the continued inhalation of dust certainly produces some fibrosis.

15. Tuberculosis of the lungs is not yet present amongst miners in Western Australia to any alarming extent. The evidence seems to me to point fairly definitely to the infectious nature of tuberculosis of the lungs, and seems to me to indicate strongly that this disease must be regarded in the light of an infectious rather than an industrial disease. Although the amount of tuberculosis in this State does not yet approximate to that which exists in Cornwall and in Bendigo, yet it is clear that there is already in this State at least one local focus of infection; and it may be expected that others will develop—and then tuberculosis of the lungs, instead of being a disease which can be comparatively easily dealt with as at present, will become so widespread that its effective eradication will be impossible.

16. There is not forthcoming any evidence to show that tuberculosis of the lungs amongst miners is the result of anything in the nature of a "mine infection"—that is to say, the hypothetical impregnation with tubercle bacilli of the dust in the levels, the rock at the working faces, the timber or any other part of the mine workings has not been shown to be one of the factors producing tuberculosis amongst men working underground. This point has been investigated experimentally, and I have been led to the firm conclusion that tuberculosis of the lungs is contracted by one man directly from another man, without the intervention of any indirect agent. This statement must be modified to the extent that, in exceptional circumstances, such articles as blankets, etc., may possibly be credited with such indirect action where, for example, a man has purchased the

belongings of an infected miner leaving a district. As a general statement (open, of course, to modification), it may be said, within the limits of this investigation, that where there is no consumptive there will be no consumption.

17. Any measures which aim at the eradication of an infectious disease logically begin with the isolation of sources of infection—that is, of all persons already suffering from the disease to be eradicated. Any consideration of the measures necessary for the eradication of tuberculosis amongst miners must not stop short at the exclusion of affected miners from the mines or mining communities, but must also include consideration of the segregation of tubercular persons who are not themselves miners, but who come into more or less close association with miners.

18. In paragraph 15 it is stated that tuberculosis of the lungs must be considered more in the light of an infectious than an industrial disease. This statement must not be misunderstood. The fact that tuberculosis is most common in men engaged on machine work has been interpreted as indicating primarily that this class of work, by reason of the close association of the two men working upon one machine, offers the greatest facility for personal infection. It has, however, been generally accepted that lung tissue which has been impaired by the action of dust is thereby rendered more susceptible to the action of tubercle bacilli. So far as I have been able to ascertain, there is no direct experimental evidence upon this point, but the fact that tuberculosis is found in all countries to be excessively prevalent amongst men engaged in other dusty occupations—for example, knife grinders, pottery makers, etc.—must be accepted as indicating the correctness of this commonly-accepted belief. Therefore, while tuberculosis amongst machine men is more an infectious than an industrial disease, it appears certain that the action of dust does predispose to the action of the tubercle bacillus. In this connection, the significance of the existence of a large number of cases of fibrosis must not be lost sight of.

19. Experiments which have been performed, when placed side by side with the observations of other observers upon the lungs of men affected with advanced fibrosis, reveal plainly the nature of the changes which take place in the lung as a result of the presence of dust therein. Briefly the effects created by the presence within the lung of dust are inflammatory changes throughout the lung substance, resulting in the production of fibrosis; and the ultimate effects are: (1) Diminished area of lung tissue available for the purification of the blood; (2) diminution in the amount of air which can reach the lungs; (3) diminution in the amount of blood which can reach the lungs.

20. There is considerable reason for believing that dust alone does not produce pleuritic inflammation, and therefore that dust alone is not the cause of the adhesions between the lung and the chest wall which are so commonly met with in cases of fibrosis. These affections of the pleurae—which are an important factor, because through them the full expansion of the chest is prevented—are probably produced by the action upon lungs already affected by dust, of an exposure to rapid changes of temperature. This exposure is rendered the more complete by want of care on the part of the men themselves with regard to the protection of their chests upon leaving work.

21. There seems to be good reason, from the experiments, for concluding that the development of fibrous tissue consequent upon the irritation by dust does not necessarily cease when the affected person is removed from a dusty environment, but will only cease when the whole of the dust within the lung, has been collected, and encapsulated with fibrous tissue. As this process would be likely to take a considerable time, mere temporary cessation of work amongst dust would not be of any value.

22. The study of statistics which has been carried out in Part I. of this Report shows that pneumonia has been very prevalent amongst miners, but that it is now becoming rapidly less. As this is an acute disease, it would not, of course, be amongst the conditions discovered by the examination of men actually at work; and therefore it does not appear in Part II. of the Report. A good deal of light is thrown upon this disease by Experiment No. 3, in which a guinea pig died from acute congestion of the lungs after treatment with dust for one hour daily on eight days. There is here found an indication of the reasons why pneumonia has been in the past so prevalent amongst miners and why it is now on the decrease. When a man first becomes exposed to continued inhalations of large quantities of dust his lungs will become congested and he may possibly die from this cause alone. If, however, there should be present in the lungs any organisms which cause pneumonia (and it is known that these organisms are very frequently present in normal lungs), then acute pneumonia is likely to supervene, and death may occur. If, however, the lungs are able to withstand this first attack, then the inflammatory process will become slower and more like that seen in Experiment No. 4. So that, in the first years of the decade, the figures of which have been reviewed, during which machines became much used in the mines of this State and during which development work was being actively carried out, those men susceptible to the action of dust died from acute pneumonia. It is obviously to be expected, however, that this susceptible section of miners would soon become exhausted; and this we may presume is what has happened. Therefore, pneumonia is on the decrease and early fibrosis is fairly common.

23. Although an inquiry into the occurrence of ankylostomiasis is not within the scope of the present Commission, it seemed desirable to bear this subject in mind, as such exceptional opportunities were afforded for discovering its existence. As is set out in Appendix J, only two cases excited suspicion, and of these only one proved to be ankylostomiasis. This was a man who had been mining in Cornwall for some years and had evidently become infected there. Inasmuch as no evidence could be obtained that the parasite still lived at the time of examination, it is possible that this man may be suffering from the after effects of the disease rather than that he still harbours a live parasite.

24. From the experimental and pathological evidence it seems clear that dust, and dust alone, is responsible for fibrosis; that the causation of pleurisy is somewhat obscure, but that here dust and cold both probably play some part; that there is not forthcoming any evidence to show that there are any other factors producing abnormal conditions in the lungs (except, of course, the tubercle bacillus), though the possibility of the rapid alterations of air pressure having some effect has been considered. It may be that these alterations of air pressure have

some effect in the direction of producing emphysema, but this is pure supposition.

25. It would be of great assistance in following the development of these lung affections amongst miners if the annual reports issued by the Registrar General could be made to include a table showing all the causes of death amongst miners.

26. The reply to the terms of the Commission issued to me is contained sufficiently in the foregoing paragraphs; and as no recommendations are asked for, none are here given.

27. Throughout this work it has been my invariable experience that any person who could assist the Commission did so willingly and freely. All of these cannot be individually specified; but I should like particularly to mention some whose assistance has been particularly valuable:—

(a.) Members of Parliament whose districts were visited;
(b.) The Secretaries of the Labour Organisations in the various districts;
(c.) The individual mine managers;
(d.) District Medical Officers;
(e.) The Registrar General and the officers of his staff;
(f.) The officials of the Mines Department, both at the head office and the district branch offices;
(g.) Various Government Departments in the other States, New Zealand, South Africa, and England.

28. I desire particularly to express my appreciation of the assistance rendered to me by Dr. M. K. Davies for supervising much of the experimental work during my absence, for examining specimens sent down from various mining centres, and for much assistance in other directions; to Dr. R. M. Mitchell, D.M.O. at Coolgardie, for much valuable assistance; the officials of the Kalgoorlie School of Mines; to Professor H. B. Allen, of the Melbourne University, and Dr. Chapman, of the Sydney University, for many valuable suggestions; to Dr. G. A. Walpole, of Gormanston, Tasmania, for an account of his experiences amongst men working at the Mount Lyell mine; to the Secretary of the Chamber of Mines at Kalgoorlie for a great deal of assistance; to Dr. Steel for much valuable advice and assistance; to Mr. H. J. Pether, the Government Lithographer, for his very valuable assistance in the production of the illustrations in this Report.

29. I particularly desire to record my appreciation of the work done by Mr. S. W. Cusack, who has performed all the secretarial duties of the present Commission. Had it not been for Mr. Cusack's very willing and very able assistance the work recorded in this Report could not have been brought to completion.

(Signed.) J. H. L. CUMPSTON,
M.D., B.S., D.P.H.

4th October, 1910.

## PART I.—STATISTICS RELATING TO THE TEN YEARS 1900-1909.

This investigation consists mainly of a research into the extent to which lung diseases exist amongst that section of the community engaged in mining. Whilst, however, information thus obtained will be of value, in that it will clear up a question in regard to which there has hitherto been much uncertainty, it cannot be considered complete unless placed side by side with data revealing at a glance the position in past years in regard to lung diseases amongst miners.

It becomes necessary, therefore, to ascertain which of the diseases of the lungs have in past years been prevalent amongst miners, and whether those diseases have been prevalent to a greater or less extent amongst miners than amongst the general population.

The study of statistics is of real value only when it proceeds in logical order. It is therefore necessary to inquire first which diseases of the lungs affect the general population.

There are two official sources from which this information is obtainable—the annual reports issued by the Registrar General, which supply the causes of death, and the returns furnished to the Medical Department, which state the occupations of all patients treated in the Government hospitals and the diseases for which they are under treatment.

Table 1 (page 20) shows the diseases of the lungs which caused deaths in Western Australia during the ten years 1900-1909, inclusive, and Table 16 (page 30) the diseases of the lungs for which patients were under treatment in Government hospitals during the same period.

The ten-year period 1900-1909, inclusive, was selected as being the most representative of mining in this State, and as the most likely to give evidence of the existence of any factors which would favourably or unfavourably affect the health of those engaged in the mining industry.

The records show that prior to 1897 the amount of gold obtained by treating ore was comparatively small (*Western Australian Year Book*, 1902-1904, pp. 872 to 948). If, therefore, three years be allowed for the mining industry to become established, the decade 1900-1909 is entered upon; and by carrying the statistics to the end of 1909, the information obtained is brought as nearly as possible up to date.

From the two sources mentioned it is found that the only diseases of the lungs occurring to any important extent in this State are:—

Tuberculosis of the lungs,
Bronchitis, acute and chronic,
Pneumonia and broncho-pneumonia.
Pleurisy,
Congestion of the lungs,
Gangrene of the lungs,
Asthma and emphysema.

All other lung diseases are grouped under the comprehensive heading, "Other Respiratory Diseases."

The first fact to be discovered, then, as has already been said, is the extent to which these diseases exist amongst the whole population.

This is shown in Table 1 (page 20), which gives the total number of deaths from each of the diseases under consideration for each of the ten years, and also the total number of deaths from all causes whatever for each of the years. At the end of the Table is a column showing the percentage which the total number of deaths from each of the lung diseases during the ten years represents, when expressed as a numerical proportion of the total deaths from all causes.

A proper comparison, however, cannot be made between the percentages of deaths amongst miners and of those amongst the general population; for included in the latter is a large number of females, and there may be factors operating amongst females which invalidate the comparison. Therefore Table 2 (page 20) has been drawn up showing similar sets of figures confined to males.

As the minimum age for employment in mines is 16 years (Mines Regulation Act, 1906, Sec. 53), even this table is not truly comparable with that to be given for miners. Table 3 has therefore been compiled, showing the causes (lung diseases only) of deaths during the ten years amongst *all males over fifteen years of age*. Whilst the minimum age for mining is sixteen it has not been possible to compile a more comparable table for the purpose owing to the fact that, in the returns issued by the Registrar General, deaths are tabulated in five-yearly groups.

Inasmuch as the object of inquiry is to ascertain whether lung diseases have caused a larger or smaller number of deaths amongst miners than amongst the non-mining community, a comparison between the frequency of these diseases as causes of death amongst miners with their frequency amongst all males over fifteen (Table 3) will be sufficiently accurate for all practical purposes.

As the position for the past ten years has now been ascertained with regard to the whole population and certain sections of it (each of which sections includes all miners) it remains to find out what the position has been for the miners themselves, and how that position compares with that for the other sections considered.

Before doing this, however, it is necessary to state the sources from which the figures have been ascertained, and also to point out certain features within the figures themselves.

The tables for the whole population and for all males have been constructed from the annual reports of the Registrar General, which of course may be accepted without further comment. The table for males over fifteen has also been compiled from the same source.

It was found, however, when this inquiry was undertaken, that there had never been any attempt to classify the deaths of miners in a separate set of tables. It was therefore necessary to go right through the whole records of deaths in the State for the ten years and take out the deaths of miners, and from these individual records construct the necessary tables. This work has been very carefully done and subsequently checked, and there is little likelihood of error in the tables.

In taking out these death records for miners, only those individual deaths were included in the tables in which the occupation of the deceased was registered as "miner." All others were separately dealt with and the particulars concerning these are shown separately in Table 11 (page 26). From this table it will be seen that the exclusion of these deaths has not affected the totals and percentages to any appreciable extent. It did not seem to be correct to include any other than those who were registered as "miners," for the conditions of work and life of the "mine manager" or "mining engineer" are not comparable with those of the "miner," nor are the working conditions of the "assayer" or the "prospector" at all comparable with those of the "miner."

It will be noticed in the tables for the whole population and for all males that the figures for certain diseases are shown differently before and after 1907. The reason for this is that it was agreed between the Registrars General of the Australian States that a uniform classification should be adopted from the beginning of 1907, and this new system of classification of the causes of death (the Bertillon international system) differed slightly from the system which had been in vogue in this State previously. The system previously followed in this State was one which had been drawn up in 1887 by Mr. H. H. Hayter, the Government Statist of Victoria.

In order to keep the series uniform for the ten years I have retained for the last three years the same grouping as had previously been in force, and accordingly for the last three years acute and chronic bronchitis are considered together as bronchitis; broncho-pneumonia and pneumonia together as pneumonia, and asthma and emphysema together as one group.

Inasmuch as the deaths of miners had not been grouped at all for any of the ten years, it was thought better to invite the assistance of the officer in the Registrar General's Department who has charge of this work in the grouping of the deaths of miners. This was accordingly done, and the deaths of miners are therefore grouped on a uniform basis with those of all other sections of the population.

It is necessary, however, to point out one or two details in this connection. The actual numbers of deaths from all lung diseases amongst miners have been detailed in Table 6 (page 22). These causes of death have been set down just as they were registered from the medical certificates, and have then been grouped according to the two systems used during the ten years. The use of the two systems has led to a slight confusion in three instances only—seven deaths from "tuberculosis" and one from "tuberculosis, chronic," would have been classed as "other tubercular diseases" before 1907, and as "tuberculosis of the lungs" after 1907; one death from hæmorrhage of the lungs as "phthisis" before 1907, and as "other tubercular diseases" after 1907; and four deaths from "acute inflammation of the lungs" as "pneumonia" before 1907, and as "other respiratory diseases" after 1907.

These eight deaths from "tuberculosis" and "chronic tuberculosis" have been included in the table as "tuberculosis of the lungs," thereby making the percentage from this disease amongst miners higher, but only to an unimportant extent. Had they been excluded (and for this course there was no justification) the percentage of the total deaths amongst miners due to tuberculosis of the lungs would have been 9.19 instead of 9.62. It was, however, considered more correct to include them, thus keeping the percentage at 9.62.

So far as the four deaths from pneumonia are concerned, their inclusion in the group of "other respiratory diseases" makes no appreciable difference, and has the advantage of keeping the series of figures uniform.

Having made the position clear, it is now necessary to tabulate the information regarding miners on lines identical with those used in the previous tables. This has been done in Table 4 (page 21).

For the purpose of ready comparison between these figures relating to various sections of the population, the percentages are shown in parallel columns in Table 5 (page 21). It should be remembered that these percentages represent the proportion of the total deaths which are due to the diseases of the lungs specified.

This table shows that of every hundred deaths amongst the whole population of the State 15.17 are due to diseases of the lungs, while the corresponding percentage amongst all males is 15.86; amongst males over fifteen years of age it is 19.62, and amongst miners it is 27.02. The figures are shown thus:—

| | |
|---|---|
| Whole population of the State .. | 15.17 |
| All males .. .. .. .. | 15.86 |
| Males over fifteen years of age .. | 19.62 |
| *Miners* .. .. .. .. | 27.02 |

It is obvious from this table that the proportion of deaths due to lung diseases increases steadily as the field of statistics is restricted progressively more and more nearly to the group, "miners," until for miners the figure is much higher than it is for the whole population, for males generally, or for the group which is more comparable with the group of miners—all males over fifteen years of age.

It is clear, then, that lung diseases generally have, during the ten years under review, been much more active in causing death amongst miners than amongst all males over fifteen years of age, and even more so than amongst the whole population of the State.

So much having been ascertained, it now becomes necessary to dissect the group of lung diseases and learn whether each shows a corresponding preponderance; and if not, then to discover which of the diseases within this group is operating to produce this excess of mortality.

*Tuberculosis of the Lungs.*—Considering the diseases in the order in which they are given in the table, the following are the figures for tuberculosis of the lungs:—

| | |
|---|---|
| Whole population of the State | 6.32 p.c. |
| All males .. .. .. .. | 6.36 p.c. |
| Males over fifteen years of age | 9.52 p.c. |
| *Miners* .. .. .. .. | 9.62 p.c. |

From these figures it is clear that tuberculosis of the lungs was more frequent as a cause of death amongst miners than amongst the whole population. But it was only slightly more frequent amongst miners than amongst all males over fifteen years of age. This fact illustrates the necessity for comparing the percentages for miners, not with the whole population, but with the males over fifteen. For, so far as tuberculosis of the lungs is concerned, it is a well-known fact that it is more prevalent in males over fifteen than in the general population.*

* Phthisis in Australia, page 5.

*So far as this table goes,* then, the information it affords is that a man is very little more liable to tuberculosis because he is a miner than he would be if he were following any other occupation. It remains to be seen whether other sources of information agree with this result.

This result, and the deduction provisionally drawn from it, must not be accepted as in any way final. A more accurate comparison than the one drawn would be that between the death-rates from tuberculosis per 10,000 living of miners and of all males over fifteen years of age. This is considered later (see page 12).

*Bronchitis.*—The figures for this disease are as follows:—

| | |
|---|---|
| Whole population of the State | 1.89 p.c. |
| All males .. .. .. .. | 1.85 p.c. |
| Males over fifteen years of age | 1.68 p.c. |
| *Miners* .. .. .. .. | 2.12 p.c. |

Bronchitis as a cause of death operated to a greater extent amongst miners than amongst the whole population, and to an even greater extent than amongst males over fifteen years of age.

*Pneumonia.*—The figures for pneumonia are as follows:—

| | |
|---|---|
| Whole population of the State | 5.78 p.c. |
| All males .. .. .. .. | 6.32 p.c. |
| Males over fifteen years of age | 6.60 p.c. |
| *Miners* .. .. .. .. | 11.36 p.c. |

The percentage of deaths due to pneumonia is very much greater amongst miners than amongst males over fifteen, and is almost double that amongst the whole population.

*Pleurisy.*—The figures for pleurisy are as follows:—

| | |
|---|---|
| Whole population of the State | 0.44 p.c. |
| All males .. .. .. .. | 0.47 p.c. |
| Males over fifteen years of age | 0.67 p.c. |
| *Miners* .. .. .. .. | 0.54 p.c. |

Pleurisy during the ten years produced a higher percentage of deaths amongst miners than amongst the general population, but a lower percentage than amongst males over fifteen.

*Congestion of the Lungs.*—The figures for congestion of the lungs are as follows:—

| | |
|---|---|
| Whole population of the State | 0.25 p.c. |
| All males .. .. .. .. | 0.24 p.c. |
| Males over fifteen years of age | 0.22 p.c. |
| *Miners* .. .. .. .. | 0.11 p.c. |

The term "congestion of the lungs" is a very inexact one, and it is difficult always to attach any very clear interpretation to it. As a rule it means pneumonia, and is more often used in connection with the deaths of infants than those of adults. By reason of this inexactness, therefore, it is difficult to decide how much importance should be attached to the figures relating to it. With this reservation, the significance of the figures given above is that congestion of the lungs has produced during the last ten years a lower proportion of deaths amongst miners than amongst males over fifteen.

*Asthma and Emphysema.*—The figures relating to these two diseases, considered as one group, are as follows:—

| | |
|---|---|
| Whole population of the State | 0.23 p.c. |
| All males .. .. .. .. | 0.29 p.c. |
| Males over fifteen years of age | 0.46 p.c. |
| *Miners* .. .. .. .. | 0.65 p.c. |

These two diseases, therefore, have during the ten years produced a larger proportion of the total deaths amongst miners than amongst males over fifteen, and almost three times the proportion amongst the whole population.

*Gangrene.*—This is so infrequent a cause of death (only one death having occurred from this cause during the ten years) that it may be left unconsidered.

*Other Diseases of the Respiratory System.*—The figures for this comprehensive group are as follows:—

| | |
|---|---|
| Whole population of the State | 0.26 p.c. |
| All males .. .. .. .. | 0.33 p.c. |
| Males over fifteen .. .. | 0.47 p.c. |
| *Miners* .. .. .. .. | 2.61 p.c. |

Therefore all the other diseases of the lungs not included in the above headings but included in the group "other respiratory diseases" have produced in the ten years a much greater proportion of the total deaths amongst miners than amongst the total population, and more than six times as great a proportion as amongst the males over fifteen.

This points to an excessive incidence amongst miners of the diseases included in this comprehensive group.

It might be expected that the explanation of the excess in this group would be found in the existence of some disease of the lungs more or less peculiar to miners. Is this so?

If Table 6 (p. 22) be consulted it will be seen that a large proportion of the diseases specified belong to a class which may be all included in the pathological group of fibrosis of the lungs, and it is an already well-known fact that this pathological condition is most often found in those whose occupation exposes them to the inhalation of dust.

The excessive incidence of asthma and emphysema is also significant in this connection, for emphysema is not infrequently one of the pathological types of, and asthma generally a symptom of, the condition produced in the lungs of miners by the continued inhalation of dust.

The high proportion of deaths amongst miners due to this group of "other respiratory diseases" is thus provisionally explained.

It will now be of interest to consider these results as revealed by a study of the proportion which deaths from various lung diseases present amongst the total number of deaths from all causes.

The figures make it clear that during the past ten years, *i.e.* 1900-1909 inclusive, miners have been much more liable to die from lung diseases generally than the whole group of males over fifteen.

Miners have been very little, if at all, more likely to die from tuberculosis than other males over fifteen.

Bronchitis, pneumonia, and asthma and emphysema have attacked miners to a very much greater extent than they have attacked other males over fifteen.

The same is true of the group "other respiratory diseases," which includes "fibrosis of the lung" in a large proportion.

Pleurisy as a cause of death has been present in a slightly less proportion than in the group of males over fifteen.

Congestion of the lungs is noticeably less prevalent amongst miners than amongst males over fifteen: but the caution mentioned above must be remembered.

In attempting any interpretation of these results it must be borne in mind that the causes of death as certified frequently represent the terminal condition

which actually produces death, and may leave unmentioned some other condition which is present in the lungs and which may possibly render the lungs more susceptible to the disease which has actually caused the death. For example, it is possible that the high number of deaths from pneumonia may be the indirect result of some condition present in the lungs of miners which renders such lungs susceptible to attacks of pneumonia. For the present it will be sufficient to indicate this hypothesis, as it will be more fully entered upon at a later stage (page 69).

In order to complete the study of what causes of death are operating amongst miners Table 7 (page 23) has been inserted. This table shows the whole of the individual causes of death amongst miners for the last ten years, with the total numbers of deaths which have been produced by those causes. There is no need to consider this table further.

There is included in Table 7 a list of the deaths which have been in part due to some terminal condition of the lung, but in conformity with the system of classification adopted these have not been considered as being deaths from lung diseases but deaths from the pre-existing condition.

Table 8 (page 24) shows the total numbers of deaths amongst miners from any cause whatever, classified according to individual years and the individual registry districts in which the deaths were registered.

There has now been completed the study of the causes of death amongst various sections of the population and the percentages of the total deaths which have been due to diseases of the lung. Before, however, these comparative percentages can be accepted as in any way conclusive, it is necessary to ascertain the actual numbers of males over fifteen and the actual numbers of miners living in each of the years under consideration. This is necessary, for no deductions from the total numbers of deaths can be considered complete without a study of the rates of those deaths per 10,000 of the total number of individuals living in any particular section of the community.

To take an example to illustrate the necessity for paying greater attention to the death-rates per 10,000 of the whole number living than to the percentages of the total deaths due to any individual cause of death.

Suppose now that the mining industry in Western Australia were suddenly to become almost extinct, and that (as in that event would be most likely) almost all the young strong miners were to leave the State or engage in some work other than mining, leaving the older miners and the invalids behind, it is very likely that a large number of the latter would die and that a large percentage of these deaths would be due to lung diseases, for we will see later on that the chronic lung affections (bronchitis, asthma and emphysema, and fibroid phthisis) appear to be the special property of miners. Then out of every 100 deaths of miners an extremely high percentage would be due to lung diseases. But when it is ascertained that there are only a few miners left in the State, and they the older men, the reason for this high percentage becomes apparent. Therefore it is obvious that the death-rate from any individual cause of death per 10,000 miners living (and the same is true of any section of the population) is the figure that is more reliable than the percentage of the total deaths due to any individual cause of death.

## RATES PER 10,000 OF DEATHS FROM LUNG DISEASES AMONGST MINERS AND AMONGST ALL MALES OVER FIFTEEN YEARS OF AGE.

The necessity for computing the rates per 10,000 living for the deaths amongst miners and amongst the general population from the various lung diseases has been shown.

For such a computation four sets of figures are necessary:—

(a) The total number of males living in each of the years 1900-1909 who had passed the age of fifteen years.

(b) The total number of miners engaged in their occupation during the same years.

(c) The total number of deaths amongst all males over fifteen, during the same years, from the various lung diseases.

(d) The total number of deaths amongst miners from the same lung diseases during the same years.

*Deaths*:—

(c) Deaths from lung diseases amongst all males over fifteen years of age. This set of figures has been obtained from the annual reports of the Registrar General.

(d) Death from lung diseases amongst miners. This set of figures has been compiled, as has been already explained, by extracting from the death records all those deaths in respect of which the occupation of deceased was entered as "miner." (See also the explanatory notes below and on page 10 with reference to surface and underground workers).

*Numbers Living*:—

(b) Total number of miners living. This set of figures (Table 25, page 36) was obtained from the Statistical Branch of the Mines Department, and sets out the actual number of men working on the various registered mines for each of the years under consideration. (In taking out these totals, only underground men have been considered. Inasmuch as in taking out the deaths of miners, only "miners" were considered, and all surface hands excluded, it is only accurate to exclude the surface hands from consideration in the tables now being dealt with; also as the death returns from the district in which Collie is situated are included in the returns of deaths of "miners," the total number of underground coal miners have been included.)

(c) Total number of males over fifteen years of age. This set of figures is not exact; it is only an estimate, for there are no exact data from which the age distribution of the population can be obtained. It was very desirable to obtain an estimate of the total number of males living over the age of fifteen years, in order to get a population similar in sex and age distribution to miners, with which the mining population could be compared. An attempt was therefore made to estimate the number of males living in the State, in each of the ten years, who were over the age of fifteen years.

By the Education Act, 1889, Sec. 6, the ages for compulsory attendance at school are: minimum, six years; maximum, fourteen years. Therefore, the compulsory attendance officer has complete data from which the number of children subject to this section of the Act can be ascertained.

Table 9 (page 25), which gives the number of children between the ages of six and fourteen years, may be taken as substantially correct. There are two other columns in this table giving the ages of children in attendance at the various schools (both Government and private) under six and over fourteen years of age. Between the ages of six and fourteen these figures are exact, or practically so. It remains to estimate the numbers below six and above fourteen years of age.

*Below six years of age*:—

There are for each year approximately 2,000 male children in attendance at school; and there were each year approximately the same number of male births. Therefore it may be assumed that the number of children in attendance at school represents the number of male children alive between the ages of five and six years. There remain the children under five years of age. It has been assumed for the present purpose that one-fifth of all male children have died or have left the State before reaching the age of six years, and to make up the required total there have been added to the total number of children in each year the total of the births during the preceding four years.

*Over fourteen years of age*:—

To make up the difference between the number of children fourteen years and less and the total fifteen and under, there has been added to the total under fourteen one-fifteenth of that total. Therefore, in computing the total number of males fifteen and under, the following quantities have been added together—the sum of those additions representing the number fifteen and under in each individual year:—

(a) The total number of children liable to school attendance under Sec. 6 of the Education Act.
(b) The total number of births in the four years preceding the particular year under consideration.
(c) One-fifteenth of the totals of (a) and (b).
(d) Children in attendance under five years of age.
(e) Children in attendance over 14 years of age.

It is realised that this is rather a crude estimate, but there did not appear to be any better method available. It was very desirable that some estimate should be arrived at, and in default of a better, the one computed as above will be made to serve.

A comparison with the figures actually obtained at the last census will assist in deciding whether the estimate is a reliable one. The total male population at that census was 112,875, and of these 86,030 were over fifteen years of age.

| | |
|---|---|
| Estimated male population (Registrar General), total for ten years .. .. | 1,414,807 |
| Estimated male population over 15 years (present report), total for ten years | 1,131,090—79.9 p.c. |
| Total male population last census (1901) .. .. | 112,875 |
| Total male population over 15 years (1901) .. .. | 86,030—76.8 p.c. |

It appears, then, that while the total number of males fifteen years and over was, at the taking of the census in 1901, 76.8 per cent. of the total number of males, the estimate now formed gives a slightly higher percentage, viz., 79.9

The estimate here formed is therefore fairly accurate.

What, then, are the comparative death-rates from lung diseases per 10,000 of the total population amongst miners and amongst all males over fifteen years of age? (It must not be forgotten that the group "All males over fifteen years of age" includes miners.)

Table 3 (page 21) sets out the actual number of deaths from lung diseases amongst all males over fifteen years of age for each year, and the total for the ten years.

Table 4 (page 21), the actual number of deaths from lung diseases amongst miners for each year and the totals for the ten years.

Table 10 (page 25), sets alongside each other the rates per 10,000 for each of these diseases (for each section of the population under consideration) for the ten years.

From Table 10 it is seen that the rate for the total respiratory diseases amongst miners is very much higher than amongst all males over fifteen years of age:—

*Total Respiratory Diseases*:—

| | |
|---|---|
| All males over fifteen years of age | 19.8 p.c. |
| MINERS .. .. .. .. | 53.9 p.c. |

This shows that respiratory diseases are fatal in a very much greater rate amongst miners than amongst all males (including miners) over fifteen.

If the comparison be made, not between miners and *all* males (*i.e.*, including miners), but between miners and all male *non-miners* over fifteen, then the disproportion becomes very much more pronounced:

| | |
|---|---|
| Total population over fifteen years of age for ten years (estimated) | 1,131,090 |
| Total number of miners .. .. | 92,134 |
| Male non-miners over fifteen years of age (estimated .. .. | 1,038,956 |

Total deaths from all respiratory diseases:—

| | |
|---|---|
| *Non-miners* over fifteen years of age | 1,742 |
| *All* males over fifteen years of age | 2,239 |
| MINERS .. .. .. .. | 497 |

Corresponding rates per 10,000 of each population:—

| | |
|---|---|
| Non-miners over fifteen years of age (males) .. .. .. .. | 16.7 |
| All males over fifteen years of age .. | 19.8 |
| MINERS .. .. .. .. | 53.9 |

It is therefore clear that respiratory diseases, considered as a group, are very much more fatal among the mining population than amongst males generally over fifteen.

It will be of interest, therefore, to consider the individual diseases and see how they compare between the two populations under consideration.

*Tuberculosis of the Lungs*:—

| | |
|---|---|
| *All* males over fifteen years of age (rate per 10,000) .. .. .. | 9.60 |
| MINERS (rate per 10,000) .. | 19.21 |

So that tuberculosis has been, during the last ten years, twice as prevalent amongst the mining community as amongst males over fifteen generally.

*Bronchitis.*—The rates per 10,000 for bronchitis are:—

| | |
|---|---|
| *All* males over fifteen years of age .. | 1.69 |
| MINERS .. .. .. .. | 4.23 |

Bronchitis, therefore, has been more prevalent amongst the mining community than amongst males over fifteen generally.

*Pneumonia.*—The rates per 10,000 for pneumonia, are:—

| | |
|---|---|
| *All* males over fifteen years of age | 6.65 |
| MINERS .. .. .. .. | 22.68 |

Pneumonia has therefore been, during the ten years, strikingly more prevalent as a cause of death amongst miners than amongst males over fifteen generally.

*Pleurisy.*—The rates per 10,000 for pleurisy are:—

| | |
|---|---|
| *All* males over fifteen years of age .. | 0.67 |
| MINERS .. .. .. .. | 1.08 |

Pleurisy has, therefore, been present as a cause of death amongst miners to nearly twice the extent that it has been amongst males over fifteen generally.

*Congestion of the Lungs.*—The rates for congestion of the lungs per 10,000 are:—

| | |
|---|---|
| *All* males over fifteen years of age .. | 0.22 |
| MINERS .. .. .. .. | 0.00 |

(*Note.*—The figure 0.00 means that the number of cases was so few as to give a rate per 10,000 so small that it could not be expressed in two places of decimals.)

Congestion of the lungs was, therefore given as the cause of death more often among males over fifteen generally than amongst miners. (The warning given above, page 11, as to this disease must be repeated here.)

*Asthma and Emphysema.*—The rates per 10,000 for these two diseases considered together are:—

| | |
|---|---|
| *All* males over fifteen years of age .. | 0.46 |
| MINERS .. .. .. .. | 1.31 |

These diseases were, therefore, almost three times as prevalent amongst miners as amongst all males over fifteen generally

*Gangrene.*—This disease is negligible, only one case being recorded amongst males generally, and none amongst miners.

*Other Respiratory Diseases.*—The rates for this composite group are:—

| | |
|---|---|
| *All* males over fifteen years of age .. | 0.48 |
| MINERS .. .. .. .. | 5.24 |

Amongst miners, therefore, this group of diseases has been nearly twelve times as fatal as amongst males over fifteen generally.

The same statement applies here as in the former set of figures, *i.e.*, that this excess of deaths in this group is made up largely of the diseases which come within the pathological group of fibrosis of the lung.

A brief summary may now be made of the facts revealed by the study of the death rates which has just been concluded.

It is clear that respiratory diseases as a whole are much more prevalent as causes of death amongst miners than amongst males over fifteen years of age generally.

Pneumonia, the typical example of acute lung diseases, is more than three times as prevalent, while tuberculosis is twice as prevalent, amongst miners.

Bronchitis, pleurisy, asthma, and emphysema are all distinctly in excess; while the group, "other respiratory diseases," is nearly twelve times as fatal to miners as to males generally—and it has been established (page 11) that this excess is almost entirely due to fibrosis of the lung.

It cannot be doubted, therefore, that some factor or factors have been operating to produce an important excess in the incidence of lung diseases amongst the mining population.

## PROGRESS OF LUNG DISEASES AMONGST MINERS DURING TEN YEARS.

Having now outlined the position for the ten years considered as a whole period, it will be of interest to consider what has been the incidence of these diseases amongst miners during the period.

Table 12 (page 27) shows the death rates per 10,000 living for miners from each of the lung diseases in each of the ten years. From this it appears that tuberculosis of the lungs has steadily increased since 1901 until the end of 1909; from less than 10 in 1901 it rose to over 30 in 1909.

Bronchitis and pleurisy have shown no noticeable alteration during the ten years.

Pneumonia has steadily declined throughout the whole period.

Asthma and emphysema show the same figures at the beginning and end of the period, with a marked decline in the middle.

The significance of these figures will be discussed in detail at a later stage of the report. For the present it will suffice to point out the two most significant features of this Table—the rise in tuberculosis and the decline in pneumonia.

This Table has to be compared with that issued by the Registrar-General, in which the death rates for the whole population from some of the principal diseases are given.

From this Table (Table 13, page 27) it appears that tuberculosis of the lungs has been steadily on the decline in the whole population during the ten years; pneumonia has shown a slight decline amongst miners, whilst bronchitis has remained almost stationary.

A comparison is also inserted for the two terminal years between the two sections of the whole population, miners, and all males over fifteen years of age. (Table 14, page 27.)

From this it appears that while the death-rate for tuberculosis was practically the same in each of the two terminal years amongst males over fifteen years of age generally, the gradual rise of the tuberculosis death-rate amongst miners (which was seen in Table 12) is brought startlingly into prominence. Little more can be said on the facts shown in Table 14, except that it appears that the decline in the pneumonia death-rate amongst miners has been part of a general decline amongst all males over fifteen years of age.

## LOCALITY DISTRIBUTION OF DEATHS FROM LUNG DISEASES AMONGST MINERS.

Table 15 (page 28) shows the number of deaths amongst miners from the various lung diseases for each year in each registry district.

This Table brings out nothing more than the other Tables have already shown further than that the deaths are distributed amongst the various registry districts very much in the proportion of the mining population of those districts.

There is, however, one striking fact about the figures in this Table, i.e., it is noticeable that a large number of deaths from phthisis have occurred in Perth. This indicates that many of the miners affected with phthisis come to Perth for treatment, and therefore any attempt to compare the death-rates for various mining districts would be faulty to the extent to which miners had died from phthisis in Perth.

## HOSPITAL PATIENTS.

The information available from the Tables issued by the Registrar-General have now been exhaustively studied, and all that can be learned from the deaths amongst miners has been set out.

There is one other source of information from which some light on this subject may be obtained.

There is published each year for each of the Government hospitals an analysis of the number of patients treated, and the number of patients treated for each disease are tabulated.

This information has been compiled in Table 16 (page 30), in which the total number of cases treated in each year at each of the Government hospitals is shown. These totals have also been split up within the same table into the numbers treated for diseases of the lungs and for all other diseases.

From this Table it appears that 70,398 patients passed through the Government hospitals during the ten years, and that of these 6,830 were treated for diseases of the lungs, i.e., 9.70 per cent. of all patients treated in those hospitals were suffering from disease of the lungs.

But, as will be presently pointed out, the records of the occupations of patients treated were not entered until 1904. No comparison can therefore be made as to the relative number of deaths amongst miners and others before that year. The figures will therefore be studied only from 1904 to 1909.

Taking these six years only, it appears that there were treated a total of 47,090 patients; of these 4,373 were under treatment for diseases of the lungs.

The percentage, therefore, of patients treated for lung diseases was 9.28 per cent. (The figures above were taken from the annual reports of the Registrar-General.)

A comparison needs now to be made between the percentage for all patients treated and miners treated.

The figures relating to miners were obtained by myself. Monthly returns are sent in by each hospital to the Medical Department, and these were carefully gone through, and all those patients whose occupations were entered as "miner" were extracted, and the diseases for which they were under treatment classified as "lung diseases" and "all other diseases." The results are set out in Table 17 (page 32).

From this Table it appears there were under treatment a total of 2,827 miners during the six years, and that of these 290 were in hospital on account of lung disease, i.e., 10.26 per cent. of all miners in hospital were under treatment for diseases of the lung.

Placing side by side the percentages for all patients and for miners, they are as follows:—

| | |
|---|---|
| All patients .. | .. 9.28 per cent. |
| MINERS .. | .. 10.26 per cent. |

That is, lung diseases were more frequently the reason for the admission of miners into Government hospitals than was the case with all patients admitted.

There are, however, two sources of error in these Tables.

(a.) On examining Table 16 (page 30) it will be seen that the year 1906 is subdivided into sections, whereas in Table 17 (page 32) this is not so.

The reason for this is that prior to 1906 the figures relating to hospitals published annually by the Registrar-General covered periods embraced in the financial year as observed in all Government departments, i.e., the years began on July 1 and ended on June 30—consequently these "annual" figures included six months of each of two years. In 1906 it was decided to make the years coincide with the calendar years; and accordingly there was published in that year a Table for the preceding financial year (the twelve months ended June 30, 1906), and also a Table for the remaining six months of that year. Those are the two sections of the year 1906 shown in Table 16 (page 30). Thus, the six years 1904-09, which have been considered, represent in fact six and a-half years, for they include the latter half of 1903.

Table 17 (page 32), relating to miners, however, begins on January 1, 1904, so that the period treating of miners comprises only the full six calendar years.

The comparison which has been drawn between the percentages for all patients and for miners is not, then, truly an exact one; for it is a comparison made of figures covering two unequal periods.

Had the figures been available for the exact six calendar years for *all* patients, the total would have been less, but the total for lung diseases would also have been less; so that in all probability the result, i.e., the percentage, would have remained practically unaffected. This, however, can only be surmised, and the comparative percentages must be accepted with this reservation.

(b.) The second fallacy in this Table is a more serious one. If the names of the individual hospitals be referred to, it will at once be seen that many of the goldfields hospitals are excluded.

The explanation is that many of the hospitals on the goldfields are what are known as "Committee" hospitals, i.e., they are managed by local committees, assisted by subsidies from the Government, and are not so-called Government hospitals at all. Their statistics are, therefore, not available, and are not published by the Registrar General.

A list of the assisted hospitals on the goldfields in 1909 is given in Table 24 (page 36). From this it is clear that the majority of the goldfields hospitals are not included in Table 16.

This exclusion of the majority of the hospitals in which miners have for the past ten years been treated lowers the percentages for miners very considerably; and had they been included, the disparity between miners and all sections of the community (including miners) would probably have been very much more marked.

A little light is thrown on this aspect of the question by dividing the hospitals into goldfields and other hospitals, as has been done in Table 16 (page 30). From this Table the following figures are extracted:—

Goldfields Hospitals (1904-1909)—
Lung diseases—cases treated .. .. 1,487
All diseases—cases treated .. .. 11,869
Percentage of lung diseases to total cases treated, 12.53 per cent.

Other Hospitals (1904-1909)—
Lung diseases—cases treated .. .. 2,886
All diseases—cases treated .. .. 35,221
Percentage of lung diseases to total cases treated, 8.17 per cent.

All Hospitals (1904-1909)—
Lung diseases—cases treated .. .. 4,373
All diseases—cases treated .. .. 47,090
Percentage of lung diseases to total cases treated, 9.28 per cent.

It should be stated that an attempt was made to make this table complete by visiting the various assisted hospitals and ascertaining from their books how many miners were under treatment, and how many of these were treated for diseases of the lung.

It was found that no reliable data could, however, be obtained in this way for various reasons. Some of the hospital records gave all the necessary data except the occupation of the patient, others omitted the diagnosis of the disease for which the patient had been under treatment; and for one or other reason it was decided that the figures for these assisted hospitals could not be included.

Table 18 (page 33) gives the number of miners who were under treatment for each individual disease of the lung for each year at each hospital. This table gives no information of any value.

We are, therefore, justified in concluding that so far as the patients under treatment in the hospitals of the State are concerned, lung diseases have for the last six years been more prevalent amongst miners than amongst all patients under treatment (including miners).

It is clear that the goldfields hospitals have treated a much higher percentage of lung diseases than have hospitals in non-mining districts. The figures for 1904-09 have been taken; but those for 1900-1909 do not differ to any material extent.

## AGE DISTRIBUTION.

Table 19 (page 34) gives the age distribution for each year of all miners who died from each of the principal diseases of the lung.

This table is of interest, inasmuch as several points stand out clearly.

The men who died from bronchitis, asthma, and emphysema, and fibroid phthisis, were for the greater part over 45 years of age.

Those who died from pneumonia and from tuberculosis were for the greater part under 45 years of age.

Pneumonia and tuberculosis are, therefore, the diseases which do more damage among young miners; and bronchitis, asthma, emphysema, and fibroid phthisis do the greater damage among the older miners.

The figures for the age distribution have an especial significance when considered in connection with the experimental results obtained, and with the results of the examination of individual miners actually at work. This significance will be referred to later.

Table 22 (page 36) compiled from Tables 20 (page 35) and 21 (page 35) shows the percentages of the total deaths amongst miners and amongst all males over fifteen years of age who died at the various age-groups specified.

When the percentages of the total deaths which have occurred at the various age periods for miners and for all males over fifteen are placed side by side, it is seen that there is a difference in the ages at which miners die and the ages at which all males over fifteen die.

While 26.6 per cent. of all males over fifteen live to be more than 60 years old, only 12.7 per cent. of miners reach that age. Miners are therefore less long lived than the aveage male over fifteen.

Between 15 and 25 years miners die less frequently than all males over fifteen.

From 25 years onwards miners die in a much greater proportion than all males over fifteen until the age of 60 is reached. The preponderance is, however, progressively diminishing from the age of 45 until the age of 60.

The deduction justified from this table is that between 25 and 45 miners are more likely to die than the average male over fifteen, and very much fewer miners survive until their sixtieth year than is the case among the average population over fifteen.

This is supported by a computation of the average age at death of miners and of the general population over fifteen. The following are the figures:—

Average age at death of all males over fifteen years of age, 47.8.

Average age at death of miners, 44.2.

In computing the average age at death of all males over fifteen miners are of course included; had they been excluded and the comparison made between

miners and all other males over fifteen, the disparity between the average ages at death would have been greater.

As it stands, the miner has three and a-half years less life than the average male over fifteen.

In computing these average ages at death it was not possible to be exact, for the Registrar-General gives the ages at death in five-year groups. To overcome this difficulty the five-year period was taken to be represented by the middle point of that five-year period.

For example, amongst all males over fifteen 5,015 deaths occurred in the 15 to 20 age group. This age group was considered as being sufficiently accurately represented by the age of 17½, and the total number of deaths, 5,015, was multiplied by 17½; so with each individual age group.

## SUMMARY OF STATISTICAL SECTION OF THE REPORT.

The whole of the information available as to the conditions existing in the past has now been exhaustively reviewed, and it only remains to briefly summarise this information.

The period dealt with has, for the reasons given, been confined to the ten years 1900 to 1909, inclusive.

In the compilation of the statistical data certain sources of error have been met with. It has been impossible to correct the figures to do away with these sources of error; but where they have occurred they have been pointed out, and the influence they have, or may have, upon the results has been shown. For the greater part they have not affected the validity of the comparisons which have been drawn.

The sources of information have been:—

(1.) The annual report of the Registrar-General, and I should like to take this opportunity of expressing my sense of the value of these annual statistical reports. There does not appear to be any set of statistics published in Australia of equal value or completeness.

(2.) The records of individual deaths in the office of the Registrar-General.

(3.) The returns sent in by the individual hospitals to the Principal Medical Officer.

(4.) The records in the Education Department of those children subject to the compulsory attendance sections of the Education Act.

The first set of statistics investigated was the total number of deaths from all the various lung diseases among the total male population over fifteen years of age and the same figures for all miners.

From these it became apparent that amongst miners all lung diseases, considered as a group, produced a much higher percentage of the total deaths than amongst all males over fifteen years of age; also that pneumonia, bronchitis, asthma and emphysema, were proportionately much more fatal amongst miners than amongst all males over fifteen years of age.

That pleurisy and congestion of the lungs were slightly less fatal amongst miners than amongst all males over fifteen years of age.

That the group "other respiratory diseases" was very much more fatal amongst miners than amongst all males over fifteen years of age.

That tuberculosis of the lungs was, however, not more fatal to any appreciable extent amongst miners than amongst all males over fifteen years of age.

Checking these results by the more accurate method of estimating the death rates per 10,000 living for each of the various lung diseases under consideration, it is found that very similar results are obtained, except in the case of tuberculosis.

Lung diseases generally showed a much higher death rate among miners than amongst all males over fifteen years of age.

Pneumonia, bronchitis, asthma, and emphysema showed very much higher rates among miners than amongst males over fifteen generally.

Pleurisy instead of being lower—as it was when considered as a percentage of the total deaths—appears, when considered by the death rates, to be productive of a much higher rate among miners than amongst males generally.

Congestion of the lungs shows a lower rate for miners than for males generally. This is in accord with the figures for the percentage of the total deaths.

The group, "other respiratory diseases," shows a very much higher rate for miners than for males generally.

But an important difference appears when the rates for tuberculosis of the lungs are considered. Amongst miners the death rate for tuberculosis is twice that for males generally. This is not in accord with the figures for the percentages of the total deaths, but it must be accepted as the more correct figure, and therefore the conclusion is justified that miners have been during the last 10 years twice as liable to tuberculosis as males generally.

These two sets of figures support each other in the main. They show undoubtedly that diseases of the lungs have been much more fatal to miners than to males generally; and that of the individual diseases pneumonia and pleurisy as acute diseases, and bronchitis, asthma, and emphysema, and the group "other respiratory diseases" (which is chiefly composed of fibrosis of the lung), as chronic diseases, have played the chief part in producing this excessive mortality from lung diseases.

Tuberculosis also is in excess among miners; but, as will be seen immediately, this is a phenomenon of the more recent of the ten years.

When the progress of these individual lung diseases during the ten years is considered, it becomes apparent that for pneumonia there has been a steady decline; for bronchitis and pleurisy there has been no noticeable alteration; for asthma and emphysema there has been first a fall and then a rise, so that the figures at the beginning and end of the period are at about the same level. For tuberculosis, on the other hand, the rate has risen steadily throughout the whole period, so that the excess in the rate for miners over that for males generally is the result of this increase, and is due to the larger number of deaths which have occurred in the later years.

These results are of very great interest, for it will appear when the results of the examination of miners actually at work, and the results of certain experiments performed in the laboratory are recorded, that there is a definite significance to be attached to these death rates and their incidence through the ten-year period.

Particularly should attention be directed at this stage to the importance of pneumonia as the principal acute cause of death; and of bronchitis, asthma, emphysema and fibrosis of the lungs as the principal chronic causes of death.

An attempt was made to classify the death returns according to the various mining fields, so as to ascertain whether there has been during the period under review any factor operating on particular mining fields in producing an excessive mortality from any cause on those fields, but it was found that the addresses of the deceased miners were entered with so little regard to the field from which they had recently come that this attempt had to be abandoned.

In addition to the records of death, the returns of the various Government hospitals relating to patients under treatment (without any regard to whether these patients had died or not) were analysed.

The results obtained by these analyses supported those obtained from the consideration of the death records, in so far that the percentage of miners who were under treatment for diseases of the lungs was higher than the corresponding percentage of all patients.

The percentage for miners was not very much higher than that for all patients, but as has been pointed out the majority of the hospitals on the goldfields were not included in these tables.

Had they been, it is probable that the disparity between the percentage for miners and for all patients would have been greater.

This supposition is supported by the fact that when the hospitals are grouped—those on the goldfields and all others—the percentage of all the patients who were treated for lung diseases is notably higher in the goldfields hospitals than it is for the hospitals elsewhere; and this in spite of the fact that many of the miners come to the other hospitals —Perth, *e.g.*—for treatment as in indicated in Table 15 (page 29).

When the deaths of miners are tabulated in age groups it appears that pneumonia and tuberculosis are principally fatal before forty-five, and are the principal lung diseases producing fatal results at those ages. On the other hand bronchitis, asthma, emphysema, and fibrosis result fatally principally at ages over forty-five.

It also appears that miners die earlier than the average male over fifteen years of age, fewer miners surviving until they are sixty years old.

The percentage of deaths is greater amongst miners than it is amongst males over fifteen generally, at all ages between 25 and 60; but the excess amongst miners is most marked between 25 and 45. i.e., if the deductions from the other tables are reliable, this excess at these ages is chiefly due to deaths from pneumonia and tuberculosis.

So far as the average age at death is concerned the miner has three and a-half years less life than the average male over fifteen years of age.

To briefly sum up the position as revealed by these statistics:—

The miner is more liable to lung diseases generally than the average male over fifteen.

The miner is less long lived than the average male over fifteen years of age; partly on account of his greater liability to lung diseases.

Tuberculosis of the lungs is on the increase amongst miners, and is twice as prevalent amongst miners as amongst all males over fifteen.

Pneumonia among the acute, and bronchitis, asthma, emphysema, and fibrosis of the lungs among the chronic, lung diseases are more prevalent among miners than amongst males over fifteen generally.

## COMPARISON OF THE FIGURES FOR WESTERN AUSTRALIA WITH THOSE FOR OTHER COUNTRIES.

It will be of interest now to ascertain how the figures for this State compare with those for miners in other countries.

### *England and Wales.*

The following information is compiled from the Supplement to the Sixty-fifth Annual Return of the Registrar-General of Births, Deaths, and Marriages for England and Wales, based on the figures obtained on the Census of 1901 and on the death returns for the years 1900, 1901, and 1902. This report was issued in 1908 by the Registrar-General, and the quotations are from p.p. xciii. to xcix. Of the aggregate mining population coal miners constitute more than nine-tenths.

Miners as a whole appear to suffer more heavily than the average population from diseases of the respiratory system, but on the other hand the mortality from phthisis is little more than half the standard.

Coal miners show a general mortality figure (from all diseases) slightly less than that for the mining industry as a whole, this difference being mainly seen under the headings of influenza and phthisis.

The mortality among ironstone miners from accident is excessive, but except for a slight excess of influenza the mortality from all other causes is exceptionally low.

Tin miners.—The mortality among tin miners is more than double the standard for all occupied and retired males, the excess occurring almost entirely under the headings phthisis and respiratory diseases.

Lead miners appear to suffer inordinately from phthisis and respiratory diseases.

So that while among coal miners the incidence of the various diseases of the lungs is low, and is therefore low for all miners (as coal miners constitute nine-tenths of all miners in England and Wales) yet among tin miners—the group most similar to the gold miners of Western Australia—the mortality from lung diseases is unduly high.

While, however, coal miners are not more subject to diseases of the lungs than the general population, it is interesting to notice that with the exception of "accident" the three causes of death amongst coal miners which give the highest figures are pneumonia, bronchitis, and phthisis in that order. (See page 133 of the report quoted.) And it is also of interest to observe that at ages over 55 the proportion of deaths from bronchitis becomes unduly high (loc. cit., p. 133).

The figures given in Table 23 (page 36) show that the death rates for all the lung diseases are very much higher in England and Wales than they are in Western Australia.

## AUSTRALIAN STATES.

### *South Australia.*

No reliable information could be obtained from this State.

### *New Zealand.*

The reports from New Zealand are somewhat contradictory.

The Under Secretary for Mines writes as follows: "I am, however, pleased to say that miners' disease is practically unknown in New Zealand, and that during the time pneumoconiosis was included in the Workers' Compensation Act no claim for compensation was made against the Government Life Insurance Department on account of this disease."

The Registrar-General writes: "I regret that it is impossible for me to give any satisfactory information as to the prevalence of pulmonary disease amongst miners.

The number of deaths certified as occurring during 1909 from miners' phthisis was ten, and from pneumonia six."

So far as this information goes, then, it is clear that the disease known as miners' phthisis exists in New Zealand; but there is no information to show to what extent.

In a publication by Dr. J. S. Purdy, on the subject of lung diseases amongst miners, the figures for the Waihi Hospital are given for the years 1904-1908. From these it appears that of 94 patients treated in the hospital for all lung diseases, there were 37 miners.

So that it is clear that other diseases of the lungs are also found amongst miners in New Zealand.

### *New South Wales.*

The Registrar-General writes: "I regret that I can obtain little information that is likely to be of value to you in your inquiry. So far as this State is concerned there are practically no data available except those shown in the attached statement, which I send for what it is worth. It gives the number of deaths of males engaged as miners or quarrymen from phthisis and other pulmonary diseases during the five years 1902-06. I have no reliable particulars of the number engaged in these pursuits from which to deduce the mortality rates."

The Table forwarded by the Registrar-General shows that phthisis, pneumonia, bronchitis, pleurisy, and "other diseases of the respiratory system" all have operated in producing deaths amongst miners. But that is all that can be deduced from it. There is, therefore, no useful information regarding the prevalence of lung diseases amongst miners in New South Wales.

### *Victoria.*

The Registrar-General for Victoria writes: "The deaths from tuberculosis during 1906-09 were 88.04 per 10,000 Bendigo miners, as against 15.82 for all males in the State aged 21 years and upwards, excluding Bendigo miners. The excess of the former over the latter may be taken as the tubercular mortality due to mining occupation."

These figures for Bendigo show that at that mining centre the mortality amongst miners was about five and a-half times that for all other adult males in the State.

The figures for Western Australia show that the mortality from tuberculosis was, during ten years, only twice as great amongst miners as amongst all males over fifteen years of age.

It is evident that tuberculosis is not nearly so prevalent in this State as in Bendigo.

### *Queensland.*

By the courtesy of the Registrar-General for Queensland, the following figures for 1909 are available:—

| | |
|---|---|
| Total number of miners employed in the State .. .. .. .. .. | 14,099 |
| Total number of deaths amongst miners (all causes) .. .. .. .. .. | 276 |
| Total number of deaths from lung diseases .. | 71 |

The distribution of lung diseases responsible for the 71 deaths amongst miners quoted above is as follows:—

| | |
|---|---|
| Phthisis .. .. .. | 32 |
| Bronchitis .. .. .. | 11 |
| Pneumonia .. .. .. | 18 |
| Asthma .. .. .. | 4 |
| Pleurisy .. .. .. | 2 |
| Miners' Phthisis .. .. | 4 |
| | 71 |

Death rates per 10,000 miners living, in Queensland and in Western Australia—in each case for the year 1909 only.

| | Queensland. | Western Australia. |
|---|---|---|
| Phthisis .. .. | 22.6 .. | 31.06 |
| Bronchitis .. | 7.8 .. | 7.49 |
| Pneumonia .. | 12.7 .. | 14.99 |
| Asthma .. .. | 2.8 .. | 3.21 |
| Pleurisy .. .. | 1.4 .. | 1.07 |
| Miners' Phthisis .. | 2.8 .. | 3.21 |

From these figures it is apparent that for the year 1909 the death rate amongst miners per 10,000 living from lung diseases in Queensland was 50.03. This is slightly less than the rate for Western Australia for the ten years 1900-09, which was 53.

From the comparison drawn between the death rates from various lung diseases in Queensland and in Western Australia, it is evident that both the acute diseases and the chronic diseases are in excess in Western Australia. But it must be remembered that these figures relate only to a single year.

### *Tasmania.*

No reliable information was forthcoming from Tasmania.

To sum up the position in Western Australia, as compared with that in other countries it is clear that the death rates for all lung diseases are much lower in this State than in England; that the death rate from phthisis is lower by a good deal here than in Bendigo; that the death rate for lung diseases as a whole, and for each disease individually, except pleurisy and bronchitis, is slightly higher in Western Australia for the single year 1909 than it was in Queensland for the same year.

TABLE 1.—*Deaths from Lung Diseases, Ten Years* 1900–1909.

WHOLE POPULATION.

| Disease. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Totals for ten years. | Percentages of the total deaths from all causes. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tuberculosis of the Lungs | 137 | 151 | 146 | 144 | 198 | 162 | 213 | 206 | 193 | 188 | 1,738 | 6·32 |
| Acute Bronchitis .. | 48 | 66 | 54 | 61 | 45 | 56 | 57 | 26 | 20 | 25 | 521 | 1·89 |
| Chronic Bronchitis .. | | | | | | | | 23 | 18 | 22 | | |
| Broncho-Pneumonia .. | 145 | 166 | 194 | 165 | 143 | 170 | 146 | 45 | 53 | 47 | 1,590 | 5·78 |
| Pneumonia .. .. | | | | | | | | 112 | 119 | 85 | | |
| Pleurisy .. .. .. | 12 | 12 | 20 | 8 | 12 | 12 | 10 | 8 | 13 | 14 | 121 | 0·44 |
| Congestion of the Lungs | 8 | 9 | 5 | 5 | 5 | 9 | 11 | 6 | 1 | 9 | 68 | 0·25 |
| Asthma .. .. .. | 6 | 4 | 11 | 8 | 5 | 10 | 7 | 4 | 1 | 4 | 63 | 0·23 |
| Emphysema .. .. | | | | | | | | 3 | .. | .. | | |
| Gangrene .. .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 0·00 |
| Other Respiratory Diseases | 5 | 2 | 11 | 4 | 6 | 10 | 14 | 6 | 8 | 9 | 75 | 0·26 |
| Totals .. .. | 361 | 410 | 441 | 395 | 414 | 429 | 458 | 439 | 427 | 403 | 4,177 | 15·17 |
| Total Deaths *all* Causes | 2,240 | 2,519 | 2,823 | 2,788 | 2,817 | 2,709 | 3,084 | 2,924 | 2,882 | 2,706 | 27,487 | 100·00 |

TABLE 2.—*Deaths from Lung Diseases, Ten Years* 1900–1909.

ALL MALES.

| Disease. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Totals for ten years. | Percentage of the total deaths from all causes. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tuberculosis of the Lungs | 81 | 93 | 101 | 99 | 124 | 102 | 142 | 132 | 123 | 120 | 1,117 | 6·36 |
| Acute Bronchitis .. | 34 | 42 | 36 | 35 | 32 | 33 | 26 | 19 | 12 | 17 | 326 | 1·85 |
| Chronic Bronchitis .. | | | | | | | | 9 | 14 | 17 | | |
| Broncho-Pneumonia .. | 120 | 135 | 138 | 124 | 103 | 114 | 89 | 20 | 36 | 28 | 1,120 | 6·32 |
| Pneumonia .. .. | | | | | | | | 76 | 81 | 56 | | |
| Pleurisy .. .. .. | 8 | 10 | 14 | 6 | 10 | 8 | 5 | 5 | 6 | 11 | 83 | 0·47 |
| Congestion of the Lungs | 7 | 5 | 1 | 3 | 2 | 7 | 8 | 2 | .. | 6 | 41 | 0·24 |
| Asthma .. .. .. | 5 | 3 | 9 | 7 | 4 | 9 | 6 | 3 | 1 | 3 | 52 | 0·29 |
| Emphysema .. .. | | | | | | | | 2 | .. | .. | | |
| Gangrene .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 0·00 |
| Other Respiratory Diseases | 4 | 2 | 7 | 4 | 6 | 7 | 11 | 5 | 6 | 6 | 58 | 0·33 |
| Totals .. .. .. | 259 | 290 | 306 | 278 | 281 | 280 | 287 | 273 | 280 | 264 | 2,798 | 15·86 |
| Total Deaths from *all* Causes .. .. | 1,487 | 1,653 | 1,832 | 1,829 | 1,823 | 1,728 | 1,878 | 1,860 | 1,803 | 1,673 | 17,566 | 100·00 |

TABLE 3.—*Deaths from Lung Diseases, Ten Years* 1900-1909.

MALES OVER FIFTEEN.

| Disease. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Total for ten years. | Percentage of total deaths. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tuberculosis of Lungs .. | 79 | 90 | 100 | 93 | 122 | 100 | 139 | 126 | 120 | 117 | 1,086 | 9·52 |
| Bronchitis .. .. | 19 | 24 | 23 | 14 | 23 | 19 | 12 | 16 | 16 | 26 | 192 | 1·68 |
| Pneumonia .. .. | 94 | 88 | 113 | 79 | 76 | 71 | 55 | 60 | 71 | 46 | 753 | 6·60 |
| Pleurisy .. .. .. | 6 | 10 | 12 | 6 | 10 | 8 | 5 | 4 | 6 | 9 | 76 | 0·67 |
| Congestion of Lungs .. | 5 | 3 | .. | 1 | 1 | 6 | 6 | .. | .. | 3 | 25 | 0·22 |
| Asthma and Emphysema | 5 | 3 | 9 | 7 | 4 | 9 | 6 | 5 | 1 | 3 | 52 | 0·46 |
| Gangrene .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 0·00 |
| Other Respiratory Diseases | 4 | 2 | 7 | 3 | 5 | 6 | 10 | 5 | 6 | 6 | 54 | 0·47 |
| Totals .. .. .. | 212 | 220 | 264 | 203 | 241 | 219 | 233 | 216 | 221 | 210 | 2,239 | 19·62 |
| Total Deaths *all* Causes | 954 | 1,066 | 1,163 | 1,111 | 1,198 | 1,121 | 1,210 | 1,210 | 1,197 | 1,171 | 11,401 | 100·00 |

TABLE 4.—*Deaths from Lung Diseases, Ten Years* 1900–1909.

MINERS.

| Disease. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Total deaths. | Percentage of total deaths from all causes. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tuberculosis of the Lungs | 7 | 8 | 22 | 16 | 19 | 14 | 16 | 21 | 25 | 29 | 177 | 9·62 |
| Bronchitis .. .. | 5 | 3 | 3 | 2 | 5 | 7 | 1 | 5 | 1 | 7 | 39 | 2·12 |
| Pneumonia .. .. | 37 | 22 | 33 | 20 | 15 | 18 | 15 | 16 | 19 | 14 | 209 | 11·36 |
| Pleurisy .. .. .. | 1 | 1 | 1 | 1 | 1 | 3 | .. | .. | 1 | 1 | 10 | 0·54 |
| Congestion of the Lungs | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | .. | 2 | 0·11 |
| Asthma and Emphysema | .. | 3 | 1 | 1 | 1 | 2 | .. | .. | 1 | 3 | 12 | 0·65 |
| Gangrene of the Lungs .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Other Respiratory Diseases | .. | 4 | 6 | 4 | 3 | 4 | 11 | 7 | 5 | 4 | 48 | 2·61 |
| Totals .. .. .. | 50 | 41 | 67 | 44 | 44 | 49 | 43 | 49 | 52 | 58 | 497 | 27·02 |
| Total Deaths amongst Miners *all* Causes .. | 185 | 197 | 234 | 184 | 159 | 167 | 187 | 177 | 163 | 186 | 1,839 | 100·00 |

TABLE 5.—*Deaths from Lung Diseases expressed as Percentages of Total Deaths from all Causes.*

(Percentages calculated on totals for ten years, 1900–1909.)

| Disease. | Total Population. | All Males. | Males over Fifteen. | Miners. |
|---|---|---|---|---|
| Tuberculosis of the Lungs .. .. .. | 6·32 | 6·36 | 9·52 | 9·62 |
| Bronchitis .. .. .. .. .. .. | 1·89 | 1·85 | 1·68 | 2·12 |
| Pneumonia .. .. .. .. .. | 5·78 | 6·32 | 6·60 | 11·36 |
| Pleurisy .. .. .. .. .. .. | 0·44 | 0·47 | 0·67 | 0·54 |
| Congestion .. .. .. .. .. | 0·25 | 0·24 | 0·22 | 0·11 |
| Asthma and Emphysema .. .. .. | 0·23 | 0·29 | 0·46 | 0·65 |
| Gangrene .. .. .. .. .. .. | 0·00* | 0·00* | 0·00* | .. |
| Other Respiratory Diseases .. .. .. | 0·26 | 0·33 | 0·47 | 2·61 |
| Total Respiratory Diseases .. .. | 15·17 | 15·86 | 19·62 | 27·02 |

* Means that percentage gave no unit in the second place of decimals.

TABLE 6.— *Table of Lung Diseases amongst Miners, for Ten Years* 1900–1909.

| Disease. | Bertillon. | Hayter. | No. of Cases | |
|---|---|---|---|---|
| Pulmonary tuberculosis and phthisis | Tuberculosis of lungs | Phthisis | 162 | |
| Tuberculosis | do. | Other tubercular | 7 | |
| Tuberculosis, chronic | do. | do. | 1 | |
| Tubercular disease of the lungs | do. | Phthisis | 2 | |
| Tuberculosis, pleurisy, and exhaustion | do. | do. | 1 | |
| Tubercular bronchitis | do. | do. | 1 | |
| Pulmonary tuberculosis and congestive pneumonia | do. | do. | 1 | |
| Miners' phthisis and tuberculosis of the lungs | do. | do. | 1 | |
| Broncho-pneumonia and phthisis | do. | do. | 1 | |
| | | | | 177 |
| Pneumonia | Pneumonia | Pneumonia | 180 | |
| Alcoholic pneumonia | do. | do. | 2 | |
| Chronic pneumonia | do. | do. | 3 | |
| Chronic pneumonia and pleurisy | do. | do. | 1 | |
| Pulmonary œdema | do. | Pleurisy | 2 | |
| Broncho-pneumonia | Broncho-pneumonia | Pneumonia | 21 | |
| Congestion of the lungs | Congestion of the lungs | Congestion of lungs | 2 | |
| | | | | 211 |
| Pleurisy | Pleurisy | Pleurisy | 8 | |
| Recurrent pleurisy | do. | do. | 2 | |
| | | | | 10 |
| Bronchitis and pleurisy | Acute bronchitis | Bronchitis | 1 | |
| Bronchitis | do. | do. | 17 | |
| Bronchitis, acute | do. | do. | 1 | |
| Bronchitis, chronic | Chronic bronchitis | do. | 12 | |
| Chronic bronchitis and emphysema | do. | do. | 2 | |
| Bronchitis and asthma | do. | do. | 2 | |
| Bronchiectasis | do. | do. | 2 | |
| Bronchitis and pneumonia | do. | do. | 1 | |
| Bronchitis and pleuro-pneumonia | do. | do. | 1 | |
| | | | | 39 |
| Bronchial asthma | Asthma | Asthma and Emphysema | 1 | |
| Asthma | do. | do. | 8 | |
| Asthma and emphysema | do. | do. | 1 | |
| Emphysema | Emphysema | do. | 2 | |
| | | | | 12 |
| Hæmorrhage of the lungs | Other respiratory | Phthisis | 1 | |
| Acute inflammation of the lungs | do. | Pneumonia | 4 | |
| Miners' disease of the lungs | do. | Other respiratory | 2 | |
| Miners' asthma | do. | do. | 1 | |
| Miners' phthisis | do. | do. | 4 | |
| Miners' complaint | do. | do. | 2 | |
| Fibrosis of the lungs | do. | do. | 1 | |
| Fibroid phthisis | do. | do. | 22 | |
| Fibroid phthisis and acute pneumonia | do. | do. | 1 | |
| Fibroid lung | do. | do. | 1 | |
| Cirrhosis of the lung | do. | do. | 2 | |
| Pulmonary fibrosis | do. | do. | 1 | |
| Chronic interstitial pneumonia | do. | do. | 1 | |
| Silicosis | do. | do. | 1 | |
| Pneumoconiosis | do. | do. | 1 | |
| Anthracosis of the lungs | do. | do. | 1 | |
| Abscess of the lung | do. | do. | 1 | |
| Pulmonary abscess | do. | do. | 1 | |
| | | | | 48 |
| | | Total | | 497 |

TABLE 7.—*Deaths of Miners (only) from all Causes other than Lung Diseases, Ten Years* 1900–1909.

| | | |
|---|---|---|
| Apoplexy | 13 | |
| Aneurism | 21 | |
| Anæmia | 1 | |
| Anæmia (pernicious) | 1 | |
| Arteriosclerosis | 1 | |
| Cardiac disease | 146 | |
| Cerebral hæmorrhage | 34 | |
| Disease of the heart and kidneys | 1 | |
| Hemiplegia | 6 | |
| Pericarditis | 1 | |
| Rheumatic endocarditis | 1 | |
| Syncope | 5 | |
| | | 231 |
| Alcohol | 19 | |
| Abscess | 4 | |
| Alcoholic neuritis | 1 | |
| Asphyxia | 1 | |
| Cellulitis | 3 | |
| Cholera, simplex | 1 | |
| Cholera, English | 1 | |
| Dysentery | 18 | |
| Diphtheria | 2 | |
| Delirium tremens | 1 | |
| Diabetes | 4 | |
| Diarrhœa | 3 | |
| Dropsy | 1 | |
| Enteric | 37 | |
| Enteritis | 1 | |
| Epilepsy | 3 | |
| Erysipelas | 4 | |
| Fever | 1 | |
| Cancer | 90 | |
| Gangrene of foot | 1 | |
| Hydatids | 1 | |
| Influenza | 4 | |
| Mastoid disease | 1 | |
| Marasmus | 1 | |
| Malaria | 4 | |
| Morphinism | 1 | |
| Plumbism | 1 | |
| Pyæmia | 1 | |
| Rheumatism | 6 | |
| Rheumatic fever | 1 | |
| Acute rheumatism | 1 | |
| Septicæmia | 1 | |
| Syphilis | 4 | |
| Scarlet fever | 1 | |
| Scurvy | 1 | |
| Typhoid fever | 107 | |
| Tetanus | 2 | |
| Thoracic tumour | 1 | |
| | | 335 |
| Accident | 398 | |
| Burns | 6 | |
| Cyanide poisoning | 4 | |
| Drowning | 7 | |
| Exposure | 3 | |
| Fume poisoning | 2 | |
| Poisoned | 1 | |
| Suicide | 57 | |
| Sunstroke } Heat apoplexy } | 16 | |
| Starvation | 3 | |
| Shock | 4 | |
| Thirst | 6 | |
| | | 507 |
| General break-up | 1 | |
| Senility | 42 | |
| Natural causes | 10 | |
| Unknown | 11 | |
| | | 64 |

| | | |
|---|---|---|
| Appendicitis | 6 | |
| Abdominal abscess | 1 | |
| Colitis | 2 | |
| Cirrhosis of the liver | 2 | |
| Cholecystitis | 2 | |
| Gastritis | 6 | |
| Gastro enteritis | 4 | |
| Gall-stones | 1 | |
| Gastric ulcer | 1 | |
| Ulceration of the stomach | 1 | |
| Hernia | 1 | |
| Hernia, strangulated | 3 | |
| Intestinal obstruction | 12 | |
| Ulceration of the bowels | 4 | |
| Chronic indigestion | 1 | |
| Ulceration of the Intestines | 1 | |
| Liver, ruptured | 1 | |
| Liver, abscess | 7 | |
| Liver, cancer | 1 | |
| Liver, cirrhosis | 5 | |
| Peritonitis | 14 | |
| Stricture of the rectum | 1 | |
| Tubercular peritonitis | 1 | |
| | | 78 |
| Inflammation of the brain | 2 | |
| Abscess of the brain | 2 | |
| Cerebral thrombosis | 2 | |
| Cerebral embolism | 1 | |
| Cerebral tumour | 3 | |
| Cerebral softening | 3 | |
| General paralysis of the insane | 2 | |
| Meningitis | 10 | |
| Myelitis | 3 | |
| Mania | 3 | |
| Paraplegia | 1 | |
| Paralysis | 5 | |
| | | 37 |
| Bright's Disease | 46 | |
| Cystitis | 2 | |
| Tubercular kidney | 1 | |
| Nephritis | 6 | |
| Nephritis, chronic | 3 | |
| Nephritis, tubercular | 1 | |
| Prostatic disease | 3 | |
| Perinephritis | 1 | |
| Ulcerated testicle | 1 | |
| Uræmia | 2 | |
| Vesical Calculus | 1 | |
| | | 67 |
| Congestion of the lungs and heart disease | 1 | |
| Cardiac congestion of the lungs | 1 | |
| Valvular disease of the heart, congestion of the lungs, and apoplectic stroke | 1 | |
| Enteric fever and double pneumonia | 1 | |
| Enteric fever and pneumonia | 6 | |
| Typhoid fever and pneumonia | 2 | |
| Influenza and pneumonia | 1 | |
| Influenza and broncho-pneumonia | 1 | |
| Influenza and pleurisy | 1 | |
| Influenza and bronchitis | 1 | |
| Laryngeal tuberculosis | 1 | |
| Pleurisy and pericarditis | 1 | |
| Rheumatism and pleurisy | 1 | |
| Cancer of the lungs | 1 | |
| Abscess of the lungs and septic pneumonia | 1 | |
| Pneumonia caused by fumes | 1 | |
| Ruptured lung | 1 | |
| | | 23 |
| Grand Total | | 1,319 |

TABLE 8.—*Total Deaths of Miners from all Causes, Ten Years 1900–1909.*

| Registry District. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Totals. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashburton | .. | 1 | 1 | .. | .. | 1 | 1 | .. | 1 | 1 | 6 |
| Beverley | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 |
| Black Range † | .. | .. | .. | .. | .. | .. | .. | 1 | 7 | 2 | 10 |
| Blackwood | 1 | .. | 1 | 1 | 1 | .. | .. | 3 | .. | 3 | 10 |
| Boulder * | .. | .. | .. | 6 | 32 | 30 | 36 | 31 | 25 | 35 | 195 |
| Broad Arrow | 9 | 3 | 4 | 2 | .. | 2 | .. | 4 | 8 | .. | 32 |
| Broome | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 |
| Canning | .. | .. | .. | .. | 1 | .. | 1 | .. | .. | .. | 2 |
| Claremont | .. | .. | .. | .. | 1 | .. | 5 | 14 | 15 | 14 | 49 |
| Coolgardie | 14 | 21 | 14 | 13 | 7 | 18 | 12 | 10 | 15 | 19 | 143 |
| Coolgardie, East | 69 | 70 | 92 | 56 | 25 | 19 | 32 | 17 | 11 | 21 | 412 |
| Coolgardie, North | 13 | 12 | 15 | 11 | 8 | 3 | 4 | 10 | 5 | 2 | 83 |
| Coolgardie, North-East | 9 | 9 | 13 | 10 | 11 | 7 | 11 | 5 | 3 | 9 | 87 |
| Dandarragan | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Dundas | 3 | 3 | 2 | 1 | 3 | 2 | 4 | 1 | 3 | 2 | 24 |
| Esperance | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 1 |
| Eucla | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Fremantle | 1 | 3 | 3 | 3 | 2 | 2 | 5 | 2 | 4 | 4 | 29 |
| Gascoyne | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | 2 |
| Geraldton | 3 | 7 | 3 | 5 | .. | 2 | .. | 1 | .. | 2 | 23 |
| Gingin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Greenough | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Irwin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Jarrahdale | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Katanning | .. | .. | .. | .. | .. | .. | 2 | 1 | .. | .. | 3 |
| Kimberley, East | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Kimberley, West | 1 | 1 | 1 | .. | .. | .. | .. | 1 | 1 | 1 | 6 |
| Kimberley Goldfields | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | 2 | 4 |
| Leederville | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Mount Margaret | 21 | 12 | 19 | 13 | 5 | 18 | 16 | 18 | 12 | 8 | 142 |
| Murchison | 14 | 18 | 23 | 14 | 3 | 14 | 20 | 19 | 12 | 11 | 148 |
| Murchison, East | 1 | 10 | 9 | 12 | 6 | 7 | 6 | 8 | 6 | 6 | 71 |
| Murray | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Northam | 1 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | 3 |
| Northampton | .. | 1 | 1 | .. | .. | .. | .. | 2 | .. | 2 | 6 |
| Peak Hill | 5 | 2 | 1 | 3 | 1 | 1 | .. | .. | 2 | 1 | 16 |
| Perth | 5 | 8 | 18 | 23 | 30 | 21 | 11 | 12 | 15 | 24 | 167 |
| Phillips River | .. | .. | 1 | 2 | .. | .. | .. | 2 | .. | 2 | 7 |
| Pilbarra | 8 | 8 | 3 | 6 | 5 | 9 | 11 | 8 | 7 | 8 | 73 |
| Plantagenet | 1 | .. | 1 | .. | 2 | .. | 1 | 1 | 1 | 1 | 8 |
| Port Hedland | .. | .. | .. | .. | .. | .. | 1 | 1 | 3 | .. | 5 |
| Roebourne | 1 | .. | 2 | 3 | 2 | 2 | .. | .. | 3 | 2 | 15 |
| Subiaco | .. | 1 | 1 | .. | 5 | 4 | 1 | 1 | .. | 1 | 14 |
| Sussex | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Swan | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Victoria Plains | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Wellington | 1 | 2 | 1 | .. | 6 | 1 | 2 | 2 | 2 | .. | 17 |
| Williams | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Yalgoo | 2 | 1 | .. | .. | 1 | 1 | 1 | .. | .. | .. | 6 |
| Yilgarn | 2 | 1 | 3 | .. | 1 | 1 | 2 | 2 | 1 | 2 | 15 |
| York | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | 185 | 197 | 234 | 184 | 159 | 167 | 187 | 177 | 163 | 186 | 1,839 |

* Only a separate district after September 7th, 1903, previously included in East Coolgardie.
† Only a separate district after July 1st, 1907, previously included in East Murchison.

TABLE 9.—*Number and Ages of Male Scholars on Roll in Government and Private Schools at end of each year*, 1900–1909.

| Year. | Under 6. | 6 and up to 14. | 14 and upwards. |
|---|---|---|---|
| 1900 .. .. .. .. .. .. | 1,487 | 10,143 | 539 |
| 1901 .. .. .. .. .. .. | 1,372 | 11,223 | 645 |
| 1902 .. .. .. .. .. .. | 1,572 | 12,125 | 880 |
| 1903 .. .. .. .. .. .. | 1,851 | 12,843 | 831 |
| 1904 .. .. .. .. .. .. | 1,977 | 13,629 | 1,033 |
| 1905 .. .. .. .. .. .. | 2,048 | 14,584 | 1,104 |
| 1906 .. .. .. .. .. .. | 1,830 | 15,358 | 1,207 |
| 1907 .. .. .. .. .. .. | 1,760 | 15,562 | 1,372 |
| 1908 .. .. .. .. .. .. | 1,691 | 16,285 | 1,304 |
| 1909 .. .. .. .. .. .. | 1,917 | 16,860 | 1,357 |

TABLE 10.—*Death Rates amongst Miners and amongst Total Male Population over Fifteen.*

(Rates calculated upon the Totals for the Ten years 1900-1909.)

| Disease. | Total Population over Fifteen. | | | Registered Number of Miners. | | |
|---|---|---|---|---|---|---|
| | Population. | Total Deaths. | Rate per 10,000. | Rate per 10,000. | Total Deaths. | Population —Miners. |
| Tuberculosis of Lungs .. .. | 1,131,090 | 1,086 | 9·60 | 19·21 | 177 | 92,134 |
| Bronchitis .. .. .. .. | 1,131,090 | 192 | 1·69 | 4·23 | 39 | 92,134 |
| Pneumonia .. .. .. .. | 1,131,090 | 753 | 6·65 | 22·68 | 209 | 92,134 |
| Pleurisy .. .. .. .. | 1,131,090 | 76 | 0·67 | 1·08 | 10 | 92,134 |
| Congestion of Lungs .. .. .. | 1,131,090 | 25 | 0·22 | *0·00 | 2 | 92,134 |
| Asthma and Emphysema .. .. | 1,131,090 | 52 | 0·46 | 1·31 | 12 | 92,134 |
| Gangrene .. .. .. .. | 1,131,090 | 1 | 0·00 | .. | .. | 92,134 |
| Other Respiratory Diseases .. | 1,131,090 | 54 | 0·48 | 5·24 | 48 | 92,134 |
| Total Respiratory Diseases .. | 1,131,090 | 2,239 | 19·8 | 53·9 | 497 | 92,134 |

* 0·00 means that the rate did not give any unit in the second place of decimals.

TABLE 11.—*All Causes of Death amongst men engaged in the Mining Industry, other than those entered in Death Registers as "Miners." Ten Years* 1900–1909.

| Disease. | Prospector. | Dryblower. | Tin Miner. | Mine-owner and Manager. | Battery and Mill hand. | Cyanider. | Surface Hands. | Assayers. | Engine-drivers. |
|---|---|---|---|---|---|---|---|---|---|
| Phthisis | 6 | .. | .. | .. | 1 | .. | .. | .. | 1 |
| Bronchitis | 1 | 1 | .. | .. | .. | .. | .. | .. | .. |
| Pneumonia | 5 | .. | 1 | .. | 1 | .. | 1 | .. | .. |
| Fibroid phthisis | .. | .. | .. | 1 | .. | .. | .. | .. | .. |
| Lung disease | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Asthma | .. | 1 | .. | .. | .. | .. | .. | .. | .. |
| Suicide | 5 | .. | .. | .. | 1 | .. | .. | .. | .. |
| Accident | 12 | 1 | .. | .. | 2 | 2 | .. | .. | .. |
| Thirst | 6 | .. | .. | .. | .. | .. | .. | .. | .. |
| Starvation | 2 | 1 | .. | .. | .. | .. | .. | .. | .. |
| Sunstroke | 2 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Unknown | 5 | 1 | .. | .. | .. | .. | .. | .. | .. |
| Senility | 3 | .. | .. | .. | .. | .. | .. | .. | .. |
| Hydatids | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Cancer | 6 | 1 | .. | 1 | .. | .. | .. | .. | .. |
| Typhoid fever | 2 | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Cardiac | 12 | 3 | .. | .. | .. | .. | .. | .. | .. |
| Apoplexy | 3 | .. | .. | .. | .. | .. | .. | .. | .. |
| Aneurism | 1 | 1 | .. | .. | .. | .. | .. | .. | .. |
| Diabetes | .. | 1 | .. | .. | .. | .. | .. | .. | .. |
| Septicæmia | .. | 1 | .. | .. | .. | .. | .. | .. | .. |
| Hepatic Cirrhosis | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Myelitis | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Cerebral Tumour | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Intestinal Obstruction | 2 | .. | .. | .. | .. | .. | .. | .. | .. |
| Bright's Disease | 2 | 1 | .. | .. | .. | .. | .. | .. | .. |
| Disease of bladder | 2 | .. | .. | .. | .. | .. | .. | .. | .. |
| Plumbism | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Malaria | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Alcohol | 2 | .. | .. | .. | .. | .. | .. | .. | .. |
| Inflammation of Bowels | 2 | .. | .. | .. | .. | .. | .. | .. | .. |
| Nephritis | 2 | .. | .. | .. | .. | .. | .. | .. | .. |
| Beri-beri | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Peritonitis | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Total | 92 | 13 | 1 | 2 | 5 | 2 | 1 | 1 | 3 |

TABLE 12.—*Death Rates for various Lung Diseases each year per* 10,000 *living (Miners only).*

| Disease. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. |
|---|---|---|---|---|---|---|---|---|---|---|
| Tuberculosis of the Lungs | 7·8 | 8·9 | 23·7 | 16·5 | 20·6 | 14·1 | 17·02 | 23·01 | 29·04 | 31·06 |
| Bronchitis | 5·6 | 3·4 | 3·1 | 2·1 | 5·4 | 7·05 | 1·06 | 5·5 | 1·2 | 7·49 |
| Pneumonia | 41·6 | 24·7 | 34·2 | 20·7 | 16·3 | 19·2 | 15·16 | 17·5 | 22·1 | 14·99 |
| Pleurisy | 1·1 | 1·1 | 1·0 | 1·0 | 1·1 | 3·2 | .. | .. | 1·2 | 1·07 |
| Congestion of the Lungs | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Asthma and Emphysema | .. | 3·4 | 1·0 | 1·0 | 1·1 | 2·1 | .. | .. | 1·2 | 3·21 |
| Other Respiratory Diseases | .. | 4·75 | 6·39 | 4·27 | 3·36 | 4·51 | 12·03 | 7·83 | 5·71 | 4·43 |
| All Respiratory Diseases | 56·1 | 46·25 | 69·39 | 45·57 | 47·86 | 50·16 | 46·07 | 53·84 | 60·45 | 62·25 |
| Total Number of Men employed underground in the State | 8,597 | 8,625 | 9,390 | 9,349 | 8,922 | 9,074 | 9,164 | 8,945 | 8,403 | 9,034 |

TABLE 13.—*Death Rates per* 1,000 *of the Mean Population from certain specially important Causes during the* 11 *years ending* 1909. *

| Cause of Death. | 1899. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | Average for 10 years. | 1909. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Typhoid Fever | 0·88 | 0·72 | 0·64 | 0·88 | 0·60 | 0·37 | 0·43 | 0·49 | 0·47 | 0·28 | 0·55 | 0·30 |
| Phthisis (Consumption) | 0·68 | 0·77 | 0·80 | 0·71 | 0·65 | 0·84 | 0·64 | 0·82 | 0·78 | 0·72 | 0·74 | 0·68 |
| Other Tubercular | 0·23 | 0·23 | 0·21 | 0·24 | 0·19 | 0·15 | 0·14 | 0·12 | 0·16 | 0·21 | 0·18 | 0·16 |
| Influenza | 0·36 | 0·14 | 0·11 | 6·12 | 0·64 | 0·10 | 0·06 | 0·11 | 0·06 | 0·14 | 0·12 | 0·09 |
| Pneumonia | 0·98 | 0·82 | 0·88 | 0·94 | 0·75 | 0·63 | 0·68 | 0·56 | 0·60 | 0·64 | 0·72 | 0·48 |
| Diphtheria | 0·04 | 0·02 | 0·05 | 0·04 | 0·08 | 0·15 | 0·14 | 0·23 | 0·24 | 0·40 | 0·15 | 0·27 |
| Cancer | 0·36 | 0·29 | 0·44 | 0·41 | 0·42 | 0·44 | 0·51 | 0·59 | 0·50 | 0·52 | 0·46 | 0·66 |
| Diarrhœa and Enteritis (under two years of age) | †† | † | † | † | † | † | † | † | 1·18 | 1·00 | † | 0·89 |
| Measles | 0·03 | 0·01 | 0·24 | 0·09 | 0·01 | .. | .. | 0·02 | 0·02 | 0·10 | 0·05 | 0·03 |
| Whooping Cough | 0·17 | 0·18 | 0·07 | 0·11 | 0·19 | 0·07 | .. | 0·04 | 0·39 | 0·07 | 0·13 | 0·01 |
| Bronchitis | 0·35 | 0·27 | 0·35 | 0·26 | 0·28 | 0·19 | 0·22 | 0·22 | 0·19 | 0·14 | 0·24 | 0·17 |
| Scarlet Fever | 0·01 | 0·01 | 0·01 | 0·01 | 0·01 | 0·01 | 0·01 | 0·01 | .. | 0·01 | 0·01 | .. |

* Extracted from Annual Report of Registrar General (W.A.), 1909.

† Information not available owing to re-arrangement of classification.

TABLE 14.—*Death Rates per* 10,000 *of Miners and of all Males over Fifteen.*

| Disease. | Miners. | | All Males over Fifteen. | |
|---|---|---|---|---|
| | 1900. | 1909. | 1900. | 1909. |
| Tuberculosis of the Lungs | 7·8 | 31·06 | 9·1 | 9·53 |
| Bronchitis | 5·6 | 7·49 | 2·2 | 2·12 |
| Pneumonia | 41·6 | 14·99 | 10·72 | 3·75 |
| Pleurisy | 1·1 | 1·07 | 0·68 | 0·73 |
| Asthma and Emphysema | .. | 3·21 | 0·57 | 0·24 |

TABLE 15.—*Deaths from various Lung Diseases, tabulated according to Registry Districts, for each of the Ten Years, 1900-1909 (Miners only).*

| Registry District. | Bronchitis. | | | | | | | | | | Pneumonia. | | | | | | | | | | Tuberculosis. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. |
| Ashburton | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Beverley | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Black Range | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. |
| Blackwood | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Boulder | .. | .. | .. | .. | 1 | .. | .. | 4 | .. | 3 | .. | .. | .. | .. | 2 | 5 | 6 | 3 | 6 | 5 | .. | .. | .. | 1 | 3 | 2 | 2 | 4 | 2 | 5 |
| Broad Arrow | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Broome | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Canning | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Claremont | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 2 | 5 | .. |
| Coolgardie | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 2 | 2 | 3 | 1 | 1 | .. | 1 | .. | .. | .. | 1 | 3 | 3 | 1 | .. | 5 | 2 | 4 | 8 | 13 |
| Coolgardie, East | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Coolgardie, North | .. | 2 | 3 | 1 | 1 | 1 | 1 | .. | 1 | 1 | 29 | 12 | 23 | 11 | 6 | 4 | 3 | 4 | .. | 3 | 3 | 3 | 7 | 5 | 5 | .. | 3 | 3 | .. | 3 |
| Coolgardie, North-East | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | 2 | 1 | 2 | .. | .. | .. | .. | .. | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | .. |
| Dundas | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 1 | 2 | .. | .. | 1 | .. | .. | 5 | 1 | 3 | .. | .. | 1 | .. | .. |
| Esperance | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Eucla | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. |
| Fremantle | .. | .. | .. | .. | .. | 1 | .. | .. | .. | 1 | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | .. | .. | 1 | .. | .. |
| Gascoyne | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Geraldton | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. |
| Gingin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Greenough | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Irwin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Jarrahdale | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Katanning | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kimberley, East | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kimberley, West | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kimberley Goldfields | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Leederville | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Moora | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Mount Margaret | .. | .. | .. | .. | .. | 1 | .. | .. | .. | 1 | 4 | .. | 2 | 2 | 1 | 4 | 1 | 3 | 3 | .. | 1 | 1 | 2 | .. | .. | .. | 5 | 2 | .. | .. |
| Murchison | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 2 | 1 | .. | 1 | 2 | 1 | 2 | 2 | 1 | 1 | .. | .. | .. | .. | .. | 1 | 1 | 1 | 1 |
| Murchison, East | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Murray | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Northam | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Northampton | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Peak Hill | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Perth | .. | .. | .. | 1 | 2 | 1 | .. | .. | .. | 1 | .. | 1 | 1 | 3 | .. | .. | .. | 1 | 2 | .. | .. | .. | 2 | 5 | 5 | 4 | 1 | 1 | 5 | 5 |
| Phillips River | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Pilbara | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 1 | .. | 2 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Plantagenet | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 |
| Port Hedland | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Roebourne | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Subiaco | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | .. |
| Sussex | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Swan | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. |
| Victoria Plains | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Wellington | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Williams | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Yalgoo | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Yilgarn | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| York | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Totals | 5 | 3 | 3 | 2 | 5 | 7 | 1 | 5 | 1 | 7 | 37 | 22 | 33 | 20 | 15 | 18 | 15 | 16 | 19 | 14 | 7 | 8 | 22 | 16 | 19 | 14 | 16 | 21 | 25 | 29 |

| Registry District. | Asthma and Emphysema. | | | | | | | | | | Fibroid Phthisis. | | | | | | | | | | Pleurisy. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. |
| Ashburton | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. |
| Beverley | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Black Range | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Blackwood | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Boulder | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 3 | 3 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Broad Arrow | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Broome | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Canning | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Claremont | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. |
| Coolgardie | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | 2 | 1 | .. | 2 | 2 | 1 | .. | 1 | .. | 1 | .. | .. | 1 | 1 | .. | .. | .. | .. |
| Coolgardie, East | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Coolgardie, North | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Coolgardie, North-East | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Dundas | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Esperance | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Eucla | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Fremantle | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Gascoyne | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Geraldton | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Gingin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Greenough | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Irwin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Jarrahdale | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Katanning | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kimberley, East | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kimberley, West | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kimberley Goldfields | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Leederville | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Moora | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Mount Margaret | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | .. |
| Murchison | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Murchison, East | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Murray | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Northam | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Northampton | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Peak Hill | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Perth | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | 2 | .. | .. | 1 | .. | .. | 1 | 2 | 1 | 1 | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Phillips River | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Pilbara | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Plantagenet | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Port Hedland | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Roebourne | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Subiaco | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Sussex | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Swan | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Victoria Plains | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Wellington | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Williams | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Yalgoo | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Yilgarn | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| York | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Totals | .. | 3 | 1 | 1 | 1 | 2 | .. | .. | 1 | 3 | .. | 3 | 6 | 3 | 2 | 3 | 10 | 6 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | .. | .. | 1 | 1 |

TABLE 16.—*Numbers of all Patients treated in Government Hospitals during Ten Years* 1900–1909, *tabulated according to*

| | Lung Diseases. | | | | | | | | | | | Lung Diseases. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1906. | 1907. | 1908. | 1909. | Total 1900–1909. | Total 1904–1909. | Total 1900–1909. | Total 1904–1909. |
| Black Range | .. | .. | .. | .. | .. | .. | .. | 1 | 10 | 3 | .. | 14 | 14 | .. | .. |
| Collie | .. | .. | 5 | 8 | 3 | 6 | 4 | 3 | .. | 4 | 5 | 38 | 25 | .. | .. |
| Coolgardie | 68 | 78 | 45 | 47 | 29 | 37 | 38 | 44 | 115 | 118 | 176 | 795 | 557 | .. | .. |
| Cue | 9 | 10 | 13 | 18 | 8 | 12 | 14 | 6 | 19 | 14 | 17 | 140 | 90 | .. | .. |
| Kalgoorlie | 113 | 139 | 113 | 146 | 124 | 94 | 118 | 53 | 88 | 91 | 72 | 1,151 | 640 | .. | .. |
| Kookynie | .. | .. | 3 | 9 | 8 | 13 | 5 | 5 | 3 | 2 | 1 | 49 | 37 | .. | .. |
| Lawlers | .. | .. | 1 | 5 | 5 | 2 | 3 | 2 | .. | 3 | 2 | 23 | 17 | .. | .. |
| Marble Bar | .. | 3 | 2 | 3 | 3 | 2 | 4 | 1 | 4 | 2 | 4 | 28 | 20 | .. | .. |
| Menzies | .. | 10 | 25 | 17 | 9 | 5 | 7 | 2 | 3 | 2 | 4 | 84 | 32 | .. | .. |
| Southern Cross | 4 | 17 | 2 | 17 | 5 | 6 | 13 | 5 | 10 | 10 | 6 | 95 | 55 | .. | .. |
| Pilbara | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. |
| | | | | | | | | | | | | 2,419 | 1,487 | 2,419 | 1,487 |
| Albany | 8 | 10 | 15 | 13 | 9 | 8 | 7 | 6 | 7 | 2 | 6 | 91 | 45 | .. | .. |
| Bridgetown | .. | 2 | 3 | 4 | 1 | 2 | 3 | .. | .. | 1 | 3 | 19 | 10 | .. | .. |
| Broome | .. | .. | 7 | 10 | 10 | 12 | 4 | 4 | 9 | 4 | 8 | 68 | 51 | .. | .. |
| Bunbury | 36 | 26 | 24 | 41 | 34 | 32 | 31 | 20 | 25 | 25 | 19 | 313 | 186 | .. | .. |
| Carnarvon | 3 | 3 | 2 | 1 | 3 | 2 | 7 | 2 | 2 | 6 | 9 | 40 | 31 | .. | .. |
| Derby | .. | 2 | .. | .. | .. | .. | 1 | .. | .. | 1 | .. | 4 | 2 | .. | .. |
| Geraldton | 16 | 12 | 17 | 12 | 13 | 25 | 15 | 11 | 17 | 20 | 16 | 174 | 117 | .. | .. |
| Katanning | 3 | 5 | 7 | 8 | 5 | 8 | 8 | 7 | 13 | 8 | 6 | 78 | 55 | .. | .. |
| Midland Junction | 16 | 22 | 23 | 19 | 15 | 6 | .. | 1 | 4 | 7 | 8 | 121 | 41 | .. | .. |
| Newcastle | .. | 3 | 1 | .. | .. | 1 | 3 | 3 | .. | 2 | 5 | 18 | 14 | .. | .. |
| Narrogin | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | 12 | 22 | 22 | .. | .. |
| Northam | 12 | 23 | 33 | 18 | 19 | 24 | 20 | 10 | 20 | 17 | 27 | 223 | 137 | .. | .. |
| Onslow | .. | .. | 1 | .. | 2 | 2 | 3 | 1 | 3 | .. | .. | 12 | 11 | .. | .. |
| Pinjarrah | 4 | 1 | .. | 4 | 2 | 2 | 1 | .. | 2 | 1 | 2 | 19 | 10 | .. | .. |
| Roebourne | 3 | 4 | 2 | 3 | 2 | 1 | 5 | 3 | 5 | 2 | 4 | 34 | 22 | .. | .. |
| Wagin | .. | .. | .. | .. | .. | .. | .. | .. | .. | 5 | .. | 5 | 5 | .. | .. |
| Wyndham | .. | 1 | 2 | 2 | 3 | 2 | .. | 1 | 1 | 2 | .. | 14 | 9 | .. | .. |
| York | 11 | 13 | 13 | 15 | 7 | 2 | 4 | 1 | 7 | 12 | 7 | 92 | 40 | .. | .. |
| Perth | 109 | 162 | 201 | 208 | 207 | 210 | 227 | 167 | 258 | 281 | 221 | 2,251 | 1,571 | .. | .. |
| Fremantle | 99 | 52 | 60 | 72 | 66 | 98 | 58 | 26 | 76 | 68 | 111 | 786 | 503 | .. | .. |
| Esperance | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Busselton | 3 | .. | 3 | 2 | .. | .. | .. | .. | .. | .. | .. | 8 | .. | .. | .. |
| Williams | 6 | 1 | 2 | 6 | .. | .. | .. | .. | .. | .. | .. | 15 | .. | .. | .. |
| Greenbushes | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | 1 | 4 | 4 | .. | .. |
| Totals | 525 | 599 | 625 | 708 | 592 | 614 | 603 | 385 | 701 | 726 | 752 | 4,411 | 2,886 | 4,411 | 2,886 |
| Grand Totals for *all* Hospitals | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 6,830 | 4,373 |

*Total Numbers treated for Lung Diseases and Total Numbers treated for all Diseases.*

| Total Cases—All Diseases. | | | | | | | | | | | Total Cases—All Diseases. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1906. | 1907. | 1908. | 1909. | Total 1900–1909. | Total 1904–1909. | Total 1900–1909. | Total 1904–1909. |
| .. | .. | .. | .. | .. | .. | 2 | 32 | 101 | 35 | .. | 170 | 170 | .. | .. |
| .. | .. | 47 | 89 | 64 | 67 | 100 | 44 | 81 | 52 | 58 | 602 | 466 | .. | .. |
| 743 | 665 | 543 | 446 | 358 | 299 | 274 | 154 | 313 | 427 | 462 | 4,684 | 2,287 | .. | .. |
| 177 | 185 | 202 | 226 | 151 | 134 | 159 | 57 | 191 | 198 | 120 | 1,800 | 1,010 | .. | .. |
| 937 | 920 | 833 | 972 | 1,097 | 989 | 1,058 | 475 | 789 | 769 | 779 | 9,528 | 5,866 | .. | .. |
| .. | .. | 26 | 128 | 164 | 118 | 86 | 37 | 27 | 30 | 24 | 640 | 486 | .. | .. |
| .. | .. | 52 | 62 | 62 | 54 | 66 | 30 | 45 | 49 | 59 | 479 | 365 | .. | .. |
| .. | 48 | 33 | 26 | 20 | 39 | 32 | 18 | 47 | 30 | 32 | 325 | 218 | .. | .. |
| .. | 155 | 264 | 130 | 70 | 63 | 65 | 38 | 57 | 47 | 81 | 970 | 421 | .. | .. |
| 82 | 155 | 101 | 99 | 79 | 93 | 114 | 22 | 99 | 99 | 74 | 1,017 | 580 | .. | .. |
| 37 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 37 | .. | .. | .. |
| | | | | | | | | | | | 20,252 | 11,869 | 20,252 | 11,869 |
| 110 | 131 | 156 | 129 | 106 | 102 | 102 | 50 | 114 | 102 | 125 | 1,227 | 701 | .. | .. |
| 24 | 24 | 41 | 41 | 35 | 36 | 46 | 24 | 58 | 42 | 54 | 425 | 295 | .. | .. |
| .. | .. | 49 | 109 | 218 | 366 | 175 | 97 | 174 | 243 | 313 | 1,744 | 1,586 | .. | .. |
| 337 | 307 | 293 | 371 | 388 | 313 | 384 | 181 | 336 | 325 | 294 | 3,529 | 2,221 | .. | .. |
| 42 | 35 | 30 | 38 | 53 | 68 | 93 | 66 | 99 | 115 | 150 | 789 | 644 | .. | .. |
| 19 | 15 | 10 | 5 | 31 | 83 | 33 | 41 | 67 | 85 | 65 | 454 | 405 | .. | .. |
| 188 | 185 | 201 | 180 | 130 | 209 | 191 | 110 | 206 | 268 | 221 | 2,089 | 1,335 | .. | .. |
| 29 | 34 | 64 | 91 | 77 | 126 | 151 | 96 | 124 | 82 | 109 | 983 | 765 | .. | .. |
| 165 | 170 | 248 | 282 | 286 | 112 | 36 | 22 | 43 | 56 | 48 | 1,468 | 603 | .. | .. |
| 16 | 11 | 17 | .. | .. | 11 | 19 | 12 | 18 | 28 | 39 | 171 | 127 | .. | .. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | 68 | 111 | 179 | 179 | .. | .. |
| 171 | 176 | 260 | 218 | 211 | 233 | 207 | 103 | 251 | 301 | 374 | 2,505 | 1,680 | .. | .. |
| .. | .. | 7 | 21 | 19 | 32 | 35 | 9 | 39 | 24 | 25 | 211 | 183 | .. | .. |
| 15 | 22 | 22 | 27 | 20 | 13 | 17 | .. | 21 | 20 | 30 | 207 | 121 | .. | .. |
| 66 | 43 | 59 | 29 | 53 | 30 | 49 | 7 | 63 | 41 | 35 | 475 | 278 | .. | .. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | 47 | 67 | 114 | 114 | .. | .. |
| 16 | 14 | 20 | 44 | 32 | 21 | 19 | 11 | 33 | 40 | 19 | 269 | 175 | .. | .. |
| 106 | 71 | 83 | 98 | 84 | 97 | 114 | 48 | 152 | 153 | 134 | 1,140 | 782 | .. | .. |
| 1,315 | 1,360 | 1,809 | 1,810 | 1,858 | 2,252 | 2,682 | 1,433 | 3,100 | 3,386 | 2,601 | 23,606 | 17,312 | .. | .. |
| 636 | 636 | 711 | 687 | 672 | 895 | 816 | 436 | 948 | 986 | 814 | 8,237 | 5,567 | .. | .. |
| 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | .. | .. | .. |
| 25 | 17 | 36 | 20 | .. | .. | .. | .. | .. | .. | .. | 98 | .. | .. | .. |
| 15 | 11 | 18 | 30 | 2 | .. | .. | 56 | .. | .. | .. | 132 | 58 | .. | .. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | 34 | 56 | 90 | 90 | .. | .. |
| 5,275 | 5,390 | 6,235 | 6,403 | 6,250 | 6,855 | 7,125 | 3,709 | 7,596 | 8,182 | 7,373 | 50,146 | 35,221 | 50,146 | 35,221 |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 70,398 | 47,090 |

TABLE 17.—*Total Numbers of Cases treated in Government Hospitals during Six Years* 1904–1909, *grouped according to Cases of Lung Diseases, Cases of all other Diseases, and Total Cases.*
(*Miners only.*)

| | Lung Diseases. | | | | | | | Other Diseases. | | | | | | | Total Cases. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Total. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Total. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Total. |
| Albany | .. | .. | .. | 1 | .. | .. | 1 | 2 | 1 | 1 | 1 | 3 | 1 | 9 | 2 | 1 | 1 | 2 | 3 | 1 | 10 |
| Black Range | * | * | 2 | 6 | 2 | N.R. | 10 | * | * | 13 | 44 | 14 | N.R. | 71 | .. | .. | 15 | 50 | 16 | .. | 81 |
| Bridgetown | .. | 1 | .. | .. | .. | .. | 1 | 1 | 3 | 9 | 8 | 3 | .. | 24 | 1 | 4 | 9 | 8 | 3 | .. | 25 |
| Broome | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | 1 | .. | .. | 1 |
| Bunbury | .. | .. | 2 | .. | .. | 1 | 3 | 1 | 7 | 17 | 6 | .. | 2 | 33 | 1 | 7 | 19 | 6 | .. | 3 | 36 |
| Carnarvon | .. | .. | 1 | .. | .. | .. | 1 | .. | 6 | 5 | 5 | 4 | 5 | 25 | .. | 6 | 6 | 5 | 4 | 5 | 26 |
| Collie | 1 | .. | .. | 1 | .. | .. | 2 | 8 | 7 | 13 | 7 | 1 | .. | 36 | 9 | 7 | 13 | 8 | 1 | .. | 38 |
| Coolgardie | 6 | 9 | 9 | 4 | 8 | 2 | 38 | 40 | 95 | 63 | 49 | 64 | 19 | 330 | 46 | 104 | 72 | 53 | 72 | 21 | 368 |
| Cue | 5 | 5 | 4 | 4 | 7 | .. | 25 | 35 | 39 | 50 | 49 | 49 | .. | 222 | 40 | 44 | 54 | 53 | 56 | .. | 247 |
| Derby | .. | .. | .. | .. | 1 | 1 | 2 | 3 | .. | 6 | 13 | 2 | 9 | 33 | 3 | .. | 6 | 13 | 3 | 10 | 35 |
| Geraldton | .. | 1 | 1 | 1 | 3 | 2 | 8 | 4 | 10 | 9 | 15 | 17 | 12 | 67 | 4 | 11 | 10 | 16 | 20 | 14 | 75 |
| Kalgoorlie | 12 | 31 | 22 | 13 | 13 | 9 | 100 | 110 | 164 | 193 | 96 | 93 | 85 | 741 | 122 | 195 | 215 | 109 | 106 | 94 | 841 |
| Katanning | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | 2 | .. | .. | 2 | .. | .. | .. | 2 |
| Kookynie | 4 | 3 | 5 | 1 | 1 | .. | 14 | 34 | 30 | 34 | 8 | 8 | 8 | 122 | 38 | 33 | 39 | 9 | 9 | 8 | 136 |
| Lawlers | .. | 2 | .. | .. | 1 | 3 | 6 | .. | 30 | 30 | 21 | 24 | 19 | 124 | .. | 32 | 30 | 21 | 25 | 22 | 150 |
| Marble Bar | 1 | 1 | 1 | 1 | 1 | 2 | 7 | 7 | 20 | 23 | 31 | 7 | 10 | 98 | 8 | 21 | 24 | 32 | 8 | 12 | 105 |
| Midland Junction | .. | .. | .. | .. | .. | .. | .. | .. | 3 | .. | .. | .. | 1 | 4 | .. | 3 | .. | .. | .. | 1 | 4 |
| Menzies | .. | .. | .. | 1 | .. | N.R. | 1 | 15 | 19 | 8 | 14 | 15 | N.R. | 71 | 15 | 19 | 8 | 15 | 15 | .. | 72 |
| Newcastle | N.R. | .. | .. | .. | .. | .. | .. | N.R. | .. | .. | 1 | .. | .. | 1 | N.R. | .. | 1 | .. | .. | .. | 1 |
| Narrogin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Northam | .. | .. | .. | .. | .. | .. | .. | 3 | 3 | 2 | 1 | 1 | .. | 10 | 3 | 3 | 2 | 1 | 1 | .. | 10 |
| Onslow | .. | 1 | .. | .. | .. | .. | 1 | .. | .. | 4 | 1 | 6 | 4 | 15 | .. | 1 | 4 | 1 | 6 | 4 | 16 |
| Pinjarrah | .. | N.R. | .. | .. | .. | .. | .. | .. | N.R. | .. | .. | .. | .. | .. | .. | N.R. | .. | .. | .. | .. | .. |
| Roebourne | 1 | .. | .. | 2 | 1 | 2 | 6 | 4 | 7 | 9 | 15 | 1 | 3 | 39 | 5 | 7 | 9 | 17 | 2 | 5 | 45 |
| Southern Cross | 1 | 4 | 2 | 3 | .. | 2 | 12 | 5 | 12 | 30 | 17 | 8 | 13 | 85 | 6 | 16 | 32 | 20 | 8 | 15 | 97 |
| Wagin | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Wyndham | .. | .. | .. | .. | .. | 2 | 2 | .. | 1 | .. | .. | 1 | 13 | 15 | .. | 1 | .. | .. | 1 | 15 | 17 |
| York | .. | .. | .. | .. | .. | .. | .. | .. | 4 | .. | 2 | 1 | .. | 7 | .. | 4 | .. | 2 | 1 | .. | 7 |
| Perth | .. | 11 | 4 | 9 | 9 | 7 | 40 | .. | 74 | 74 | 64 | 54 | 33 | 299 | .. | 85 | 78 | 73 | 63 | 40 | 339 |
| Fremantle | .. | 2 | 2 | 1 | 4 | 1 | 10 | .. | 9 | 13 | 11 | 11 | 9 | 53 | .. | 11 | 15 | 12 | 15 | 10 | 63 |
| | 31 | 71 | 55 | 48 | 51 | 34 | 290 | 272 | 544 | 608 | 480 | 387 | 246 | 2,537 | 303 | 615 | 664 | 527 | 438 | 280 | 2,827 |

N.R.—No record. * Hospital not in existence.

TABLE 18.—*Numbers of Cases of various Lung Diseases treated in all the Government Hospitals for each of the Six Years* 1904–1909, *tabulated according to individual Hospitals* (*Miners only*).

| | Tuberculosis of Lungs. | | | | | | Bronchitis. | | | | | | Pneumonia. | | | | | | Pleurisy. | | | | | | Asthma and Emphysema. | | | | | | Congestion of the Lungs. | | | | | | Other Respiratory Diseases. | | | | | | Totals. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | |
| Albany .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Black Range | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | 2 | 2 | .. | .. | .. | 1 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 |
| Bridgetown .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Broome .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Bunbury .. | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 |
| Carnarvon .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Collie .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 |
| Coolgardie .. | 3 | 5 | 3 | 1 | 1 | .. | 1 | 3 | 2 | 1 | 3 | 1 | .. | .. | .. | .. | 2 | .. | 1 | 1 | 2 | .. | 2 | .. | .. | .. | 1 | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | 2 | .. | .. | 38 |
| Cue .. .. | .. | .. | .. | .. | 3 | .. | 1 | .. | .. | .. | .. | .. | 2 | 2 | .. | 3 | 3 | .. | 1 | 2 | 4 | 1 | .. | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 25 |
| Derby .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 2 |
| Geraldton .. | .. | .. | .. | .. | 1 | .. | .. | .. | 1 | .. | 1 | .. | .. | 1 | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 8 |
| Kalgoorlie .. | 1 | 10 | 6 | 2 | 2 | 2 | 2 | 6 | 1 | 1 | .. | 1 | 4 | 7 | 9 | 6 | 2 | 3 | 3 | 6 | 4 | .. | 2 | 2 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | 2 | 1 | 4 | 5 | 3 | 100 |
| Katanning .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kookynie .. | 1 | .. | 2 | .. | .. | .. | 1 | 1 | .. | 1 | .. | .. | .. | 1 | 1 | .. | 1 | .. | 1 | 1 | .. | .. | .. | .. | 1 | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 14 |
| Lawlers .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | .. | 1 | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 6 |
| Marble Bar .. | .. | 1 | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 1 | .. | .. | 1 | 1 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 |
| Mid. Junction | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Menzies .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Newcastle .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Parrogin .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| Portham .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Pinslow .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Pinjarrah .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Roebourne .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 2 | 1 | 1 | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 6 |
| Southern Cross | .. | .. | .. | .. | .. | 1 | 1 | 2 | 1 | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | 12 |
| Wagin .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Wyndham .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 |
| York .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Perth .. | .. | 7 | 1 | 4 | 6 | 5 | .. | 2 | 1 | 2 | 2 | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | 2 | .. | 1 | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | .. | .. | .. | .. | 2 | 1 | .. | 40 |
| Fremantle .. | .. | 1 | 2 | .. | 3 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 10 |
| Totals | 6 | 25 | 16 | 8 | 16 | 10 | 7 | 15 | 6 | 9 | 7 | 6 | 7 | 14 | 12 | 15 | 12 | 5 | 6 | 13 | 14 | 3 | 8 | 3 | 1 | 2 | 4 | 2 | 1 | 5 | 1 | .. | .. | .. | .. | .. | 3 | 2 | 3 | 11 | 7 | 5 | 290 |

TABLE 19.—*Deaths from various Lung Diseases amongst Miners, classified according to Age-groups for each of the Ten Years 1900-1909.*

| | Bronchitis. | | | | | | Pneumonia. | | | | | | Tuberculosis. | | | | | | Asthma and Emphysema. | | | | | | Fibroid Phthisis. | | | | | | Pleurisy. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15–25. | 25–35. | 35–45. | 45–55. | 55–65. | 65 and over. | 15–25. | 25–35. | 35–45. | 45–55. | 55–65. | 65 and over. | 15–25. | 25–35. | 35–45. | 45–55. | 55–65. | 65 and over. | 15–25. | 25–35. | 35–45. | 45–55. | 55–65. | 65 and over. | 15–25. | 25–35. | 35–45. | 45–55. | 55–65. | 65 and over. | 15–25. | 25–35. | 35–45. | 45–55. | 55–65. | 65 and over. |
| 00 .. .. | .. | .. | .. | 2 | 2 | 1 | 1 | 10 | 14 | 7 | 4 | 1 | .. | 2 | 3 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| 01 .. .. | .. | .. | .. | 2 | 1 | .. | 1 | 6 | 4 | 7 | 2 | 2 | 1 | 1 | 5 | .. | 1 | .. | .. | .. | .. | .. | 1 | 2 | .. | .. | .. | 2 | 1 | .. | .. | .. | .. | .. | 1 | .. |
| 02 .. .. | .. | .. | .. | .. | .. | 3 | 4 | 8 | 10 | 3 | 5 | 3 | .. | 10 | 5 | 2 | 4 | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | 4 | 1 | .. | .. | 1 | .. | .. | .. |
| 03 .. .. | .. | .. | .. | 1 | 1 | .. | .. | 1 | 10 | 4 | 3 | 2 | 2 | 4 | 4 | 4 | 1 | 1 | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 1 | 2 | .. | 1 | .. | .. | .. | .. | .. |
| 04 .. .. | .. | .. | 1 | 1 | .. | 3 | 1 | 5 | 3 | 4 | 1 | 1 | 1 | 5 | 6 | 3 | 4 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | .. | .. | .. | 1 |
| 05 .. .. | .. | .. | .. | 3 | 2 | 2 | 2 | 6 | 4 | 4 | 1 | 1 | 1 | .. | 4 | 5 | 3 | 1 | .. | 1 | .. | .. | 1 | .. | .. | .. | .. | 2 | 1 | .. | .. | .. | .. | 1 | 2 | .. |
| 06 .. .. | .. | .. | .. | .. | .. | 1 | 1 | 5 | 5 | 4 | .. | .. | .. | 3 | 5 | 2 | 4 | 2 | .. | .. | .. | .. | .. | .. | .. | 1 | 4 | 4 | .. | 1 | .. | .. | .. | .. | .. | .. |
| 07 .. .. | .. | 1 | .. | 1 | .. | 3 | 1 | 4 | 6 | 1 | 3 | 1 | .. | 5 | 9 | 2 | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | 3 | .. | 1 | .. | .. | .. | .. | .. | .. |
| 08 .. .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 6 | 5 | 4 | 3 | 1 | 2 | 9 | 8 | 3 | 2 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | 2 | 2 | .. | .. | .. | 1 | .. | .. |
| 09 .. .. | .. | .. | .. | 3 | 2 | 2 | .. | 2 | 1 | 6 | 2 | 3 | 1 | 6 | 11 | 7 | 3 | 1 | .. | .. | 1 | .. | .. | 2 | .. | .. | .. | 2 | 1 | .. | .. | .. | .. | 1 | .. | .. |
| Totals .. | .. | 1 | 1 | 13 | 8 | 16 | 11 | 48 | 63 | 45 | 25 | 17 | 7 | 38 | 61 | 34 | 29 | 8 | .. | 1 | 2 | 2 | 2 | 5 | .. | 1 | 6 | 15 | 11 | 7 | 1 | .. | 2 | 4 | 1 | 2 |
| Total for each disease .. | 39 | | | | | | 209 | | | | | | 177 | | | | | | 12 | | | | | | 40 | | | | | | 10 | | | | | |

TABLE 20.—*Age Distribution of Deaths from all Causes for Ten Years, 1900–1909, Males over Fifteen.*

| Age Periods. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15–20 .. .. | 24 | 20 | 34 | 29 | 35 | 32 | 34 | 29 | 33 | 25 | 295 |
| 20–25 .. .. | 77 | 80 | 98 | 96 | 97 | 79 | 80 | 78 | 75 | 61 | 821 |
| 25–30 .. .. | 98 | 122 | 140 | 114 | 122 | 108 | 106 | 84 | 78 | 66 | 1,038 |
| 30–35 .. .. | 100 | 112 | 120 | 100 | 102 | 127 | 115 | 116 | 86 | 85 | 1,063 |
| 35–40 .. .. | 122 | 123 | 118 | 132 | 127 | 95 | 112 | 116 | 122 | 95 | 1,162 |
| 40–45 .. .. | 103 | 107 | 116 | 135 | 131 | 113 | 123 | 112 | 113 | 134 | 1,187 |
| 45–50 .. .. | 68 | 94 | 90 | 87 | 109 | 97 | 107 | 136 | 122 | 144 | 1,054 |
| 50–55 .. .. | 64 | 71 | 75 | 68 | 99 | 93 | 115 | 107 | 110 | 113 | 915 |
| 55–60 .. .. | 64 | 65 | 72 | 86 | 65 | 73 | 80 | 63 | 86 | 82 | 736 |
| 60–65 .. .. | 57 | 63 | 70 | 75 | 68 | 61 | 90 | 83 | 86 | 70 | 723 |
| 65–70 .. .. | 66 | 57 | 64 | 62 | 76 | 69 | 66 | 81 | 77 | 85 | 703 |
| 70–75 .. .. | 41 | 55 | 66 | 55 | 74 | 56 | 71 | 60 | 58 | 79 | 615 |
| 75–80 .. .. | 39 | 37 | 45 | 36 | 34 | 56 | 50 | 62 | 74 | 74 | 507 |
| 80–85 .. .. | 19 | 33 | 28 | 21 | 39 | 29 | 30 | 38 | 38 | 33 | 298 |
| 85–90 .. .. | 6 | 8 | 10 | 3 | 16 | 16 | 14 | 28 | 17 | 14 | 132 |
| 90–95 .. .. | 1 | 1 | 2 | 4 | 2 | 1 | 2 | 3 | 2 | 2 | 20 |
| 95 and over .. | 1 | 2 | 2 | .. | .. | .. | .. | 1 | 1 | 2 | 9 |

TABLE 21.—*Deaths of Miners from All Causes, grouped according to ages at Death, Ten Years, 1900–1909.*

| | 15-20. | 20-25. | 25-30. | 30-35. | 35-40. | 40-45. | 45-50. | 50-55. | 55-60. | 60-65. | 65-70. | 70-75. | 75-80. | 80-85. | 85-90. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Deaths in each age group | 19 | 117 | 211 | 204 | 227 | 240 | 188 | 165 | 134 | 126 | 92 | 66 | 37 | 11 | 2 | 1,839 |
| Percentage of the total deaths at all ages | 1·03 | 6·4 | 11·5 | 11·1 | 12·3 | 13·03 | 10·2 | 8·9 | 7·3 | 6·85 | 5·00 | 3·5 | 2·01 | 0·59 | 0·1 | 100 |

TABLE 22.—*Percentages of Total Male Deaths occurring at the various specified age groups.*

| | All Males over Fifteen. | Miners. |
|---|---|---|
| 15–20 .. .. .. | 2·6 | 1·03 |
| 20–25 .. .. .. | 7·3 | 6·4 |
| 25–30 .. .. .. | 9·2 | 11·5 |
| 30–35 .. .. .. | 9·4 | 11·1 |
| 35–40 .. .. .. | 10·3 | 12·3 |
| 40–45 .. .. .. | 10·5 | 13·03 |
| 45–50 .. .. .. | 9·3 | 10·2 |
| 50–55 .. .. .. | 8·1 | 8·9 |
| 55–60 .. .. .. | 6·5 | 7·3 |
| 60 and over .. .. | 26·6 | 18·1 |

TABLE 23.—*The following figures are taken from the Return of the Registrar General for England and Wales* (*see page 18.*)

| E. and W. | No. Living. | Ph. | Br. | Pn. | Pl. | O.R.D. |
|---|---|---|---|---|---|---|
| Coal Miner .. | 618,732 | 1,444 | 1,033 | 1,310 | 97 | 323 |
| Ironstone .. | 17,031 | 67 | 23 | 37 | 5 | 11 |
| Copper .. | 820 | 12 | 6 | 2 | .. | 10 |
| Tin .. .. | 6,599 | 134 | 33 | 13 | 2 | 73 |
| Lead .. .. | 4,500 | 45 | 8 | 11 | 3 | 18 |

*And from these the following rates are estimated.*—

| | Rates per 10,000. | | | | | |
|---|---|---|---|---|---|---|
| Coal .. .. | 23·34 | 16·36 | 21·16 | 1·56 | 5·22 | 68·64 |
| Iron .. .. | 39·3 | 13·5 | 21·7 | 2·9 | 6·7 | 84·1 |
| Copper .. | 146·3 | 73·2 | 24·4 | .. | 121·9 | 365·8 |
| Tin .. .. | 203·1 | 50·07 | 20·3 | 3·03 | 110·6 | 387·1 |
| Lead .. .. | 100·00 | 17·7 | 14·4 | 6·66 | 40·0 | 178·83 |
| Gold and Coal, W.A. | 9·62 | 2·12 | 11·36 | 0·54 | 3·37 | 27·02 |

TABLE 24.—***Hospitals subsidised by the Government, and known as "Assisted Hospitals."***

| | |
|---|---|
| Broad Arrow | Mount Morgans |
| Bulong | Nannine |
| Davyhurst | Norseman |
| Kanowna | Peak Hill |
| Laverton | Ravensthorpe |
| Leonora | Sandstone |
| Meekatharra | Sir Samuel |
| Mount Magnet | Wiluna |
| Mount Malcolm | |

TABLE 25.—***Total number of men employed in each of the ten years 1900-1909.***

| | Gold Miners. | Coal Miners. | |
|---|---|---|---|
| | Underground. | Underground. | Total. |
| 1900 .. .. | 8,597 | 296 | 8,893 |
| 1901 .. .. | 8,625 | 279 | 8,904 |
| 1902 .. .. | 9,390 | 284 | 9,674 |
| 1903 .. .. | 9,349 | 308 | 9,657 |
| 1904 .. .. | 8,922 | 283 | 9,205 |
| 1905 .. .. | 9,074 | 261 | 9,335 |
| 1906 .. .. | 9,164 | 236 | 9,400 |
| 1907 .. .. | 8,945 | 179 | 9,124 |
| 1908 .. .. | 8,403 | 204 | 8,607 |
| 1909 .. .. | 9,034 | 301 | 9,335 |
| | 89,503 | 2,631 | 92,134 |

## PART II.—RESULTS OBTAINED BY THE ACTUAL EXAMINATION OF WORKING MINERS.

While the statistical data available were very valuable as affording information as to the amount of lung disease existing in the past amongst miners, yet the most important point to be decided was the amount of lung disease existing amongst miners at the present time.

There were several ways (all of which were considered) of attempting to form an estimate upon this question:—

(1.) The evidence of medical men practising at the various mining centres could be obtained;

(2.) The evidence of the officials of the miners' unions and of the mine managers could be obtained;

It was also hoped that the secretaries of the miners' unions would have complete records of either sickness or deaths amongst the men working in their districts; it transpired, however, on inquiry, that this was not so. (See evidence.)

(3.) Steps could be taken that all known cases of lung diseases amongst miners should come to a central point in each district, to give what information they could, and to be examined;

(4.) An examination according to a uniform system of a large number of miners actually at work could be conducted.

(This method would have the advantage of ensuring uniformity in the methods of examination, and also in the nomenclature of any conditions found; and would at the same time be likely to reveal unsuspected cases; and this method was the one decided on as the principal feature of the inquiry, while all the other methods were also utilised.)

It was thought desirable that the men examined should be, considered as a whole, a fair average sample of the miners at work throughout the State, and that they should be examined under conditions as nearly as possible similar to the conditions under which their work is actually carried on.

Therefore, the method adopted throughout was that men be examined either as soon as they came off shift or during the progress of their work, and that as nearly as possible the whole of one shift should be examined.

That this plan was successfully carried out was entirely due to the courtesy of the mine managers, and I take this opportunity of acknowledging the courteous co-operation extended to me by the managers throughout the whole of my work.

It was recognised, however, that this method would not result in a complete knowledge of the prevalence of lung diseases amongst miners, for there is always a surplus of cases whose disease has progressed so far as to render them incapable of further work.

Of these some would be likely to have left the mining districts and gone to other parts of the State. Indeed, it is obvious that this was so, as has been already seen (page 15).

In order to obtain details of any cases of lung diseases amongst miners known to the medical men practising in the State (other than those medical men whom it was intended to orally examine on the goldfields), a circular was sent out asking for particulars of any cases known to the medical men addressed.

The circular sent out is given on page 71. Of those circulars 84 in all were sent out; only sixteen replies being received. The sixteen replies conveyed the following information:—

Twelve knew of no cases of lung diseases amongst miners; three reported one case each of tuberculosis; one reported two cases of tuberculosis.

It is obvious that no importance can be attached to this method of obtaining information. Therefore it was necessary to be content with the advanced cases found in those centres visited.

Such cases were sought out and examined, either at their homes, or at some central place such as the office of the miners' union. It is believed that few, if any, such cases in the districts visited escaped examination or were overlooked; and the statements by union secretaries, made in evidence, support this belief.

Without the co-operation of the union officials it would not have been possible to obtain knowledge of these advanced cases within any reasonable time; and I desire to acknowledge this assistance, which was always willingly and completely given.

At many of the centres visited there was definite evidence that miners affected with lung disease had left the district and gone to live (perhaps died) in some other country (*e.g.*, Italy) or other State.

An attempt was made to verify these statements, for while they were made in the utmost good faith, they could not, of course, be accepted without verification.

It was found that some of the statements were true, and that the persons referred to had undoubtedly died from lung diseases, likely enough contracted as a result of their occupation.

But, on the other hand, it was found that others of these statements were unreliable. For instance, it was stated that one man had left the State and subsequently died from tuberculosis in another country. On inquiry it was found that the cause of death had nothing to do with the lungs, although it was such that the person would look very ill and possibly be thought to have tuberculosis.

Therefore, all such cases were disregarded, and attention paid only to those persons actually examined by myself.

Any attempt to assess from hearsay the number of men who had been affected in the past, however sincere the informant may have been, would inevitably result in hopeless confusion.

There were, therefore, two types of men examined —those actually at work, and those rendered incapable of further work by the advanced nature of their disease. In addition, there were a few other men examined at the offices of the unions and at other places, who desired for various reasons to submit themselves for examination; but these formed a negligible percentage of the total.

As will be presently seen, these two groups of men have been considered separately, and all figures and percentages have been given independently for the two groups. To make the position more clear at the outset, the two groups examined were:

(a.) Men examined at work or on the surface as they came off shift.

(b.) Men examined at their homes or at other places and known or suspected to be affected with some complaint.

(Included in this group are those cases examined at the Sanatorium at Coolgardie.)

It was not possible to mix these two sets of cases, for the one group—the men examined under working conditions—were what would be known in statistics as an "average population;" and the other, those known or suspected to be affected, were what would be known in statistics as a "selected" group.

Accidentally a favourable factor was introduced into the work. The inquiry was conducted at the change of seasons when the cold weather was just beginning and when at the same time the regularly recurring epidemic "colds" were prevalent. The presence of these "colds" acted in the direction of rendering any pre-existing affection of the lung more easily detectable without introducing any source of error.

When it is said that no source of error was introduced, it is necessary to explain that no attempt was made to keep a record of the number of men suffering from common colds.

In the first place there is a great deal of variation between the conditions which various people dignify with the name of a cold. Some will intend, when they use the term cold, to signify a nasal catarrh, others will include only such affections as are accompanied with some cough, and so on.

Further, it was found on arriving at some districts that nasal catarrhs or influenza were epidemically prevalent in those districts, affecting not only miners but also the general population widely.

For these reasons no importance was attached to the existence of a cold *per se* and no record was kept of the number of men attacked in this way.

It was frequently stated to me that certain mines were characterised by an undue amount of cough and other catarrhal conditions amongst the men working in them. This was especially stated to be true of the Black Range Mine at Sandstone. This statement was borne in mind and it was found when this mine was visited that there were a number of men with catarrhal affections of the nose and bronchi; but the same was found at other mines in districts where such catarrhal conditions were prevalent amongst the general population. Therefore no definite statement can be made with regard to the particular mine under discussion or of other mines in this respect.

It was stated just now that no importance was attached to the existence of a cold *per se*. This statement is subject to the modifications that appear later on.

When the men presented themselves for examination the necessary details as to their age, number of years during which they had been mining, number of years at work on machines, etc., were taken down. The form of inquiry will be seen in the reproduction of the cards actually used as shown on page 72.

When these details had been recorded the men were then asked to strip to the waist and the chest was examined. The method of examination was not in any way different from the classical one including inspection, percussion, and auscultation.

Where any abnormality, the nature of which could not be immediately decided, was detected the subject was requested to wait and the chest was then examined more at leisure.

In all instances in which tuberculosis of the lungs was diagnosed or suspected, the subject was requested to present himself at some appointed place at a later hour, in order that the cutaneous-tuberculin test might be made. In some cases the request was not complied with; but wherever it was possible the assistance afforded by this means of examination was taken advantage of.

In the routine examination of the chests special importance was attached to the expansion of the chest on full inspiration. This full inspiration, which was always the first step in the examination, served another useful purpose in that it assisted to bring into prominence any abnormal condition present in the lungs.

The total number of men examined was 2,050, grouped as follows:—

| | | | |
|---|---|---|---|
| *Gold Miners*— | | | |
| Men actually at work .. .. .. | | | 1,805 |
| Selected cases— | | | |
| At Sanatorium .. .. .. | 14 | | |
| At Union offices, etc. .. .. | 75 | | |
| | — | | 89 |
| *Coal Miners*— | | | |
| Coal miners—all at work.. .. .. | | | 156 |
| Total .. .. .. .. | | | 2,050 |

Although when considering the statistics gold and coal miners were taken together as "miners," it will be seen they are now being considered separately.

There is good reason for grouping them together when the statistics are being studied; for in the registration of death the occupation is almost invariably given as "miner," and there is nothing to show whether the deceased was a gold or coal miner.

Now, however, when the results of actual examinations are being dealt with, there is accurate information as to the type of mining carried on by the individual, and therefore the most reasonable method is to study the results separately.

Table A (page 50) shows the mines visited and the number of men engaged in each of the various branches of mine work who were examined.

When the types of mine work being done by the individuals are being analysed, it will be seen that amongst the gold miners the men are subdivided into machine men, miners other than machine men, truckers, platmen, etc. In registering these occupations the particular type of work being done by the man at the time of examination is recorded, and the figures are at first founded on that basis.

It will be seen, however, that later the obvious source of fallacy—the probability of any particular man having spent most of his time at some other branch of mining and having only recently undertaken the work upon which he was engaged at the time of examination—has been taken into considera-

tion, and the figures corrected to do away with this error.

In the Appendix on page 72 are set out the various classes of men included under the different headings used.

It will be noted that throughout this Report individual mines are not referred to. The explanation is that it was found on inquiry that gold miners in this State had moved from place to place and from mine to mine to such an extent as to preclude the possibility of saying with any certainty which mine was responsible for the subject's physical condition.

There have been laid down certain criteria (page 73) by the presence or absence of which the condition of the lungs of the men examined was judged. It remains to justify the selection of these standards, and to ask "Are these standards reasonable?"

It will perhaps be useful to briefly summarise at this point these criteria.

*Pleurisy.*—There is a definiteness about the presence of friction sounds which is sufficiently satisfactory, and there was no other criterion which was taken to indicate the presence of pleurisy.

*Emphysema and Tuberculosis.*—Both of these diseases have definite features which are classically laid down, and no departure was made from these classical standards in the present series of cases.

*Fibrosis.*—No authoritative account could be found describing what features are accepted as indicating the presence of this condition, and therefore recourse must be had to the reports of those authorities who have paid special attention to the subject. The standards fixed by each of these authorities will presently be discussed, but first attention must be drawn to one point in which the classification adopted in this Report differs from all the others that have been made. The cases of fibrosis have been divided into cases of early, intermediate and advanced fibrosis. It was thought advisable to do this for two purposes: in the first place, such a subdivision enabled one to study more carefully the pathological features of the disease; and secondly as it was desirable to study carefully the features of such cases of the disease as appeared to be locally produced, it was thought that the division of the cases into early and late would facilitate the detection of the locally produced disease.

To briefly recapitulate the main features of each of the stages of the disease:

The early case is the man who finds that he is continually getting "colds," associated with cough, which he finds great difficulty in throwing off; he finds that his wind is not as good as it used to be, and that he cannot run so far nor work so hard as formerly, and in whom on examination the effort at expansion of the chest wall reveals a rigidity—a rigidity which has characteristics entirely its own, and which is not, so far as I am aware, seen in any other disease. At this early stage the man is apt to smile indulgently if it is suggested that there is anything wrong with his lungs, although he recognises clearly that his wind is not so good as formerly and that he gets colds more often than he used and cannot throw them off so easily.

The next stage in the disease is marked by the fact that the intervals between the attacks of "cold on the chest" are less frequent and less lengthy—the bronchitis has become an established fact; the wind is now always short; occasional attacks of "asthma" occur, although hardly ever at night; expectoration is frequent, and a certain blueness of the lips and face indicate that the heart is beginning to feel the strain, on examination the rigidity is more marked, roughening of the breath sounds confirms the hypothesis that the bronchitis has become established; emphysematous changes may be present, and the heart signs show the reason for the blueness of the lips and face. But the subject can still do an average day's work.

When the subject finally has to cease work the advanced stage has been reached and then all the features above detailed are emphasised; the heart and lungs becoming progressively less able to carry out their functions.

With this description of what characteristics were considered to indicate fibrosis in its various stages clearly before us, a comparison can now be made with the criteria adopted by the other investigators who have studied this disease. There are in reality only three authorities who have laid down standards which can be accepted:—

The Royal Commission on Miners' Phthisis in the Transvaal (1902).

The Report on the health of the Cornish Miners, by Dr. Haldane and Dr. J. S. Martin (1904).

Report on Miners' Phthisis at Bendigo, by Dr. Summons (1906).

It will be seen from the extracts from these reports, which appear as an Appendix (page 81) that the standards adopted in this inquiry are in accord with those adopted in the Transvaal and at Bendigo —although there appears to be some confusion in the report by Dr. Summons between cases of pure fibrosis and pure tuberculosis.

The description I have given of the pure fibrosis type includes secondary cardiac manifestations, which were undoubtedly present in some of the cases met with, whereas Dr. Summons says (*loc. cit.*, p. 37):—

> "Though secondary disorders of the heart and other organs are to be expected, such were late accompaniments, and in every instance subsequent to infection with the tubercle bacilli, and thus resulted from the combined action of both the fibrosis and the tuberculosis."

With this exception, the fibrosis described in the present Report for Western Australia is the same condition as exists in Victoria and in the Transvaal.

At this point I would like to draw attention to the fact that both the quoted reports refer to the existence of pleuritic inflammation. Dr. Summons is emphatic on this point:—

> "Rarely was a case, moderately advanced, examined without finding evidence of old or present pleurisy, as a rule of the dry chronic type."

The Transvaal Report says:—

> "Percussion and auscultation often give very indefinite results. . . . . sometimes crepitation and pleuritic friction are the most that can be made out."

## FACTS REVEALED BY THE EXAMINATION.

The total number of men examined has been stated to be 2,050. The question arises whether this was a sufficiently good sample of all the miners in the State to justify any deductions drawn and their application to the whole mining industry.

From Table A (page 50) it will be seen that the 26 largest and most representative gold mines, and the four coal mines of any importance, were visited.

Table B (page 51) gives the official numbers of men working at each of the mines at the time they were visited, and alongside those figures the number of men examined.

From this Table it appears that on the 26 gold mines visited there were employed a total of 6,846 men, and that of these 1,805 were physically examined, *i.e.*, 20.52 per cent.; also that on the four coal mines there were 281 men employed, and of these 156, or 55.5 per cent. were examined. If the underground workers be considered alone, it is seen there were employed a total of 3,955 and that of these 1,450 or 36.6 per cent. were examined, while of the treatment hands 242 were examined out of a total of 1,567, *i.e.*, 15.44 per cent.

There have now been defined the method of examination of the men (page 38); the system of classification of the men according to their occupations (page 75); and the criteria adopted in allotting each of the abnormal conditions discovered to its pathological group (page 73).

It now remains to analyse the results of the examinations.

Table C sets out in detail the whole classification of the abnormal conditions discovered according to the occupations of the subjects.

These are crude figures, representing the actual numbers of individuals found affected under each heading. This table, however, cannot be accepted as representing the true position with regard to the incidence of the abnormal conditions on each occupational group.

As stated above, it is necessary to introduce a correction to overcome the objection that while a man was employed at one branch of mining—on the dump for example—at the time of examination, he may have been for the greater part of his time engaged in some other branch of mining, and have taken on dump work a very short time prior to the examination.

This does not apply to machine men, ordinary miners, or truckers; for they were carefully grouped at the outset. But for each of the other occupations the details are set out at length (see pages 76-79), and on these details all men who have been engaged in any other branch of mining than that under which they are classed have been excluded. In Appendix E (pages 76 to 79) are given the data upon which this grouping was effected.

The totals resulting after these corrections have been made are shown in Table D; and Table E shows the corresponding percentages. To take an example to illustrate exactly how these percentages are arrived at:

In Table E it will be seen that 805 machine men were examined, and the percentage of men affected with early fibrosis is given as 33.16 per cent. This means that of the 805 machine men 267 were found to be affected with early fibrosis, which is 33.16 per cent., and so for all the other percentages.

Now this table represents the state of the health of the miners (so far as lung diseases are concerned) entirely regardless of their past history, *i.e.*, the fact that any individual man may have been mining in other parts of the world for many years before he came to this State, or even been the subject of some lung disease when he arrived here, is not at present taken into account.

The table shows merely the state of things existing at the present time for all men engaged in the mining industry. The facts relating to Western Australia regarded intrinsically to the exclusion of all other factors will be dealt with presently.

What then does this table show? It reveals that the three conditions most prevalent are fibrosis, pleurisy, and tuberculosis.

It will perhaps not be inopportune to state here a fact which will be emphasised at a later stage, viz., that tuberculosis and fibrosis are two different conditions; different in their essential pathological natures different therefore in their causation; different in the conditions under which they manifest themselves and demanding entirely distinct consideration in any discussion on the remedial measures to be instituted for them.

Further, my investigations lead me to the pronounced conclusion that in Western Australia it is the exception for these two conditions to occur in the same patient (see page 46). For these reasons any such term as "miners' phthisis" is entirely inadmissible.

At this stage it would merely lead to confusion to attempt to consider the table as a whole, and it will be best to consider either the diseases or the occupations separately. Both will now be considered in detail.

## NORMAL.

Considering first the men found to be normal. The following groups of men were all found to be normal and need be considered no further:—

Dump hands. Skipmen. Timbermen. Carpenters. Engine-drivers. Assay office men. Electricians. Fettlers. Horse-drivers.

It must, however, be pointed out that when the figures are corrected there are only a very few men in each of these groups, so that the results are only to be taken for what they are worth, which is very little.

Taking then the other groups in the order of their normal percentages, they stand as follows with their respective percentages:—

Surface labourers—94 per cent. normal.
Wet treatment hands—91 per cent. normal.
Platmen—88.9 per cent. normal.
Non-machine miners—85.01 per cent. normal.
Truckers—82.9 per cent. normal.
Bracemen—66.66 per cent. normal.
Dry treatment hands—65.6 per cent. normal.
Machine miners—52.6 per cent. normal.
Lamp-trimmers—Nil per cent. normal.

From these percentages there must be extracted the groups of bracemen and lamp-trimmers, for there were only three of the former and one of the latter; and these figures are so small that any deductions from the percentages would not be justified.

Therefore we find that the most normal of those groups of mine hands among which any abnormal condition was found are the surface hands and the wet treatment hands. And the most affected with abnormal conditions were the machine men and the dry treatment hands.

Platmen, non-machine miners and truckers occupy an intermediate position.

## PLEURISY.

This condition was found amongst the various groups of mine hands in the following percentages, arranged in the order of their magnitude:—

Miners not machine men—4.39 per cent.
Surface hands—5.2 per cent.
Machine miners—7.7 per cent.
Wet treatment hands—8.33 per cent.
Dry treatment hands—9.8 per cent.
Platmen—11.1 per cent.
Truckers—13.9 per cent.
Bracemen—33.3 per cent.

As there were only three bracemen the fact that one of these had pleuritic inflammation cannot be taken as having any significance, the number being too small to justify any deductions.

The apparent deduction is then that non-machine miners and machine miners were the least affected with pleurisy and the most affected were the platmen and truckers. But it will be pointed out that many of the cases of early fibrosis showed friction on examination and that others gave other indications of firm adhesions which were the result of pleurisy some time in the past, while the statement made by Dr. Summons and quoted on page 39 is emphatic on the frequency with which pleurisy is associated with fibrosis.

So that, while machine men, non-machine miners, and dry treatment hands appear to have moderately low percentages for pleurisy, they should in reality have much higher percentages; for, when the diseases were classified, only those were classed "pleurisy" which had no other condition present than the friction.

As will be shown under the heading, "Pathology of the Diseases," the position is taken up regarding fibrosis that rigidity is to be taken as evidence of pleuritic adhesions; therefore nearly all the cases suffering from fibrosis in its different stages should be included also under the heading "Pleurisy."

If these be included, the order of percentages would be as follows:—

| | |
|---|---|
| Machine men .. .. .. | 44.89 per cent. |
| Dry treatment hands .. .. | 34.3 „ |
| Truckers .. .. .. .. | 17.00 „ |
| Non-machine men .. .. | 13.17 „ |
| Platmen .. .. .. .. | 11.1 „ |
| Wet treatment hands .. .. | 8.33 „ |
| Surface hands .. .. .. | 5.2 „ |

The significance of this order of percentages will be discussed later, when the incidence of the various conditions upon the different kinds of mine workers is being discussed. For the present it will be sufficient to draw attention to the fact that the two types of men who suffer most from pleurisy are those who are exposed to the most dusty of the mining processes.

## EMPHYSEMA.

This abnormal condition is seen in only two groups of miners, and in them only to a small extent. It is four times more common in non-machine miners than in machine men—a fact having a certain significance, which will be referred to at a later stage.

## FIBROSIS.

*Early Fibrosis.*—This condition was found amongst machine men, miners, truckers, and dry treatment hands in the following order:—

| | |
|---|---|
| Machine miners .. .. .. | 33.16 per cent. |
| Dry treatment hands .. .. | 24.5 „ |
| Non-machine miners .. .. | 7.23 „ |
| Truckers .. .. .. .. | 3.10 „ |

It will be observed that this condition attacks men in the order of the dustiness of their occupation, and without any relation to the purity otherwise of the atmosphere; for the dry treatment men work on the surface in pure air, the only harmful factor operating in their case being the dust—and yet they are second on the list, and less frequent than the machine miners only.

It is interesting to note that the non-machine miners and truckers are also affected to a slight extent. This will be referred to again, when the length of time which these men have been at work is being considered.

*Intermediate Fibrosis.*—Machine men and non-machine men were affected with this condition, as follows:—

| | |
|---|---|
| Machine miners .. .. .. | 3.6 per cent. |
| Non-machine miners .. .. | 1.55 „ |

Again it is noticeable that the order of percentage is identical with the order of dustiness of the work engaged in. A striking fact, however, is the absence of dry treatment men from this Table. In all probability the explanation is chiefly to be found in the Table showing the length of time during which these men have been at this class of work (Table N, page 57). No individual had been longer than sixteen years at dry treatment work.

*Advanced Fibrosis.*—Machine miners only were affected, and to less than one per cent.

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Considering fibrosis as a whole, therefore, it is obviously closely related to the dustiness of the work engaged in, the machine men being more often and worse affected than other sections of mine workers.

The other dusty branch of mining—dry treatment work—is represented by the second position in order of magnitude.

Other men—non-machine miners and truckers—are affected; but some light will be thrown on this aspect when the length of time these men have worked has been considered.

## TUBERCULOSIS.

In the corrected Table it appears that there are only 25 cases of tuberculosis and one case of doubtful tuberculosis. On the other hand, in the uncorrected Table, 27 cases of ascertained tuberculosis and one case of doubtful tuberculosis. The 27 cases are distributed amongst the groups as follows:—

| Type of mining. | No. found affected. |
|---|---|
| Machine miners .. .. .. | 18 |
| Non-machine miners .. .. .. | 4 |
| Dump hands .. .. .. .. | 1 |
| Platmen .. .. .. .. .. | 1 |
| Lamp trimmers .. .. .. .. | 1 |
| Surface labourers .. .. .. | 2 |

(One of the surface labourers had been affected for 18 months, and had been working at any sort of mine work for only nine months.)

When the corrected Table is studied, it appears the order of percentages is as follows:—

| | |
|---|---|
| Machine miners .. .. .. | 2.2 per cent. |
| Non-machine miners .. .. | 1.02 „ |
| Lamp trimmers .. .. | 100.00 „ |

As only one lamp trimmer was examined, and he only because he was known to be affected, the percentage of 100 cannot be considered.

For the rest it appears that the only two groups of miners affected in the corrected Table are machine men and non-machine men—and the machine men are in excess.

It will be noted that the other dusty process which is so active in producing fibrosis does not appear in either the original or the corrected Table as one of the groups affected by tuberculosis.

A doubt is therefore raised whether dust can play any part in the production of tuberculosis; and provisionally the connection between dust and tuberculosis must be regarded as doubtful.

Is there any other factor peculiar to machine mining which would operate in the direction of producing an excessive incidence of tuberculosis amongst machine miners? It will appear later that there is good reason for ascribing the spread of tuberculosis to proximity of contact; and it is certain there is no branch of mining in which men are in contact so closely and for such long periods as they are when working together on one machine.

## LUNG DISEASES AFFECTING THE MEN ENGAGED IN THE DIFFERENT BRANCHES OF MINE WORK.

For the present then, let us leave the consideration of the individual diseases and consider the individual branches of mining. The conclusions given below are, of course, warranted only within the limits of the present series of examinations. As before, normal groups may be ignored.

The fact that there was one lamp trimmer affected has no significance, except that that man had been working in the Fingall mine for five years before examination, and had worked nowhere else. This will be referred to later (page 49).

*Machine men* suffer from the three grades of fibrosis, from emphysema, pleurisy, and tuberculosis—the disease most prevalent amongst this class of worker is fibrosis.

*Non-machine miners* suffer from the first two grades of fibrosis, from emphysema, pleurisy, and tuberculosis.

*Truckers* suffer only from early fibrosis and pleurisy—and considerably more from pleurisy than from fibrosis.

*Dry treatment hands* suffer from early fibrosis, but not from the more advanced stages of the disease. There may be two reasons for the freedom from the advanced stages—the fact that they work in the open air, and therefore would not be likely to get so much dust in a given time as men working below on machines in a confined space; or, on the other hand, the explanation may be that men on the dry treatment plants have been working for a shorter period at that class of mining than the machine men, and are also much less exposed to rapid changes of temperature.

*Bracemen*, as has been already said, are so few as to be negligible.

*Platmen.*—These were affected only with pleurisy, to the extent of rather more than one in ten.

*Surface labourers* were affected only with pleurisy, to the extent of one in twenty.

*Wet treatment hands* were affected only with pleurisy, to the extent of 8 per cent.

Why is it that wet treatment men, truckers, platmen and surface labourers are affected with pleurisy? These are not engaged in dusty occupations, as are the men most liable to pleurisy—the machine miners and the dry treatment men.

The wet treatment men may be predisposed to the onset of pleurisy by the fact that the nature of their work renders them liable to become wet and remain so for long periods together; but that explanation does not apply in the case of platmen, truckers, or surface men.

Truckers are constantly passing forwards and backwards—to the hot faces and workings and then back, in a heated and perspiring state, into the comparatively cold area of the plat. Similarly, platmen are exposed to constantly varying temperatures.

While these facts appear to be of importance in connection with the incidence of pleurisy, their significance becomes more real when the order of frequency with which pleurisy was met is reconsidered. That order was as follows:—

Machine miners,
Dry treatment men,
Truckers,
Non-machine miners,
Platmen,
Wet treatment men,
Surface men.

It will be seen, then, that while the first two groups have excessive dust as a common factor in their work, the other groups are not exposed to the action of dust to any great extent.

On the other hand, machine miners, truckers, non-machine miners, and platmen are in the habit of coming rapidly to the surface in their working clothes, and in the heated state in which they cease work; and are consequently in the most favourable condition for the harmful action of cold to manifest itself.

This hypothesis is supported by the positions in which the friction is most commonly heard in the uncomplicated cases of pleurisy. To repeat these: they are the axillae, the apices and the triangle along the borders of the sternum, described in detail on page 73; and less commonly the region of the nipples.

These regions have this in common, that they are the parts of the chest wall least covered by muscular layers, and least protected from the cold; also, they are the regions least covered by clothing when the miners come up from below. It is a familiar enough sight at change of shift to see miners come to the surface perspiring profusely, with their woollen shirts open at the front (exposing the very regions most often attacked by pleuritic inflammation) and the sleeves very often are cut away, thus exposing the whole of the axillae. This exposure is illustrated in Plate 1.

It has, however, been pointed out by Dr. Summons* that the axillae are the regions at which the root of the lung is nearest the surface, and that therefore the occurrence of friction in this region is to be explained by the irritation of dust.

It has been shown from the Table now under consideration that the two groups of miners most affected by pleurisy are the two most exposed to the action of dust; therefore, there can be no hesitation in concluding that the action of dust is important in producing pleurisy.

I am, therefore, inclined to conclude that the pleurisy is caused by the rapid changes in temperature to which miners are exposed, or voluntarily expose themselves; and that this action of the cold is rendered the more easy by the presence of dust in the lungs.

This provisional hypothesis will be further developed when the experimental evidence is being considered. I may, however, state here that I am inclined to attribute to the action of cold much of the pathological change seen in fibrosis.

* Report on Miners' Phthisis at Bendigo, pp. 34-35.

Having now considered in detail the incidence of various lung diseases upon men engaged in the different branches of mine work, this part of the Report may be briefly summarised.

There is no doubt but that machine mining and dry treatment work are fertile in the production of fibrosis—machine work being the more rapid and severe of the two, probably by reason of the greater quantity of dust absorbed and the exposure to rapid changes of temperature; that non-machine miners and truckers are also affected by fibrosis but to a less extent and, as will be seen, after a much longer period of mining; that tuberculosis does not appear to be very common (only 27—or, if the doubtful case be included, 28—in a total of 1,805 men examined being discovered, or only 1.5 per cent.); and also that tuberculosis does not appear to have any relation to dust, though affecting machine miners more than other classes, probably by reason of the intimate contact of the men engaged on this class of mine work.

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It now becomes of interest to ascertain how long the abnormal conditions of the lung take to develop.

Table F (page 53) shows the total period in years during which the machine miners affected with the various types of disease, as well as those found to be normal on examination, had been engaged in underground mining of any sort.

Table G (page 53) sets out the period in years during which these machine miners (affected as well as normal) had been engaged on machine mining only.

From these tables it appears that while early fibrosis does not manifest itself to any appreciable extent until after ten years of non-machine mining, it begins to make an almost immediate appearance when a man commences machine mining.

There were instances in which early fibrosis was discovered in men who had been engaged on machine mining for less than six months only; and the majority of cases discovered in this group of mine workers occurred amongst men who had been engaged on machines for less than thirteen years.

It may be said that the figures in these tables show that fibrosis makes its appearance as a rule about the second year on machine work; the cases of intermediate fibrosis were all discovered in men who had been engaged on machine mining for not longer than sixteen years. With pleurisy the greatest incidence occurred before the fifteenth year after commencement of machine work.

The most striking information elicited by these tables is the number of years during which the normal machine miners had been engaged in that particular class of mine work. Of the total of 424 normal men, 215—or more than one-half—had been working on machines for less than four years only, while 86.1 per cent. of them had not yet reached their tenth year on machines.

From a consideration of these crude figures, then, the position may be expressed thus: A man may remain normal for ten years after commencing work on machines, but, with a diminishing chance each year. Few remained normal after the tenth year, only ten being found to be normal after the fifteenth year on machine work—and there was in some of these cases a special reason for this immunity, which is discussed later (see page 80).

Tuberculosis showed no very definite distribution according to the number of years mining or on machine work—the majority had been from ten to twenty years engaged in mine work, and less than ten years on machine mining.

The pleurisy cases are evenly distributed from the second year onwards. With regard to pleurisy, there is a striking fact in the "machine men," Table G.—the greatest number of pleuritic cases is discovered in the second year of machine work—which might at first sight appear to indicate that at about the second year the men engaged in machine mining become more liable to the effect of cold than previously.

It has just been pointed out that fibrosis makes its appearance as a rule about the second year on machine work. There appears to be some common factor operating, therefore, producing fibrosis and either producing or rendering the production of pleurisy by some other agent more easily accomplished. It is safe to conclude that the dust is that common factor operating, directly or indirectly, in the production of both fibrosis and pleurisy.

Table H. (page 54) supplies similar details as are given in Tables F. and G. in so far as they relate to non-machine miners and truckers. There is little definite information to be gathered from this table, except that there is a far greater proportion of early fibrosis amongst this class of mine workers after 20 years of work than there is amongst machine miners.

This undoubtedly indicates that there is some factor at work which produces fibrosis in both machine and non-machine miners; and that this factor operates much more quickly in the case of machine miners than in those not engaged on machine work. There is only one factor which answers to this description, *i.e.*, the dust from the machines.

Exception may be taken, and quite rightly, to the course followed in drawing deductions from the crude figures given in Tables F. G. and H. To meet such an objection the totals have been expressed in Table K. (page 55) in the form of percentages.

To explain these percentages, the following illustration will suffice: Amongst the men employed on machine mining for less than six months there were 41 normal and nine affected with early fibrosis, the total number examined who had been on machine work for the specified period being 54. Thus, of the men engaged on machine work for less than six months, 75.9 per cent. were discovered to be normal, while 16.6 per cent. were affected with early fibrosis—and so on with the other percentages given.

In parallel columns are given the percentages for machine and non-machine miners, the former being dealt with divisionally—as to their total period of mining, and as to the period of their machine mining.

This table shows that when the non-machine miners are considered the percentage of normals is markedly in excess of "early fibrosis" throughout the series of years.

When machine miners are considered according to their total mining it is seen that the normals are in marked excess of "early fibrosis" up to the twentieth

year (with the single exception of the eighteenth year, which exception does not affect the position), and that after the twentieth year the fibrosis cases are in excess.

When, however, machine men are considered according to the number of years they have been engaged on machine mining, the "normal" cases are in excess only until the tenth year—and the excess steadily diminishes from the first until the tenth year; while after the tenth year the early fibrosis cases are in marked excess.

These facts furnish additional evidence that so far as the underground men are concerned, it is the machines which are responsible for the cases of fibrosis; and a study of the percentages for individual year-periods bears out the conclusions expressed on page 43. That is to say, that the non-machine miner's chance of remaining normal is far greater than his likelihood of becoming affected with fibrosis, right throughout his mining career.

When, however, work on machines has commenced, the machine miner's chances of remaining normal are good only during the first year, and diminish rapidly thereafter until the tenth year, when his chances of becoming affected with fibrosis are greater than that he will remain normal.

## THE ORIGIN OF ABNORMAL CONDITIONS: WHETHER LOCAL OR IMPORTED.

In the foregoing tables the men have been dealt with regardless entirely of their previous histories—*i.e.*, men who have done mine work only in Western Australia have been considered together with those who have had longer or shorter mining experience elsewhere.

In view of the large number of affected men discovered, it becomes of importance to ascertain whether the abnormal conditions of the lungs is the result of circumstances peculiar to Western Australia.

It may, of course, be that, as the mining industry is of comparatively recent establishment in this State, these abnormal lung conditions are the result of mine work done in other places; and the most that could then be said is that they were aggravated, but not produced, by local mining conditions. This aspect of the question will now be dealt with.

In the first place, careful inquiry was made in every case in which a man examined had done mine work in the other States or in some other country, with the object of discovering whether he had been the subject of any affection of the lungs before coming to Western Australia. In the following cases positive information on this point was forthcoming:—

### Machine Miners.

*Intermediate Fibrosis.*

1. Had pneumonia in 1891; been in Western Australia for 15 years.
2. "Irritation of the 'tubes' and coughing before leaving Bendigo."
3. Had "asthma" before leaving Cornwall.
4. Was only "pretty well" when he came to this State.

*Advanced Fibrosis.*

1. Bad for three months with a severe cough in New South Wales.
2. Was "asthmatic" on leaving Charters Towers.

### Non-Machine Miners.

*Tuberculosis.*

The one case classed as doubtful tuberculosis had been ordered to leave Bendigo on account of "something wrong with his lungs."

*Intermediate Fibrosis.*

One man stated that he had asthma 40 years ago, recurring at intervals since. He had been mining for a total of 50 years, of which 11 had been spent in Western Australia.

No other men gave any history of having been affected on arrival in Western Australia. It is, therefore, necessary to look in other directions for information on this point.

Satisfactory information not being forthcoming from the men themselves, the next step taken was to consider men who had done mine work only in Western Australia, to the exclusion of all others.

Table L. (page 55) shows the percentages for each of the diseases amongst such men, tabulated according to the class of mine work in which they are engaged. Table L. (*a*) (page 56) gives the *total figures* for all men—those engaged in mine work before coming to Western Australia, as well as those who have done mine work only in this State.

The figures for machine miners in Western Australia only will first be set down side by side with those for all men:—

*Machine Miners.*

| | W.A. per cent. | All men. per cent. |
|---|---|---|
| Early fibrosis .. .. | 25.6 .. | 33.16 |
| Intermediate fibrosis .. | 3.05 .. | 3.6 |
| Advanced fibrosis .. | *Nil* .. | 0.49 |
| Emphysema .. .. | *Nil* .. | 0.12 |
| Pleurisy .. .. | 7.01 .. | 7.7 |
| Tuberculosis .. .. | 3.05 .. | 2.2 |
| Normal .. .. .. | 61.3 .. | 52.6 |

From these figures it appears that early fibrosis is less frequent amongst men who have worked in Western Australian mines only than amongst all men examined, including those who have worked elsewhere; but it is existent amongst purely local miners to the extent of 25 per cent.

Intermediate fibrosis is about the same in each group, while advanced fibrosis does not appear amongst the Western Australians—probably because the mines in this State have not yet been working sufficiently long for the disease to manifest itself in the advanced form amongst those who have mined only in Western Australia.

The incidence of pleurisy is practically the same in each group, while tuberculosis is apparently more frequent amongst the Western Australians than amongst the total number examined.

The percentage of normal men is, as may have been expected, higher amongst the Western Australians than amongst the whole of the men examined.

*Non-Machine Miners.*

| | W.A. per cent. | All men. per cent. |
|---|---|---|
| Early fibrosis | 4.48 | 7.23 |
| Intermediate fibrosis | 0.9 | 1.55 |
| Advanced fibrosis | *Nil* | *Nil* |
| Emphysema | 0.45 | 0.51 |
| Pleurisy | 5.4 | 4.39 |
| Tuberculosis | 1.3 | 1.02 |
| Tuberculosis (doubtful) | *Nil* | 0.25 |
| Normal | 87.4 | 85.01 |

*Truckers.*

| | W.A. per cent. | All men. per cent. |
|---|---|---|
| Early fibrosis | 2.86 | 3.10 |
| Intermediate fibrosis | *Nil* | *Nil* |
| Advanced fibrosis | *Nil* | *Nil* |
| Emphysema | *Nil* | *Nil* |
| Pleurisy | 13.8 | 13.9 |
| Tuberculosis | *Nil* | *Nil* |
| Normal | 83.2 | 82.9 |

Western Australian mines have produced an appreciable amount of fibrosis and pleurisy amongst non-machine miners and truckers; but other abnormal conditions are not present to any extent.

The dry treatment men who have been engaged upon no other branch of mining and nowhere else than in Western Australia, suffer from fibrosis to the extent of 19 per cent., and from pleurisy to the extent of 9 per cent.

Therefore, it is clear that the mines in this State can, and do, produce fibrosis to a considerable extent, both amongst machine miners and dry treatment men; and it is to be expected that as the years go by there will be an increasing number of deaths from this cause, and an increasing number of cases of fibrosis, if the conditions obtaining in the past remain unaltered in the future.

In Table M. (page 57) is set out the period of years during which the men have been engaged upon machine and other work; and from this it appears that what was said of all machine miners is true also of those who have never done machine work elsewhere than in Western Australia—viz., that a man may remain normal for ten years after commencing work on the machines, but that few remain normal after the tenth year.

Truckers had all manifested their pleurisy before the eighth year, indicating the existence of some other factor than dust.

Amongst non-machine miners, a higher percentage is found to be normal after ten years than amongst machine miners—which is in accord with the experience in general.

With tuberculosis, the percentage of cases is higher amongst machine miners than amongst miners not engaged in machine work.

Thus, the facts elicited by an examination of the results obtained from a study of the figures furnished by the examination of men who have worked only in Western Australia do not appear to differ to any important extent from those elicited by the study of the corresponding figures furnished in the case of men who have mined also in other parts of the world.

Table N. (page 57) shows the period in years worked on the dry and wet treatment plants respectively by men who have not done other than those classes of mine work and have worked at them only in this State.

The wet treatment men were found to be all normal.

Of the dry process men there was no appreciable amount of fibrosis before the eighth year—the onset being thus later than amongst machine miners.

The cases of pleurisy were distributed between the first year and the tenth.

What is the explanation of the fact that fibrosis takes longer to manifest itself in dry treatment men than in machine miners? There appear to be two reasons—or, rather, differences in the conditions under which the men respectively work.

In the first place, it may, at first sight, seem probable that there is not so much dust inhaled by the dry treatment men as by men working in "rises"; but probably, on the whole, the amount of dust inhaled by a dry treatment man in a year would not be much less than that inhaled by a machine miner.

There remains the other factor, to which I am inclined to attach greater importance—the dry treatment men are less exposed to rapid changes of temperature, which induces bronchitis, thus assisting the inflammatory changes in the lungs, and which also produces pleuritic inflammation, thus bringing about the characteristic rigidity and assisting towards shortness of breath.

It will be noticed that the cases of tuberculosis discovered were confined, for the most part, to the period up to the fifth year; whereas the characteristic dust disease, fibrosis, appears up to and beyond the tenth year.

So that the action of dust from the machines cannot be of the same nature as its action in producing fibrosis, which takes several years longer; but if it has any action, it must be in the direction of lighting up pre-existing tubercle, or of rendering the lungs more liable to the invasion of bacilli and diminishing the resistance of the lungs to infection.

## COAL MINERS.

The coal miners were examined actually at work underground at Collie; a total of 156 being so examined, and the abnormal conditions discovered were as follows:—

| | | |
|---|---|---|
| Pleurisy | 47 | 30.1 per cent. |
| Early fibrosis | 16 | 10.3 ,, |
| Intermediate fibrosis | 1 | 0.63 ,, |
| Normal | 92 | 58.9 ,, |
| | 156 | |

On page 79 are set out the details for each of the cases of early and intermediate fibrosis, and from this it is obvious that not one of these can be considered merely as a coal miner; for each of them had been engaged in other forms of mining (always metalliferous) for longer or shorter periods.

There remains, then, only pleurisy as the abnormal condition met with in coal miners; and of these there were discovered, as above stated, 47 cases. But these also are open to the objection that many of them have done other than coal mining.

The histories of these pleurisy cases have been carefully examined, and those individuals who have done other forms of mining than coal mining have been excluded.

There remained after that process of exclusion a total of 28 cases only, affected with pleurisy.

It is, however, necessary to go through the same process of exclusion in the case of the normal men, and that has been done with the result that of the 156 men examined there remained a total of 87 coal miners pure and simple—that is, men who have never done any other form of mining than coal mining; and of these 28 were affected with pleurisy, or 32.2 per cent.

This information, while interesting in itself, does not offer as full value for the purposes of this inquiry as would information as to the conditions existing in this State. Therefore, all men were excluded who had mined elsewhere than in this State, even though their mining had been only for coal.

There were left in, after this process of purification, a total of 49 men who had mined only for coal, and only in Western Australia; and of these 11, or 22.5 per cent., were affected with pleurisy.

These facts are tabulated in Table O. (page 58).

It is ascertained, then, that there is less pleurisy locally produced than is the average for all coal miners considered irrespective of where they have worked.

Why does pleurisy occur at all amongst coal miners? There appear to be two factors at work in its production amongst gold miners—dust and cold.

It may be taken that dust does not act injuriously in coal mines, for there is no appearance of fibrosis in coal miners; and many of the men examined had been working at Collie for a number of years.

On the other hand, there is noticeable a distinct and rapid fall in temperature on passing out of the workings into the shaft, or out on to the surface. This question of temperature is discussed and illustrated on page .

This, then, throws some light on the question of pleurisy in gold miners. Inasmuch as it is present in truckers in gold mines and also in coal miners, it is necessary to look for some common factor; and in both cases it is a common sight to see men emerge from the shaft mouth on a very cold day, perspiring freely and unprotected in the very places in which pleuritic friction is so often found.

It is clear, then, that the coal miners who have never worked at coal mining elsewhere than in Western Australia, and have never done any other form of mining, can and do suffer from pleurisy to the extent of 22.5 per cent.; and the only factor that seems to be at all likely to produce this result is exposure to rapid change of temperature on emerging from the warm workings into a cold shaft—just as truckers and other gold miners are exposed by being rapidly drawn in the cage to the surface, passing, it may be, from a temperature of 80deg. to one of 50deg. within sixty seconds, and without any protective covering in the vulnerable parts.

In Table P. (page 58) the period during which "Western Australian colliers" had been engaged in coal mining is tabulated according as the men were discovered to be normal or to be affected with pleurisy.

It appears from this table that the colliers affected with pleurisy had all been mining for less than ten years.

In Table S. (page 62) is given the age distribution of all men examined—both coal and gold miners—classified according to the conditions discovered on examination.

The only outstanding features of this table are that few miners remain "normal" after reaching 40 years of age, and that the majority of cases of tuberculosis and fibrosis occur before 40 years of age.

The position in this State having now been ascertained, let us see how it compares with that in other countries. As before, we must have recourse to the three Reports published—by Dr. Summons, as to Bendigo; by Dr. Haldane, as to Cornwall; and by the Transvaal Royal Commission, as to South Africa.

*Transvaal Royal Commission*:—

> "The statistical report shows that out of 4,403 miners officially declared to be working underground in the gold mines of the Witwatersrand, 1,210 have been medically examined on behalf of the Commission. Of this number, 187, or 15.4 per cent., were certified by the examining doctors to be affected by the disease, while a further 88 were suspected cases . . . . . Concerning the 187 men who were certified as being affected, the following points are of sufficient importance to require separate comments:—
>
> "Only 20 men gave any family history which shows that they have a tendency to develop pulmonary disease.
>
> "The figures in the Statistical Table somewhat confirm the statements that have been made, that amongst rock-drill miners the disease is especially prevalent—as 172, or 91.98 per cent. have been employed on rock-drills.
>
> "In addition, two other important points are brought forward prominently: first, the short average time, namely, 6.49 years, that the men have been employed on these machines; . . . .
>
> "Medical evidence has not disclosed any appreciable amount of tuberculous disease amongst miners."

From this report it is clear that tuberculosis amongst miners is not present to any very serious extent in the Transvaal. This is entirely in accord with the experience in this State.

How does the total affected with fibrosis compare with that in this State?

| | No. of Men Examined. | Fibrosis. | | | Total. |
|---|---|---|---|---|---|
| | | Early. | Inter. | Advanced. | |
| Machine miners ... | 805 | 267 | 29 | 4 | 300 |
| Non-machine miners | 387 | 28 | 6 | ... | 34 |
| Truckers ... ... | 256 | 8 | ... | ... | 8 |
| | 1,448 | 293 | 35 | 4 | 342 |

That is to say, the percentage of men employed underground in Western Australia affected with fibrosis is 23.6 per cent. as against 15.4 per cent. in the Transvaal.

Of those suffering from all stages of fibrosis there was in Western Australia a percentage of 87.7 of machine men, as against 91.98 in the Transvaal.

In making this comparison between the Transvaal and Western Australia, the figures for all men, including those who have mined elsewhere than in Western Australia, are taken as representing Western Australia; for it is clear from the Transvaal report that many of their miners had done mining elsewhere than in the Transvaal.

The average number of years for which men affected with fibrosis have worked on machines in Western Australia was 7.98, as against 6.49 in the Transvaal.

On the whole, therefore, the position in this State does not differ in any material respect from that in the Transvaal. For after all, it is not percentages, but causes, that are of moment; and if the presence

of an undesirable cause be established, then it matters not whether the percentage be a little lower or higher, so long as an appreciable amount of the result of the cause is found to exist.

Dr. Summons, speaking of his results at Bendigo, says:—

> "Inclusive of the results of autopsies, out of 204 cases positive evidence of tuberculosis was obtained in 95—that is, 47 per cent. Though it is only justifiable to consider a case tuberculous if it is positively proved such, yet the clinical history and physical signs in several other cases left little doubt in my mind that they had been infected, but at the present time the disease was quiescent. Again, many other cases presented such symptoms that they might be simple bronchitis or early tuberculosis. In the absence of bacilli in the sputum, and as they were still working, they would not submit to a tuberculin test, no definite diagnosis at the time could be arrived at. Undoubtedly 47 per cent. is a low estimate.
>
> "Out of the difficulty to determine accurately the prevalence of tuberculosis, several questions arise. Is there a type of case starting in the usual way, and progressing as a pure fibrosis, with recurring attacks of bronchitis and pleurisy, which, going on and on, finally brings about heart failure and death, without any superadded bacterial infection? And what is the cause of death in the lung diseases to which the miners are liable?
>
> "In reply to the second it can safely be concluded that at the present time all Bendigo miners dying of their respiratory diseases die of tuberculosis. This statement is based on the final ending in 27 almost consecutive cases—the only exception was that of one man who died of acute pneumonia, and who showed no signs of tuberculosis in his lungs. This series of cases also furnishes the answer to the former question. In reply to which I can only state, though it is conceivable that such an ending may happen, nevertheless I do not see any case to support a non-tuberculous cause of death. Tuberculosis is so prevalent that such susceptible cases become infected before the fibrosis and bronchitis reach so advanced a stage as to produce heart failure of themselves."

That Dr. Summons is speaking of a set of conditions entirely different from what pertains in this State I am well convinced.

On page 43 of his report, after reviewing the statements of the Transvaal Commission; of Dr. Haldane with reference to the Cornish miners, and of Dr. Black in the Report of the 1905 Commission in this State, he says:—

> "The inference to draw from these almost contradictory opinions, and the evidence obtained from the cases at Bendigo, is that the tubercular infection depends entirely on local conditions. If the disease is rare in the community, the chance of infection is diminished, and *vice versa*."

Considering the mining industry in this State as a whole, tuberculosis is far less important than fibrosis; and Dr. Summons's statement that every Bendigo miner dying from respiratory disease dies from tuberculosis certainly does not apply to this State. Quite apart from the results of my own examinations amongst the miners, there is the large number of deaths from fibroid phthisis, asthma, emphysema, miners' lung, miners' complaint, etc., to be accounted for—for those certificates of deaths were given by a variety of medical men throughout a series of years.

Dr. Summons's general statement takes no note of deaths from pneumonia—a by no means unimportant matter in connection with the question of harmful factors existing in the mining industry.

Dr. Haldane says with regard to the Cornish miners:—

> "Nearly the whole of the deaths of rock-drill men were due to 'phthisis,' and of the cases examined at least 74 per cent. were tubercular."

The conditions amongst the Cornish miners are evidently somewhat similar to those at Bendigo, and are quite different from those in this State.

There is here, however, a lesson for this State. To quote Dr. Summons again:—

> "If the disease—(*i.e.*, tuberculosis)—is rare in the community, the chance of infection is diminished and *vice versa*."

I have stated that in my opinion the disease is rare in our mining community at present; but as was seen in the statistical portion of this report, it is definitely on the increase amongst miners, and unless steps be taken to keep this disease rare, it will quickly enough spread, and the story to be told for Western Australia will be that of Bendigo and Cornwall instead of that of the Transvaal.

Already we have a local instance of a local focus of infection, where the disease is not rare amongst the mining community and where clear evidence of the spread of infection from miner to miner is forthcoming. (See page 49.)

## SELECTED CASES.

There is still to be considered the group of cases which were examined at their homes or other places, but not on the mines. These, as a rule, were examined because they or someone else suspected them to be affected with one or other type of lung disease.

They are, therefore, "selected cases," and it is impossible to express them as percentages of any total or to consider them in connection with the general examination; for if they (who represented the whole of the cases known to the union officials to be in any way affected) were to be expressed as a percentage of any total, that total would have to be the total number of men employed at mining in the whole State. If this were done it would be necessary to examine all the unexamined miners in the State, to ascertain how they—the whole mining population—compared with the sample taken as an average.

Therefore, nothing more will be done than to record the findings in these cases, except with the tubercular cases, which are open to consideration from another aspect; and those will be taken together, irrespective of whether they were brought under notice or were discovered during the examination.

There were, then, a total of 75 men examined under the conditions specified, and the results of the examination are expressed as follows:—

| | |
|---|---|
| Pleurisy | 5 |
| Early fibrosis | 10 |
| Intermediate fibrosis | 14 |
| Advanced fibrosis | 2 |
| Emphysema | 1 |
| Normal | 20 |
| Fibrosis and tuberculosis | 2 |
| Doubtful tuberculosis | 3 |
| Tuberculosis | 18 |
| | 75 |

*Normals* (20 cases).—There is nothing calling for comment in regard to this group, except that several of them came up for examination because they believed themselves affected, which must be taken as an illustration of the unreliability of lay statements.

*Emphysema* (one case).—This man had been mining for 19 years, of which only two years had been spent at machine work.

*Early Fibrosis* (10 cases).—Of these none had been mining for less than 14 years, and none on machines for less than six years.

*Intermediate Fibrosis* (14 cases).—Of these 14 cases only one had not done any machine work, and he had been a miner for 60 years.

Of those who had done machine work, only one man had been on machines for less than five years; one had been mining for a total of less than 15 years, and he had done eight years on machines.

*Advanced Fibrosis* (two cases).—Both of these conformed in every way to the description given (page 74), and both had been mining for a long time—one for 36 and the other for 23 years.

*Pleurisy* (five cases).—These do not call for any comment.

*Fibrosis and Tuberculosis* (two cases).—In these cases there were the typical evidences of intermediate fibrosis, but there was also patchy consolidation with its classical signs and a clear history of haemoptysis.

*Doubtful Tuberculosis* (three cases).—(1.) Definite history of night sweats, haemoptysis and loss of appetite and weight. On examination: No alteration of percussion note anywhere; no bronchial breathing, only comparative alteration of pitch over front of right apex with definite friction in the same region. Permission to apply von Pirquet test could not be obtained.

(2.) Recurrent attacks of "asthma" for two years; three attacks of pleurisy; subject to "colds" for more than five years; spitting with every attack of coughing, with occasional streaks of blood. On examination: Some capillary engorgement on malar prominences; cardiac dulness diminished; fine rales in right bronchus; prolongation of expiration both bases, and rhonchi marked both bases. Permission to apply von Pirquet test could not be obtained.

(3.) Shortwinded for two years past; cough and expectoration same period; phlegm, "white and slimy," no haemoptysis; appetite irregular; night sweats; losing weight; pains left chest. On examination: Fine clicking rales over both bases were all that could be discovered. Permission to apply von Pirquet test could not be obtained.

*Tuberculosis* (18 cases).—These cases were typically tubercular, presenting evidence of consolidation with typical histories of tuberculosis, and the majority giving a positive reaction with von Pirquet's test; some having tubercle bacilli in the sputum. A point that calls for notice is that some of the cases that were unmistakably tubercular had no bacilli in the sputum.

It must also be stated that not a single case where there was any doubt as to the presence of tuberculosis was excluded—either the diagnosis was verified and the case included amongst the tubercular cases or the case was one of the three grouped as doubtful tuberculosis. It is clear, therefore, that the position as regards tuberculosis is not in any way underestimated, for the importance of tuberculosis was throughout always in mind.

## TUBERCULOSIS.

It is now necessary to give special attention to the subject of tuberculosis. This disease differs from all the other diseases which have been considered by reason of the fact that it is caused by a parasitic organism—the tubercle bacillus. It has already been stated (page 40) that this condition must be dealt with from an entirely different point of view from all the other conditions that have been met with.

In Table Q. there are set out all the important particulars relating to each of the 64 cases of tuberculosis which were found. In the last column there is given all the information obtained with reference to the possible contraction of the disease from some pre-existing case of the disease.

In obtaining this information the utmost care was taken to avoid anything in the way of suggesting answers to the person being questioned, and each of the answers was tested carefully by further questions to ensure its reliability. Further, when a possible source of infection in the shape of a pre-existing case was stated to have been present, this information was verified as carefully as possible afterwards in several ways:—The doctor who attended the previous case was communicated with and his diagnosis obtained; the records of the hospital where the case was treated were searched; the death records were looked up, and, where necessary, copies of the death certificates were obtained from the other States; so that where a definite source of infection is stated to have existed I am myself satisfied that such information can be accepted as reliable.

The table shows, then, that the only factor common to any large proportion of the cases under consideration is the existence of a pre-existing case of tuberculosis with which the person under consideration had more or less intimate contact.

The periods over which they had been engaged in mining were widely various. Many had not been working at any time on machines, and among those who had the periods of time over which they had been so working differed; and it seems to me that the only possible conclusion is that the factor necessary to the production of tuberculosis is contact with a person affected with tuberculosis.

In the case of a disease such as tuberculosis, which is caused by an organism and which cannot conceivably exist without the presence of the causal organism, it seems hardly necessary to go to the trouble of producing evidence that no case of the disease can occur unless there is present some host from which the bacillus can be obtained.

It seems to me, moreover, that a more far-reaching conclusion is justified. It is certain that there have been in the past a certain number of tubercular men at work in the mines in this State, and in view of the fact that tuberculosis is an infectious disease the question at once arises, "Why is it that there are not now more men affected with this disease?"

I think the answer lies in the fact that more than a single exposure is necessary to the production of the disease, and that either a massive single dose or a repetition of exposures over a considerable period of time is necessary to its production. I think therein will be found the explanation of the above difficulty, and also of the fact that in Table Q. there is a striking repetition of the fact that the affected man was "mates with" or "camped with" an already affected man.

Professor Pannwitz, one of the official German delegates to the International Congress on Tuberculosis held at Washington, U.S.A., in 1908, is emphatic on this point:—*

> "But it must be stated emphatically that exposure must occur repeatedly before infection can take place. A single exposure is almost without danger, hence panic fear of infection is unfounded."

* Transactions of International Congress on Tuberculosis (Washington). Special Volume, page 52.

There will be produced, later, evidence that there is nothing in the way of "mine infection," if by that term is meant infection of the soil or of the rock.

When a man is working with a consumptive in the close proximity necessitated in many sections of mine work, then the wonder is that he does not get tuberculosis; and I am inclined to think that part of the explanation of the excessive incidence of tuberculosis on machine men is due to the confined space in which the two men engaged on a machine have to work, whereby the probability of infection is largely increased.

Undoubtedly the dust, by the damage it does to the lung tissue, does also play an important part, but if it were to be regarded as the factor of primary importance, then it would be difficult to understand why so few cases of tuberculosis were met with.

The facts given on page relating to the conditions found in the body of a miner killed in an accident have a very striking significance in this connection. This man was accidentally killed while apparently in perfect health, and on examination of the lungs at the *post mortem* it was found that the bronchial gland was extensively invaded by tuberculosis. The importance of infection had by this time become so firmly established in my mind that the hypothesis was at once formed that either some member of his family had tuberculosis or that he had been working with a man so affected. Enquiry revealed the fact that one of his brothers is at the present time under treatment for tuberculosis. The facts with regard to this case, as well as the authority for the above statement, are given on page

One other striking fact was revealed by the study of these tubercular cases. Of the 64 cases (which included those under treatment at the Sanatorium at the time of my visit) there were 13 who had contracted their infection at the Fingall mine. This fact was very carefully verified, and the connection between the successive cases occurring at that mine was clearly traceable.

This was the local focus of infection referred to on page 47, and there can be little reasonable doubt when the facts in this table are considered, together with the fact brought out in the study of the statistics for the past ten years that tuberculosis is steadily on the increase amongst miners, that unless steps are taken to deal with this tuberculous infection there will sooner or later be other foci of infection, for the affected men are bound not to remain long in the one place. The indication is clear: it is the consumptive only—not the mine or anything else, but the consumptive—who produces consumption.

Another aspect of this question is worthy of attention. A child was brought to me for examination. It had definite tuberculosis of the glands of the neck. Its father, a miner, had recently died from tuberculosis of the lungs in the Coolgardie Sanatorium. The significance of this case is obvious.

But if Table Q. (page 59) be again referred to, it will be seen that in several instances the source of infection was not a fellow-miner, but a person entirely unconnected with the mining industry.

Nos. 27, 32, 19, and 57 illustrate this point. Hence, any measures against tuberculosis which are intended to be entirely comprehensive must pay attention to sources of infection, not only amongst miners but amongst the general population.

It is a matter of some importance to determine whether this infectivity of tuberculosis amongst miners is peculiar to miners, or is part of a general law relating to this disease throughout the whole population.

On pages 83-85 is given a reprint of an article which appeared in the June number of the journal, *Public Health* (1909). The article sufficiently reveals its own scope, and the only fact of importance to be quoted here is that it was established clearly, that of 127 cases of tuberculosis of the lungs reported to the Central Board of Health of Western Australia during 1909, a total of 43, or 33.8 per cent., were due to personal infection from a consumptive person.

In Table Q. there are 65 cases given, and of these 32, or 49.2 per cent., showed a clear history of infection.

This question was tested in another way. All the males at the Sanatorium at Coolgardie were carefully questioned. There were 31 of these (excluding exminers, who are included in Table Q.), and of these 14, or 45.2 per cent., gave a clear history of infection, while four were doubtful. The facts relating to these 18 cases are given in detail in Table R.

Still again, to check the correctness of this hypothesis of infection in tuberculosis, the case-books at the Sanatorium were examined, with the following result:—

The total number of consumptives treated at the Sanatorium from the time of its inception until June 13, 1910, was 342. The clinical histories of 178 of these are available. These clinical histories are sometimes far from complete; but despite this incompleteness, 50 histories, *i.e.*, 28 per cent., show clear evidence of personal infection.

So that, however the hypothesis be tested, it is absolutely incontrovertible that tuberculosis of the lungs must be regarded as an infectious, rather than as an industrial, disease. Certainly there are occupations which facilitate tubercular infection; but measures which attack the disease from the industrial end have small hope of success in comparison with measures planned entirely with regard to the infectivity of the disease.

That these statements are not merely the expression of one person's opinion is clearly evidenced by the resolutions adopted at the International Congress on Tuberculosis, held at Washington, U.S.A., in 1908. The resolutions were as follows:—

> "That the utmost efforts should be continued in the struggle against tuberculosis to prevent the conveyance of tuberculous infection from man to man as the most important source of the disease."
>
> "That preventive measures be continued against bovine tuberculosis, and that the possibility of the propagation of this to man be recognised."
>
> "That this Congress urge upon the public and upon all Governments (*a*) the establishment of hospitals for the treatment of advanced cases of tuberculosis; (*b*) the establishment of sanatoriums for curable cases of tuberculosis; (*c*) the establishment of dispensaries, etc., for cases which cannot enter sanatoriums or hospitals."

## TABLE A.

*Total number of Men examined tabulated according to the class of Mine-work engaged in, and the Mine at which each was employed.*

| | Total number of men examined. | Machine Men. | Miners. | Truckers. | Dry Treatment hands. | Dump Hands. | Timbermen. | Carpenters. | Engine-drivers. | Skipmen. | Platmen. | Bracemen. | Lamp Trimmer. | Horse-driver. | Wet Treatment Hands. | Surface Laborers. | Assay Office Men. | Electricians. | Fettlers. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Associated | 121 | 44 | 8 | 23 | 21 | .. | 4 | .. | .. | .. | 3 | 1 | .. | .. | 12 | 5 | .. | .. | .. | 121 |
| Associated Northern | 32 | 14 | 11 | 1 | 1 | .. | .. | .. | 1 | .. | 1 | 1 | .. | .. | 1 | 1 | .. | .. | .. | 32 |
| Boulder | 141 | 65 | 23 | 19 | 23 | .. | 1 | .. | .. | .. | 3 | .. | .. | .. | 4 | 3 | .. | .. | .. | 141 |
| Chaffers | 43 | 26 | 16 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 43 |
| Hainault | 71 | 19 | 21 | 2 | 9 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 17 | 2 | .. | .. | .. | 71 |
| Horseshoe | 198 | 94 | 30 | 28 | 11 | 2 | 1 | .. | 1 | .. | 3 | .. | .. | .. | 23 | 4 | .. | 1 | .. | 198 |
| Ivanhoe | 132 | 44 | 21 | 30 | 17 | .. | .. | .. | .. | .. | 3 | .. | .. | .. | 17 | 1 | .. | .. | .. | 132 |
| Kalgurli | 114 | 48 | 25 | 11 | 14 | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | 10 | 3 | .. | .. | 1 | 114 |
| Lake View | 81 | 27 | 2 | 19 | 14 | 1 | 1 | .. | .. | .. | 2 | .. | .. | .. | 8 | 7 | .. | .. | .. | 81 |
| Perseverance | 12 | 10 | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 12 |
| South Kalgurli | 76 | 22 | 6 | 6 | 9 | 1 | .. | .. | .. | .. | 1 | .. | .. | .. | 8 | 21 | 1 | 1 | .. | 76 |
| Gwalia | 109 | 79 | 13 | 17 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 109 |
| Lancefield | 120 | 46 | 6 | 40 | 12 | 1 | .. | .. | .. | 2 | 1 | .. | .. | .. | 7 | 5 | .. | .. | .. | 120 |
| Vivien | 27 | 6 | 13 | 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 27 |
| Waroonga | 52 | 22 | 22 | 5 | 1 | .. | .. | .. | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | .. | .. | 52 |
| Ingliston Extended | 18 | 9 | 8 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 18 |
| Ingliston Consols | 7 | 4 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 |
| Fenian | 30 | 16 | 13 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 30 |
| Marmont | 7 | 4 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 |
| Fingall | 172 | 79 | 28 | 46 | 3 | 1 | 2 | 1 | 4 | 2 | 2 | 3 | 1 | .. | .. | .. | .. | .. | .. | 172 |
| Morning Star | 28 | 14 | 14 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 28 |
| Black Range | 69 | 23 | 46 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 69 |
| Sandstone Development | 46 | 21 | 25 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 46 |
| Oroya Black Range | 40 | 24 | 16 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 40 |
| Mararoa | 19 | 17 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 19 |
| Burbanks Main Lode | 40 | 28 | 12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 40 |
| Sanatorium | 14 | not extended | | | | | | | | | | | | | | | | | | |
| Miscellaneous | 75 | | | | | | | | | | | | | | | | | | | |
| | 1,894 | 805 | 387 | 258 | 135 | 6 | 11 | 1 | 7 | 4 | 2 | 5 | 1 | 1 | 107 | 52 | 1 | 2 | 1 | 1,805 |
| Cardiff | 26 | | | | | | | | | | | | | | | | | | | |
| Co-operative | 44 | | | | | | | | | | | | | | | | | | | |
| Proprietary | 54 | | | | | | | | | | | | | | | | | | | |
| Scottish Collieries | 32 | | | | | | | | | | | | | | | | | | | |
| | 2,050 | | | | | | | | | | | | | | | | | | | |

## TABLE B.

*Mines visited, with the total numbers employed, together with, the total numbers examined.*

| | All Hands. | | Treatment Hands. | | Underground Men. | |
|---|---|---|---|---|---|---|
| | Total Employed. | Total Examined. | Total Employed. | Total Examined. | Total Employed. | Total Examined. |
| Associated | 412 | 121 | 71 | 33 | 243 | 75 |
| Associated Northern | 67 | 32 | 24 | 2 | 32 | 26 |
| Great Boulder | 693 | 141 | 121 | 27 | 371 | 107 |
| Chaffers | 132 | 43 | 26 | .. | 84 | 42 |
| Hainault | 226 | 71 | 66 | 26 | 143 | 42 |
| Horseshoe | 970 | 198 | 143 | 34 | 623 | 152 |
| Ivanhoe | 607 | 132 | 125 | 34 | 376 | 95 |
| Kalgurli | 407 | 114 | 92 | 24 | 251 | 84 |
| Lake View | 338 | 81 | 90 | 22 | 152 | 48 |
| Perseverance | 344* | 12 | .. | .. | 111 | 12 |
| South Kalgurli | 249 | 76 | 54 | 17 | 143 | 34 |
| Gwalia | 418 | 109 | .. | .. | 277 | 109 |
| Lancefield | 295 | 120 | 78 | 19 | 172 | 92 |
| Vivien | 100 | 27 | 56 | .. | 44 | 27 |
| Waroonga | 218 | 52 | 116 | 1 | 102 | 49 |
| Ingliston Extended | 45 | 18 | 18 | .. | 27 | 18 |
| Ingliston Consols | 56 | 7 | 20 | .. | 36 | 7 |
| Fenian | 67 | 30 | 21 | .. | 46 | 29 |
| Marmont | 56 | 7 | 20 | .. | 36 | 7 |
| Fingall | 356 | 172 | 171 | 3 | 185 | 153 |
| Morning Star | 60 | 28 | 22 | .. | 38 | 28 |
| Black Range | 167 | 69 | 87 | .. | 80 | 69 |
| Sandstone Development | 130 | 46 | 40 | .. | 90 | 46 |
| Oroya Black Range | 250 | 40 | 70 | .. | 180 | 40 |
| Mararoa | 86 | 19 | 36 | .. | 50 | 19 |
| Burbanks Main Lode | 97 | 40 | .. | .. | 63 | 40 |
| | 6,846 | 1,805 | 1,567 | 242 | 3,955 | 1,450 |
| Cardiff | 88 | 26 | | | | |
| Co-operative | 57 | 44 | | | | |
| Proprietary | 56 | 54 | | | | |
| Scottish Collieries | 80 | 32 | | | | |
| Totals | 281 | 156 | .. | .. | .. | .. |

*Employed mostly on surface building work.

## TABLE C.

*Numbers of Cases of various Lung Diseases found in the Men examined, tabulated according to various branches of Mine Work.*

| | Total number examined. | Early Fibrosis. | Intermediate. Fibrosis. | Advanced Fibrosis. | Emphysema. | Pleurisy. | Tuberculosis. | Doubtful Tuberculosis. | Normal. |
|---|---|---|---|---|---|---|---|---|---|
| Machine Miners | 805 | 267 | 29 | 4 | 1 | 62 | 18 | .. | 424 |
| Miners, not Machine men | 387 | 28 | 6 | .. | 2 | 17 | 4 | 1 | 329 |
| Truckers | 258 | 8 | .. | .. | .. | 36 | .. | .. | 214 |
| Dry Treatment hands | 135 | 36 | 1 | .. | .. | 16 | .. | .. | 82 |
| Wet Treatment hands | 107 | 10 | .. | .. | .. | 10 | .. | .. | 87 |
| Dump hands | 6 | 2 | .. | .. | .. | .. | 1 | .. | 3 |
| Bracemen | 5 | .. | .. | .. | .. | 1 | .. | .. | 4 |
| Platmen | 21 | 1 | .. | .. | .. | 2 | 1 | .. | 17 |
| Skipmen | 4 | .. | .. | .. | .. | .. | .. | .. | 4 |
| Timbermen | 11 | .. | .. | .. | .. | 2 | .. | .. | 9 |
| Carpenters | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Engine-drivers | 7 | .. | .. | .. | .. | .. | .. | .. | 7 |
| Lamp-trimmers | 1 | .. | .. | .. | .. | .. | 1 | .. | .. |
| Horse-drivers | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Surface Labourers | 52 | 2 | .. | .. | .. | 3 | 2 | .. | 45 |
| Assay Office man | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Electricians | 2 | .. | .. | .. | .. | .. | .. | .. | 2 |
| Fettlers | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| | 1,805 | 354 | 36 | 4 | 3 | 149 | 27 | 1 | 1,231 |

TABLE D.

*Total numbers of Men examined and total numbers found affected with each type of Disease.*

| | Corrected Table. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Totals. | Early Fibrosis. | Intermediate Fibrosis. | Advanced Fibrosis. | Emphysema. | Pleurisy. | Tuberculosis. | Doubtful Tuberculosis. | Normal. |
| Machine miners | 805 | 267 | 29 | 4 | 1 | 62 | 18 | .. | 424 |
| Miners, non-machine | 387 | 28 | 6 | .. | 2 | 17 | 4 | 1 | 329 |
| Truckers | 258 | 8 | .. | .. | .. | 36 | .. | .. | 214 |
| Dry treatment hands | 102 | 25 | .. | .. | .. | 10 | .. | .. | 67 |
| Wet treatment hands | 60 | .. | .. | .. | .. | 5 | .. | .. | 55 |
| Dump hands | 2 | .. | .. | .. | .. | .. | .. | .. | 2 |
| Bracemen | 3 | .. | .. | .. | .. | 1 | .. | .. | 2 |
| Platmen | 18 | .. | .. | .. | .. | 2 | .. | .. | 16 |
| Skipmen | 3 | .. | .. | .. | .. | .. | .. | .. | 3 |
| Timbermen | 9 | .. | .. | .. | .. | .. | .. | .. | 9 |
| Carpenters | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Engine-drivers | 7 | .. | .. | .. | .. | .. | .. | .. | 7 |
| Lamp trimmers | 1 | .. | .. | .. | .. | .. | 1 | .. | .. |
| Horse drivers | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Surface labourers | 38 | .. | .. | .. | .. | 2 | .. | .. | 36 |
| Assay office men | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |
| Electricians | 2 | .. | .. | .. | .. | .. | .. | .. | 2 |
| Fettlers | 1 | .. | .. | .. | .. | .. | .. | .. | 1 |

TABLE E.

*Percentages in each Occupational Group suffering from each of the abnormal conditions specified.*

*(Percentages calculated on the corrected table.)*

| | Percentages of total numbers of men examined. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total number examined | Early Fibrosis. | Intermediate Fibrosis. | Advanced Fibrosis. | Emphysema. | Pleurisy. | Tuberculosis. | Doubtful Tuberculosis. | Normal. |
| Machine miners | 805 | 33·16 | 3·6 | 0·49 | 0·12 | 7·7 | 2·2 | .. | 52·6 |
| Miners not machine men | 387 | 7·23 | 1·55 | .. | 0·51 | 4·39 | 1·02 | 0·25 | 85·01 |
| Truckers | 258 | 3·10 | .. | .. | .. | 13·9 | .. | .. | 82·9 |
| Dry treatment hands | 102 | 24·5 | .. | .. | .. | 9·8 | .. | .. | 65·6 |
| Wet treatment hands | 60 | .. | .. | .. | .. | 8·33 | .. | .. | 91·66 |
| Dump hands | 2 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Bracemen | 3 | .. | .. | .. | .. | 33·33 | .. | .. | 66·66 |
| Platmen | 18 | .. | .. | .. | .. | 11·1 | .. | .. | 88·9 |
| Skipmen | 3 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Timbermen | 9 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Carpenters | 1 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Engine-drivers | 7 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Lamp trimmers | 1 | .. | .. | .. | .. | .. | 100 | .. | .. |
| Horse drivers | 1 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Surface labourers | 38 | .. | .. | .. | .. | 5·2 | .. | .. | 94·8 |
| Assay office men | 1 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Electricians | 2 | .. | .. | .. | .. | .. | .. | .. | 100 |
| Fettlers | 1 | .. | .. | .. | .. | .. | .. | .. | 100 |

## TABLE F.

*Numbers of years worked by Machine Men only, according to the total number of years Mining.*

| Number of years Mining. | Under 6 months. | 6/12–1. | 1–2. | 2–3. | 3–4. | 4–5. | 5–6. | 6–7. | 7–8. | 8–9. | 9–10. | 10–11. | 11–12. | 12–13. | 13–14. | 14–15. | 15–16. | 16–17. | 17–18. | 18–19. | 19–20. | 20–25. | 25–30. | 30–35. | 35–40. | 40–45. | 45–50. | 50–55. | Totals. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Early Fibrosis .. | .. | .. | 1 | 2 | 5 | 3 | 1 | 6 | 6 | 8 | 4 | 16 | 8 | 14 | 6 | 20 | 19 | 15 | 13 | 14 | .. | 57 | 18 | 18 | 8 | 5 | .. | .. | 267 |
| Intermediate Fibrosis | .. | .. | .. | .. | .. | 2 | .. | .. | 1 | 1 | 2 | 1 | 1 | 1 | .. | 2 | 2 | 1 | .. | .. | .. | 6 | 5 | 2 | 1 | 1 | .. | .. | 29 |
| Advanced Fibrosis .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | 1 | 1 | .. | .. | .. | 4 |
| Emphysema .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 1 |
| Tuberculosis .. .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 2 | .. | 1 | 3 | 1 | 3 | 1 | 2 | .. | .. | .. | 2 | 1 | 1 | .. | .. | .. | .. | 18 |
| Pleurisy .. .. | .. | .. | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | .. | 5 | 2 | 4 | 2 | 8 | 2 | 5 | .. | .. | .. | 15 | 1 | 3 | 3 | .. | .. | .. | 62 |
| Normal .. .. | 1 | 2 | 4 | 15 | 16 | 14 | 18 | 15 | 19 | 17 | 21 | 34 | 11 | 23 | 20 | 25 | 37 | 18 | 11 | 18 | 4 | 44 | 17 | 8 | 9 | 2 | 1 | .. | 424 |
| Total .. .. | 1 | 2 | 6 | 19 | 22 | 21 | 21 | 22 | 28 | 28 | 29 | 56 | 23 | 45 | 29 | 58 | 61 | 41 | 24 | 32 | 4 | 126 | 42 | 33 | 22 | 9 | 1 | .. | 805 |

## TABLE G.

*Number of years worked by Machine Men only, at Machine work only.*

| Number of years on Machine Work. | Under six months. | 6 months to 1 year. | 1–2. | 2–3. | 3–4. | 4–5. | 5–6. | 6–7. | 7–8. | 8–9 | 9–10. | 10–11. | 11–12. | 12–13. | 13–14. | 14–15. | 15–16. | 16–17. | 17–18. | 18–19. | 19–20. | 20–25. | 25–30. | 30–35. | 35–40. | 40–45. | 45–50. | 50–55. | Totals. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Early Fibrosis .. | 9 | 6 | 5 | 20 | 10 | 21 | 18 | 15 | 16 | 26 | 15 | 43 | 13 | 20 | 4 | 8 | 5 | 2 | 2 | .. | .. | 9 | .. | .. | .. | .. | .. | .. | 267 |
| Intermediate Fibrosis | .. | .. | .. | 2 | 1 | 2 | 3 | 2 | 4 | 1 | .. | 7 | 2 | .. | .. | 3 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 29 |
| Advanced Fibrosis .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | 2 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 |
| Emphysema .. .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Tuberculosis .. .. | 2 | 1 | 3 | .. | 2 | 1 | 2 | 1 | .. | 1 | 1 | 2 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 18 |
| Pleurisy .. .. | 2 | 3 | 12 | 2 | 3 | 6 | 3 | 3 | 6 | 3 | 3 | 5 | 2 | 2 | 1 | 2 | 1 | .. | .. | .. | .. | 2 | 1 | .. | .. | .. | .. | .. | 62 |
| Normal .. .. | 41 | 37 | 47 | 57 | 33 | 31 | 38 | 24 | 20 | 22 | 15 | 17 | 7 | 17 | 6 | 2 | 4 | 2 | .. | .. | .. | 3 | 1 | .. | .. | .. | .. | .. | 424 |
| Total .. .. | 54 | 47 | 67 | 82 | 49 | 61 | 64 | 46 | 46 | 53 | 36 | 74 | 25 | 41 | 11 | 15 | 12 | 4 | 2 | .. | .. | 14 | 2 | .. | .. | .. | .. | .. | 805 |

## TABLE H.

*Total number of years Mining in any country.*

### Non-Machine Miners.

| | Under six months. | 6 months to 1 year. | 1–2. | 2–3. | 3–4. | 4–5. | 5–6. | 6–7. | 7–8. | 8–9. | 9–10. | 10–11. | 11–12. | 12–13. | 13–14. | 14–15. | 15–16. | 16–17. | 17–18. | 18–19. | 19–20. | 20–25. | 25–30. | 30–35. | 35–40. | 40–45. | 45–50. | 50–55. | 55. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal .. .. .. | 13 | 14 | 22 | 19 | 18 | 16 | 20 | 18 | 18 | 12 | 12 | 25 | 9 | 13 | 4 | 16 | 15 | 8 | 4 | 4 | 1 | 30 | 4 | 6 | 3 | 4 | .. | 1 | .. | 329 |
| Early Fibrosis .. .. | .. | .. | .. | .. | .. | 1 | .. | 1 | 1 | .. | 1 | 3 | 2 | .. | 2 | 3 | .. | 1 | 1 | .. | .. | 2 | 1 | 4 | 2 | 1 | 1 | .. | 1 | 28 |
| Intermediate Fibrosis .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 1 | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 2 | .. | 6 |
| Emphysema .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 2 |
| Tuberculosis * .. .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | 1 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 5 |
| Pleurisy .. .. .. | .. | .. | .. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | .. | .. | 1 | 2 | 1 | .. | .. | .. | .. | .. | 2 | 1 | .. | .. | .. | .. | .. | 17 |

* Includes the case of doubtful Tuberculosis.

### Truckers.

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal .. .. .. | 25 | 17 | 35 | 27 | 28 | 17 | 11 | 9 | 9 | 10 | 3 | 3 | 5 | 4 | 1 | 4 | 1 | 2 | .. | 1 | .. | .. | .. | 2 | .. | .. | .. | .. | .. | 214 |
| Early Fibrosis .. .. | .. | 1 | .. | .. | .. | 1 | .. | 1 | .. | .. | 1 | 1 | .. | .. | .. | 2 | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 8 |
| Pleurisy .. .. .. | .. | 5 | 6 | 7 | 1 | 4 | 4 | 2 | 2 | 1 | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | .. | .. | 36 |

## TABLE K.

*Comparative percentages of the Men (in each group specified) examined in the various age-groups, who were affected with early Fibrosis and who were normal.*

| | Non-machine Miners. | | | Machine Miners—Number of years total Mining. | | | Machine Miners—Number of years on Machines. | | |
|---|---|---|---|---|---|---|---|---|---|
| —— | Percentage with Early Fibrosis. | Percentage Normal. | Total number examined. | Percentage with Early Fibrosis. | Percentage Normal. | Total number examined. | Percentage with Early Fibrosis. | Percentage Normal. | Total number examined. |
| Under 6 months .. .. | .. | 100 | 13 | .. | 100 | 1 | 16·6 | 75·9 | 54 |
| Six months to one year .. | .. | 100 | 14 | .. | 100 | 2 | 12·7 | 76·6 | 47 |
| 1–2 .. .. .. .. | .. | 100 | 22 | 16·1 | 66·6 | 6 | 7·46 | 70·1 | 67 |
| 2–3 .. .. .. .. | .. | 90·5 | 21 | 10·5 | 78·9 | 19 | 24·3 | 69·5 | 82 |
| 3–4 .. .. .. .. | .. | 94·7 | 19 | 22·7 | 72·8 | 22 | 20·4 | 67·3 | 49 |
| 4–5 .. .. .. .. | 5·5 | 88·8 | 18 | 14·3 | 66·6 | 21 | 34·4 | 50·8 | 61 |
| 5–6 .. .. .. .. | .. | 95·2 | 21 | 4·7 | 86·6 | 21 | 28·1 | 59·3 | 64 |
| 6–7 .. .. .. .. | 5·0 | 90 | 20 | 27·2 | 68·1 | 22 | 32·6 | 52·1 | 46 |
| 7–8 .. .. .. .. | 4·7 | 85·7 | 21 | 21·4 | 67·8 | 28 | 34·8 | 43·5 | 46 |
| 8–9 .. .. .. .. | .. | 92·3 | 13 | 28·6 | 60·7 | 28 | 49·1 | 41·5 | 53 |
| 9–10 .. .. .. .. | 7·1 | 85·7 | 14 | 13·8 | 72·4 | 29 | 41·7 | 41·7 | 36 |
| 10–11 .. .. .. .. | 9·4 | 78·1 | 32 | 28·6 | 60·7 | 56 | 58·1 | 22·9 | 74 |
| 11–12 .. .. .. .. | 18·2 | 81·8 | 11 | 34·7 | 49·0 | 23 | 52·0 | 28·0 | 25 |
| 12–13 .. .. .. .. | .. | 100 | 13 | 31·1 | 51·1 | 45 | 48·7 | 41·4 | 41 |
| 13–14 .. .. .. .. | 25·0 | 50 | 8 | 20·7 | 69·0 | 29 | 36·4 | 54·6 | 11 |
| 14–15 .. .. .. .. | 13·0 | 69·5 | 23 | 34·5 | 43·1 | 58 | 53·3 | 13·3 | 15 |
| 15–16 .. .. .. .. | .. | 83·3 | 18 | 31·1 | 60·6 | 61 | 41·7 | 33·3 | 12 |
| 16–17 .. .. .. .. | 11·1 | 88·8 | 9 | 36·5 | 43·9 | 41 | 50·0 | 50·0 | 4 |
| 17–18 .. .. .. .. | 14·3 | 57·1 | 5 | 54·1 | 45·9 | 24 | 100·0 | .. | 2 |
| 18–19 .. .. .. .. | .. | 100 | 4 | 43·7 | 56·3 | 32 | .. | .. | .. |
| 19–20 .. .. .. .. | .. | 100 | 1 | .. | 100·0 | 4 | .. | .. | .. |
| 20–25 .. .. .. .. | 6·3 | 93·7 | 32 | 45·2 | 34·9 | 126 | 64·3 | 21·4 | 14 |
| 25–30 .. .. .. .. | 20·0 | 80 | 7 | 42·8 | 40·4 | 42 | .. | 50·0 | 2 |
| 30–35 .. .. .. .. | 36·3 | 54·5 | 11 | 54·5 | 24·4 | 33 | .. | .. | .. |
| 35–40 .. .. .. .. | 40·0 | 60 | 5 | 36·3 | 40·5 | 22 | .. | .. | .. |
| 40–45 .. .. .. .. | 16·6 | 66·6 | 6 | 55·5 | 22·2 | 9 | .. | .. | .. |
| 45–50 .. .. .. .. | 50·0 | .. | 2 | .. | 100·0 | 1 | .. | .. | .. |
| 50–55 .. .. .. .. | .. | 33·3 | 3 | .. | .. | .. | .. | .. | .. |
| 55–60 .. .. .. .. | 100·0 | .. | 1 | .. | .. | .. | .. | .. | .. |

## TABLE L.

*Percentages of Miners who have never worked elsewhere than in Western Australia, affected with various types of Diseases.*

| —— | Early Fibrosis. | Intermediate Fibrosis. | Advanced Fibrosis. | Emphysema. | Pleurisy. | Tuberculosis. | Normal. | Totals. |
|---|---|---|---|---|---|---|---|---|
| Machine Miners .. .. .. .. | 25·6 | 3·05 | .. | .. | 7·01 | 3·05 | 61·3 | 328 |
| Non-machine Miners .. .. .. | 4·48 | 0·9 | .. | 0·45 | 5·4 | 1·3 | 87·4 | 223 |
| Truckers .. .. .. .. .. | 2·86 | .. | .. | .. | 13·8 | .. | 83·2 | 209 |
| Dry Treatment hands .. .. .. | 19·5 | .. | .. | .. | 9·7 | .. | 70·7 | 82 |
| Wet Treatment hands .. .. .. | .. | .. | .. | .. | .. | .. | 100 | 50 |

TABLE L (*a.*)

*Numbers of various affections discovered in Men who had done Mine work prior to coming to Western Australia.*

| —— | Early Fibrosis. | Inter-mediate | Advanced Fibrosis. | Emphy-sema. | Pleurisy. | Tuber-culosis. | Doubtful Tuber-culosis. | Normal. | Totals. |
|---|---|---|---|---|---|---|---|---|---|
| Machine Miners .. .. | 183 | 19 | 4 | 1 | 39 | 8 | .. | 223 | 577 |
| Non-machine Miners .. | 18 | 4 | .. | 1 | 5 | 1 | 1 | 134 | 164 |
| Truckers .. .. .. | 2 | .. | .. | .. | 7 | .. | .. | 40 | 49 |
| Dry Treatment hands .. | 20 | 1 | .. | .. | 8 | .. | .. | 24 | 53 |
| Wet Treatment hands .. | 10 | .. | .. | .. | 10 | .. | .. | 37 | 57 |

*Numbers of various affections discovered in Men who had done Mine work only in Western Australia.*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Machine Miners .. .. | 84 | 10 | .. | .. | 23 | 10 | .. | 201 | 328 |
| Non-machine Miners .. | 10 | 2 | .. | 1 | 12 | 3 | .. | 195 | 223 |
| Truckers .. .. .. | 6 | .. | .. | .. | 29 | .. | .. | 174 | 209 |
| Dry Treatment hands .. | 16 | .. | .. | .. | 8 | .. | .. | 58 | 82 |
| Wet Treatment hands .. | .. | .. | .. | .. | .. | .. | .. | 50 | 50 |

## TABLE M.

*Number of years worked by Men who have never done any Mine work except in Western Australia.*

MACHINE MEN—NUMBER OF YEARS ON MACHINES.

| | Under six months. | 6 months to 1 year. | 1–2. | 2–3. | 3–4. | 4–5. | 5–6. | 6–7. | 7–8. | 8–9. | 9–10. | 10–11. | 11–12. | 12–13. | 13–14. | 14–15. | 15–16. | 16–17. | 17–18. | 18–19. | 19–20. | 20–25. | 25–30. | 30–35. | 35–40. | 40–45. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | 21 | 29 | 25 | 33 | 18 | 19 | 12 | 7 | 9 | 10 | 5 | 7 | 2 | 2 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 201 |
| Early Fibrosis | 6 | 3 | 4 | 8 | 7 | 11 | 9 | 5 | 6 | 4 | 4 | 13 | 1 | .. | 2 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 84 |
| Intermediate Fibrosis | .. | .. | .. | 1 | 1 | .. | 1 | .. | 4 | 1 | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 |
| Tuberculosis | 2 | 1 | 1 | .. | 2 | 1 | 1 | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 |
| Pleurisy | 1 | 2 | 6 | .. | 2 | 1 | 2 | .. | 3 | 2 | 2 | 1 | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 23 |

NON-MACHINE MINERS. NUMBER OF YEARS MINING ALTOGETHER.

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | 14 | 11 | 21 | 18 | 16 | 9 | 20 | 16 | 13 | 9 | 7 | 13 | 5 | 5 | .. | 8 | 5 | 4 | 1 | .. | .. | .. | .. | .. | .. | .. | 195 |
| Early Fibrosis | .. | .. | .. | .. | .. | 1 | .. | 2 | .. | .. | 1 | 2 | .. | .. | 1 | 2 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 10 |
| Intermediate Fibrosis | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 |
| Emphysema | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 |
| Tuberculosis | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 |
| Pleurisy | .. | .. | .. | .. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | .. | .. | 1 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 12 |

TRUCKERS.

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | 25 | 17 | 33 | 28 | 21 | 15 | 10 | 7 | 7 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 174 |
| Early Fibrosis | .. | .. | .. | .. | .. | 1 | .. | 1 | .. | .. | 1 | 1 | .. | .. | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 6 |
| Pleurisy | 1 | 4 | 5 | 7 | 1 | 2 | 4 | 2 | 1 | . | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 29 |



## TABLE N.

*Wet Treatment Men who have done only Wet Treatment, and only in Western Australia.*

NUMBER OF YEARS ON WET TREATMENT PLANT

| | Under 6–12. | 6/12–1. | 1–2. | 2–3. | 3–4. | 4–5. | 5–6. | 6–7. | 7–8. | 8–9. | 9–10. | 10–11. | 11–12. | 12–13. | 13–14. | 14–15. | 15–16. | 16–17. | 17–18. | 18–19. | 19–20. | 20–21. | 21–22. | 22–23. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | 2 | .. | 1 | 5 | 7 | 3 | 3 | 2 | 1 | 4 | 3 | 4 | 3 | 6 | 2 | 1 | 1 | 1 | .. | .. | .. | .. | .. | 1 | 50 |

*Dry Treatment Men who have done only Dry Treatment work, and only in Western Australia.*

NUMBER OF YEARS ON DRY TREATMENT PLANT.

| | Under 6–12. | 6/12–1. | 1–2. | 2–3. | 3–4. | 4–5. | 5–6. | 6–7. | 7–8. | 8–9. | 9–10. | 10–11. | 11–12. | 12–13. | 13–14. | 14–15. | 15–16. | Totals. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | 2 | 2 | 6 | 6 | 8 | 8 | 2 | 3 | 3 | 2 | 2 | 5 | 1 | 2 | 3 | 2 | 1 | 58 |
| Early Fibrosis | 1 | .. | .. | .. | .. | 1 | .. | .. | .. | 1 | 2 | 3 | 3 | 2 | 1 | .. | 2 | 16 |
| Pleurisy | .. | .. | 1 | 2 | .. | 1 | .. | 2 | .. | .. | .. | 2 | .. | .. | .. | .. | .. | 8 |

## TABLE O.

### COAL MINERS.

| | | |
|---|---|---|
| Pleurisy .. .. .. .. .. .. .. .. | 47 | = 30·1% |
| Early Fibrosis .. .. .. .. .. .. .. | 16 | = 10·2% |
| Intermediate Fibrosis .. .. .. .. .. .. | 1 | = 0·6% |
| Normal .. .. .. .. .. .. .. .. | 92 | = 58·9% |
| Total .. .. .. | 156 | |

### COLLIERS.

Pleurisy—
47. { 28 had done only Coal-mining.
{ 19 had done also Gold-mining.

Normal—
92. { 59 had done only Coal-mining.
{ 33 had done also Gold-mining.

Early Fibrosis—
16. All of these 16 had done Gold as well as Coal mining.

Intermediate Fibrosis—
1 case. This man had done Gold as well as Coal-mining.

All Men—
Total of 87 men who had done only Coal-mining, of these, 28 men affected with Pleurisy.

W. A. Men—
Total 49. Pleurisy 11.

## TABLE P.

*Colliers who have done only Coal-mining, and nowhere else but in W.A.*

Number of years Mining.

| — | Under 6 months. | 6/12–1. | 1–2. | 2–3. | 3–4. | 4–5. | 5–6. | 6–7. | 7–8. | 8–9. | 9–10. | 10–11. | 11–12. | 12–13. | 13–14. | 14–15. | 15–16. | Totals. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal .. .. .. .. | 1 | 6 | 4 | 4 | 4 | 2 | 3 | 3 | 1 | 2 | 1 | 4 | 2 | .. | .. | .. | 1 | 38 |
| Pleurisy .. .. .. .. | .. | 1 | 1 | 1 | 2 | .. | 1 | 2 | .. | 2 | 1 | .. | .. | .. | .. | .. | .. | 11 |

TABLE Q.

| No. | Total number of Years Mining. | Years at Mine work in West Australia. | Years at Mine work elsewhere. | Years on Machines West Australia. | Years on Machines elsewhere. | Condition on arriving in West Australia. | Remarks, re class of Mine work engaged in. | Duration of Disease. | Number of Mines worked on in West Australia. | History of Contact. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | DOUBTFUL TUBERCULOSIS—MISCELLANEOUS CASES. | | | |
| 1 | 5 | 5 | .. | .. | .. | Well | Four months below, three years dump, rest surface | 3 years .. .. .. | 1 | Worked with a man in W.A. who had phthisis, and two of whose brothers died of phthisis. |
| 2 | 15 | 13 | 2 | 8 | .. | Well | Miner and Machines .. | 4 years .. .. .. | 7 | Father died from "miner's complaint" in Perth. Worked seven years ago with a man since dead from tuberculosis. |
| 3 | 18 | 14 | 4 | 11 | 2 | Well | Miner and Machines .. | 2 years .. .. .. | 2 | Machine mates with a man since dead from tuberculosis. Was "mates" with this man for some months before and after onset. |
| | | | | | | | FIBROSIS AND TUBERCULOSIS—"MISCELLANEOUS CASES." | | | |
| 4 | 16 | 11 | 5 | 6 months | 2 | Well | Chiefly hand work .. | 6 years .. .. .. | 4 | Worked with a man who was sent out from England with tuberculosis. Also spent considerable time with an invalid, since dead from tuberculosis. |
| 5 | 22 | 11 | 11 | 11 | 9 | Well | Mostly machines .. .. | 9 months .. .. | .. | Worked and boarded in same house with tubercular miner. Mates with another tubercular miner about 2–3 years prior to onset of his own tuberculosis. |
| | | | | | | | TUBERCULOSIS—"MISCELLANEOUS CASES." | | | |
| 6 | 16 | 16 | .. | 5 | .. | .. | Miner and machines .. | 10 months .. .. | 5 | Camped with a man affected with tuberculosis. Worked with several others similarly affected. |
| 7 | 25 | 10 | 15 | *Nil* | *Nil* | Well | Hand labour, underground | 6 months .. .. | 5 | Working mates with a man since left the State to obtain treatment for tuberculosis. |
| 8 | 12 | 3½ | 8½ | *Nil* | *Nil* | Well | Hand labour, underground | 2 years .. .. .. | 3 | Before onset camped with a man who was treated in Perth Hospital for tuberculosis. |
| 9 | 27 | 8 | 19 | .. | 2 | Well | Hand labour underground | 4½ years .. .. | 1 | Shortly before onset visited Perth and lodged in a boarding house. No facts more definite pointing to contact. |
| 10 | 5 | 5 | .. | 5 | .. | Well | Machines .. .. .. | 3 months .. .. | 1 | Was machine mates with man since dead from tuberculosis. |
| 11 | 16 | 13 | 3 | 6 | 6 months | Well | Machines .. .. .. | 4 years .. .. .. | 6 | Worked mates at different times with each of three men all since dead of tuberculosis. |
| 12 | 27 | 17 | 10 | 17 | few months | Well | Machines .. .. .. | 16 months .. .. | 1 | Occasional contact with each of three tubercular miners. |
| 13 | 23 | 9 | 14 | .. | 3 | Well | Hand labour, underground, and engine-driving | 3 months .. .. | 2 | Not ascertained. |
| 14 | 1½ | 1½ | .. | .. | .. | Well | Underground and surface | 3 years .. .. .. | 3 | Before doing any mine work, worked with a man since dead of tuberculosis. This case was therefore infected before beginning mine work. |
| 15 | 13 | 11 | 2 | 3 | .. | Well | Miner and machines .. | 1½ years .. .. | 8 | Father died of tuberculosis. Was seen by present subject the week before his death, and for some time previously. |
| 16 | 20 | 10 | 10 | 3 | .. | Well | Miner and machines .. | 6 months .. .. | 3 | Father a miner, has "bad chest." Wife's father a miner similiarly affected. Wife has "very short wind." |
| 17 | 22 | 16 | 6 | .. | .. | Well | Miner .. .. .. | Unknown .. .. | 2 | Worked recently for four months with a man, No. 15, suffering from advanced tuberculosis. |

TABLE Q.

| No. | Total number of Years Mining. | Years at Mine work in West Australia. | Years at Mine work elsewhere. | Years on Machines West Australia. | Years on Machines elsewhere. | Condition on arriving in West Australia. | Remarks, *re* class of Mine work engaged in. | Duration of Disease. | Number of Mines worked on in West Australia. | History of Conta t. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | TUBERCULOSIS—MISCELLANEOUS CASES—*continued.* | | | |
| 18 | 16 | 15 | 1 | 11 | .. | Well | Machines .. .. .. | Unknown .. .. | 4 | Worked for some time with a man with "weak chest." |
| 19 | 19 | 15 | 4 | 2 | .. | Well | Miner and Machines, and Mill work | 5 years .. .. .. | 6 | Negative. |
| 20 | 35 | 14 | 21 | 3 | .. | Well | Coal and Gold miner, and machines | Unknown .. .. | 3 | Negative. |
| 21 | 19 | 14 | 4 | 10 | .. | Well | Machines .. .. .. | 18 months .. .. | 1 | Mother died of tuberculosis. Two brothers recently dead, same disease. |
| 22 | 14 | 14 | .. | 4 | .. | Well | Machines .. .. .. | Unknown .. .. | 3 | Negative. |
| 23 | 13 | 13 | .. | .. | .. | Well | Sampling .. .. .. | 1½ years .. .. | 3 | Negative. |
| | | | | | | | TUBERCULOSIS—CASES EXAMINED AT THE SANATORIUM. | | | |
| 24 | 28 | 10 | 18 | 3 months | .. | Well | Miner .. .. .. | 3 years .. .. .. | 2 | Mates for some time, three years ago, with man since dead of tuberculosis. |
| 25 | 10 | 9 | 1 | .. | .. | Well | Coal and Gold miner .. | Doubtful .. .. | 3 | Negative. |
| 26 | 5 | 2½ | 2½ | .. | 2 | Well | Miner and machines .. | 3 years .. .. .. | 1 | Doubtful, but says he worked with a number of men in South Africa with affected lungs. |
| 27 | 5 | 1 | 4 | .. | .. | Well | Miner, no machines .. | 7 years .. .. .. | 1 | Father died from "lung trouble" 16 years ago. Occupied a room eight years ago where a consumptive girl had lived. |
| 28 | 30 | 14 | 16 | 4 | 2 | Well | Machines .. .. .. | 4 years .. .. .. | 6 | Father a miner, died from "chest trouble." Worked a few shifts with a man now under treatment for tuberculosis. |
| 29 | 14 | 14 | .. | 1 | .. | Well | Miner and machines .. | 10 years .. .. | 5 | At time of onset was working with a mate with tuberculosis. |
| 30 | 16 | 14 | 2 | 5 | .. | Well | Miner and machines .. | 3 years .. .. .. | 4 | Frequent visitor at, and slept at, hotel, manager of which died of tuberculosis at time of onset of present subject's illness. No more definite history of contact. |
| 31 | 3½ | 3½ | .. | .. | .. | .. | Miner and surface .. | Doubtful .. .. | 1 | Negative. |
| 32 | 6 | 6 | .. | .. | .. | .. | Miner and cyanider .. | 15 months .. .. | 4 | At time of onset had just returned from Melbourne, where brother-in-law was affected with advanced tuberculosis. Definite history of contact with brother-in-law, but only for a short time. |
| 33 | 15 | 15 | .. | .. | .. | .. | Miner .. .. .. | 7 years .. .. .. | 2 | Shift boss at the mine where present subject worked just prior to onset died afterwards from tuberculosis. Nothing more definite obtained. |
| 34 | 12 | 12 | .. | 8 | .. | .. | Machines .. .. .. | 9 months .. .. | 4 | Was one of a party of six, another member of which was said to have "miner's complaint." |
| 35 | .. | .. | .. | .. | .. | .. | .. .. .. .. | .. .. .. .. | .. | This case was too ill to be questioned. |
| 36 | 19 | 19 | .. | .. | .. | .. | Mostly prospecting .. | 1 year .. .. .. | 1 | Negative. |

### Tuberculosis—Various Occupations.—(Cases discovered during examination of miners at work).

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 15 | 13 | 2 | .. | .. | Well | Timbering chiefly .. | 1 year .. .. .. | 2 | Mates on timber gang with No. 33. Now under treatment for advanced tuberculosis. |
| 38 | 14 | 14 | .. | .. | .. | Well | Hand labour, underground | Several months .. | 2 | "Many men with whom he had worked had miner's complaint, with coughing and spitting." |
| 39 | 13 | 13 | .. | .. | .. | Well | Hand labour, underground | 2 or 3 months .. .. | 1 | Negative. |
| 40 | 10 | 7 | 3 | .. | .. | Well | Sand dump .. .. | 2 years .. .. .. | 1 | Contact history not enquired. |
| 41 | 5½ | 5½ | .. | .. | .. | Well | Lamp trimmer .. .. | .. .. .. .. | 1 | Contact history not enquired. |
| 42 | 11 | 10 | 1 | .. | .. | Well | Platman .. .. .. | 5 months .. .. | 3 | Camped with a man now under treatment for tuberculosis, and lived in the camp after the man had left to seek treatment. |
| 43 | 18 | 15 | 3 | .. | .. | Well | Chiefly surface carpenter.. | Doubtful .. .. | 6 | Working with a man now under treatment at Sanatorium. |
| 44 | ¾ | ¾ | .. | .. | .. | .. | Surface trucking .. .. | 1½ years .. .. | 1 | Cousin died from tuberculosis; frequently seen by present subject, who lived in same house. |
| 45 | 2¾ | 2¾ | .. | .. | .. | .. | Miner .. .. .. | Unknown .. .. | .. | Negative. |

### Tuberculosis—Machine Miners.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 46 | 6 | 6 | .. | .. | .. | .. | Miner .. .. .. | 5 months .. .. | 4 | Negative. |
| 47 | 9 | 9 | .. | 5 | .. | .. | Machines .. .. .. | 2 years .. .. .. | 3 | Brother died tuberculosis, three years ago. |
| 48 | 12 | 12 | .. | 10 | .. | .. | Machines .. .. .. | 2 years .. .. .. | 4 | Mother died tuberculosis, 24 years ago. Man died from tuberculosis who was mate of present subject, two years ago. |
| 49 | 11 | 11 | .. | 11 | .. | .. | Machines .. .. .. | 1 year .. .. .. | 5 | Worked on same machine for 12 months with man who had to leave work on account of tuberculosis. |
| 50 | 16 | 9 | 7 | 1 | .. | Well | Machines .. .. .. | Unknown .. .. | 2 | Lived for seven years in same camp with a man who died from tuberculosis in that camp. |
| 51 | 15 | 6 | 9 | 1 | .. | Well | Braceman .. .. .. | 1 year .. .. .. | 1 | Negative. |
| 52 | 14 | 10 | 4 | 10 | .. | Well | Machines .. .. .. | Unknown .. .. | 4 | Contact history not enquired. |
| 53 | 20 | 14 | 6 | 12 | .. | Well | Machines .. .. .. | 2 years .. .. .. | 4 | Negative. |
| 54 | 12 | 12 | .. | 11 | .. | .. | Machines .. .. .. | 4 years .. .. .. | 4 | Camped with man who had been under treatment for tuberculosis. |
| 55 | 25 | 11 | 14 | 11 | 3 | Well | Machines .. .. .. | Unknown, early .. | 4 | Contract mates with two men since dead from tuberculosis. |
| 56 | 14 | 14 | .. | 3 months | .. | .. | Miner .. .. .. | 1 year .. .. .. | 1 | Several men in same mine affected with tuberculosis. (This fact verified.) |
| 57 | 12 | 12 | .. | 8 months | .. | .. | Miner .. .. .. | .. .. .. .. | 2 | Constantly with a companion, non-miner, who afterwards was under treatment for tuberculosis. |
| 58 | 13 | 13 | .. | 4 | .. | .. | Machines .. .. .. | 2 years .. .. .. | 7 | Eight years ago worked with a man affected with tuberculosis. |
| 59 | 9 | 9 | .. | 3 | .. | .. | Machines .. .. .. | 6 months .. .. | 2 | Negative. |
| 60 | 20 | 15 | 5 | 8 | .. | Well | Machines .. .. .. | 2 years .. .. .. | 6 | Mates for eight months, two years ago, with a consumptive. |
| 61 | 16 | 16 | .. | 5 months | .. | Well | Miner .. .. .. | 12 years .. .. | 3 | Negative. |
| 62 | 30 | 5 | 25 | 5 | 5 | Well | Machines .. .. .. | 6 months .. .. | 1 | Not ascertained. |
| 63 | 14 | 14 | .. | 3 | .. | .. | Machines .. .. .. | Unknown .. .. | 4 | Not ascertained. |
| 64 | 4 | 4 | .. | 1 | .. | .. | Machines .. .. .. | 1 year .. .. .. | 1 | Negative. |

### Doubtful Tuberculosis—Non-Machine Miner.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 65 | 10 | 1½ | 8½ | .. | .. | .. | Miner and surface hand .. | Doubtful .. .. | 1 | Was ordered to leave Bendigo on account of something "wrong with his lungs." Nothing definite ascertained relative to contact. |

## TABLE R.

*Cases seen at Coolgardie Sanatorium—other than Miners.*

### POSITIVE CASES.

| No. | Age. | Occupation. | Duration of Disease. | History of Contact. |
|---|---|---|---|---|
| 1 | 24 | Grocer | 3½ years | Mother died from tuberculosis six years ago; living in same house with present subject. |
| 2 | 20 | Grocer | 8 months | Companion died from tuberculosis 18 months ago. |
| 3 | 19 | Clerk | 18 months | Mother died from tuberculosis 13 months ago; living in same house. |
| 4 | 48 | Prospector | 2 years | Four years ago worked and camped with consumptive man for four months. |
| 5 | 17 | No occupation | 7 months | Half-caste boy came from Residential Mission where several cases of tuberculosis had occurred. |
| 6 | 14 | Modeller's apprentice | 7 months | Father now ill with tuberculosis; uncle died from same disease. |
| 7 | 23 | Electrician | 6 years | Lived with consumptive cousin for period of six weeks three years before onset. |
| 8 | 23 | Telephone engineer | 16 months | Friend consumptive, who was ordered to leave England four years ago. Present subject was also in contact with two consumptives on same work. |
| 9 | 43 | Draper | 18 years | Brother and sister died from tuberculosis 20 years ago. |
| 10 | 49 | Packer | 12 years | Sister died phthisis eight years ago; slept with a consumptive patient for 20 years. |
| 11 | 57 | Marine stoker | 4 years | Wife died phthisis 20 years ago, also son two years ago; also married daughter and her child. |
| 12 | 37 | Clerk | 7 years | Father died phthisis 26 years ago; mother died 30 years ago; brother nine years ago—both phthisis. |
| 13 | 43 | Canvasser | 9 years | Sister died from phthisis. |
| 14 | 38 | School teacher | 5½ years | Brother died from phthisis two years ago, after 1½ years' illness; sister died from phthisis when present patient was an infant. |

### DOUBTFUL CASES.

| | | | | |
|---|---|---|---|---|
| 1 | 64 | Clergyman | Something less than six years | Three years ago occupied a room vacated by a consumptive. |
| 2 | 58 | Engineer | 16 years | Numerous mates affected with chest trouble in Queensland, where he was mining. |
| 3 | 25 | Clerk | "Since childhood" | Schoolmate died of consumption at age of fourteen. |
| 4 | 48 | Hotel-keeper | 4 years | Slept in same room prior to onset with a man probably affected with tuberculosis. |

## TABLE S.

*Age distribution of all Men examined, classified according to the abnormal conditions discovered.*

| | Early Fibrosis. | Intermediate Fibrosis. | Advanced Fibrosis. | Emphysema. | Pleurisy. | Tuberculosis.* | Normal. | Totals. |
|---|---|---|---|---|---|---|---|---|
| 15–20 | .. | .. | .. | .. | 2 | 2 | 48 | 52 |
| 20–25 | 16 | .. | .. | .. | 33 | 6 | 199 | 254 |
| 25–30 | 39 | 2 | .. | .. | 41 | 16 | 288 | 386 |
| 30–35 | 76 | 8 | .. | .. | 35 | 17 | 285 | 421 |
| 35–40 | 78 | 11 | 1 | .. | 36 | 11 | 226 | 363 |
| 40–45 | 74 | 9 | 1 | .. | 21 | 9 | 153 | 267 |
| 45–50 | 43 | 7 | 1 | 1 | 23 | 3 | 73 | 151 |
| 50–55 | 29 | 5 | 2 | 1 | 6 | 1 | 50 | 94 |
| 55–60 | 18 | 3 | 1 | 1 | 4 | .. | 15 | 42 |
| 60–65 | 5 | 5 | .. | 1 | .. | .. | 4 | 15 |
| 65–70 | 1 | .. | .. | .. | .. | .. | 1 | 2 |
| 70–75 | 1 | 1 | .. | .. | .. | .. | 1 | 3 |
| | 380 | 51 | 6 | 4 | 201 | 65 | 1,343 | 2,050 |

* Includes Sanatorium and Miscellaneous cases, also "doubtful tubercular" cases.

## PART III.—EXPERIMENTAL AND PATHOLOGICAL.

*Post-mortem examination No. 1.*

This post-mortem examination was made upon the body of a man who was not a miner, but had been for some years a boot-black in Kalgoorlie. It was clear that he had never been a miner, but there was some uncertainty as to the occupations he had followed during the early parts of his life. He was over seventy years of age at the time of his death. The cause of his death was a fall producing a large fracture of the skull. There is nothing of interest in the condition of the other organs besides the lungs to call for comment.

The *lungs* showed a distinct mottling from the deposition of dust within their substance, but there was on macroscopic examination no indication of the existence of any fibrotic process having taken place. The lungs were emphysematous and very soft and pliable, quite different from the hard resistent lung of the man affected with fibrosis.

The illustration (Plate 2) shows the mottling of the surface of the lung due to the dust. In this plate there is nothing to be seen of any interest except the mottling; but in Plate 3 there is represented another part of the same lungs, and in this are seen two nodules of tuberculosis.

This Plate 3 illustrates well the difference between the two conditions, the deposition of dust in the lung, and early tuberculosis.

On microscopic examination the changes that had taken place in the lung were found to be as follows:—

The lungs, as has been said above, showed a distinct mottling under the pleurae. On one section these mottlings were plainly visible as collections of dust, and these collections of dust were surrounded by a limited areola in which fibro-blasts were the predominating cellular element, and in which the degree of vascularity was low. In other words, the dust, having been collected into small aggregations under the pleura, these aggregations bêcame enclosed by fibrous tissue; but this fibrous tissue was very limited in amount, and its organisation was proceeding slowly.

Around the bronchioles and small vessels there were small collections of dust, and these collections were, just as were those under the pleura, surrounded by a narrow ring of early fibrous tissue. This ring of fibrous tissue was not large enough, nor sufficiently organised, to produce any constriction of the lumen of the vessel it surrounded.

This case was very illuminating, for it was an instance of an ordinary person, *i.e.*, a person not in any way especially exposed to the action of dust, in whose lungs was the accumulated dust of many years. It is a well-known fact that the lungs of people who have lived for years in cities show after death a mottling due to the deposition in the lung tissue of the dust that they have breathed during several years, but the microscopic sections of the lungs from this man of over 70 years of age show that this dust produces in the lungs exactly the same changes that occur in the lungs of miners who inhale very large quantities. *There is, however, an important difference* between the lungs of the miner and the lungs of the aged non-miner. The dust in the lungs of the non-miner is inhaled in such small quantities and over such a long period of time that while the changes produced in the lung are *essentially* the same, yet they take place so slowly and to such a slight extent that no harm results to the affected man; whereas in the miner who inhales large quantities the changes are severe and extensive, and so harm is done in a comparatively short time.

The case, taken in conjunction with the other pathological evidence, to a certain extent justifies the statement that when dust is inhaled more or less continuously for any extended period then fibrosis will *always* be produced; the degree of fibrosis being directly proportionate to the amount of dust inhaled and to the continuity of the inhalation.

It is hardly necessary to point out that the nature of the dust is a factor of the greatest importance in determining the degree of fibrosis. It is probable that the dust inhaled by the old man in post mortem No. 1 was of a far less irritating character than that inhaled experimentally by the animals, and industrially by the miner who was the subject in post mortem No. 2. But there is no direct evidence that this was so, and therefore nothing more can be done here than to point out that the effect produced by dust will probably vary in degree according as the dust inhaled consists of rounded unirritating, or of sharp, irritating particles.

*Post-mortem examination No. 2.*

This examination was made on the body of a young man killed in an accident on a mine. The man was twenty years of age at the time of the accident and the complete record of his mining experience was as follows:—He had been prospecting with his father for one year and was then engaged as a battery hand for the next two years up till the time when he met his death at his work.

By the courtesy of Dr. R. M. Mitchell, of Coolgardie I was enabled to see part of the upper lobe of the right lung, and the tissues round the root of the same lung. The bronchial glands were affected as follows: the upper one of the two which were lying together was deeply pigmented but was not increased in size; the lower one of the two was very much increased and was a caseating mass of broken down tubercular tissue.

The pleura over the portion specified was very much thickened, the thickening consisting of loose newly organised exudate, while the substance of the lung was more solid than normal, though this solidity was not of the typical red hepatisation appearance.

Under the pleura, when this was dissected back, there appeared numerous collections of pigment.

On microscopical examination it was seen that these collections of pigment were due to aggregations of dust particles under the pleura, and that the alveoli were completely filled with material composed of red

cells, exudate, leucocytes, epithelial cells from the alveolar walls, and dust. The leucocytes were in marked excess, and the dust was partly loose in the exudate, but mostly enclosed within the leucocytes.

There was no evidence of commencing fibrosis, but the dust was just beginning to be laid down in the lymphatics around the small vessels and round the bronchioles.

It is interesting to notice that though the lung condition is very similar to that found in the experimental animals in Experiments 2 and 3, yet in these latter there was no indication of the pleuritic inflammation that was so marked a feature of the lung in the present case.

The existence of the tubercular gland was a noticeable feature in this post mortem, and it at once led to the inquiry whether there was any other member of the family affected with any form of tuberculosis. I am indebted to Dr. Ellis for the information that he had at the time of inquiry a brother of this subject under treatment for tuberculosis of the lungs.

This fact of the existence of tuberculosis in another member of the family explains at once the tubercular gland, and the possibility of the pleurisy being tubercular in origin must not be overlooked when its causation is being considered.

Plate 4 shows the bronchial glands in this case, and Plate 5 shows the apex of the lung with the very marked pleuritic adhesions.

## PATHOLOGY OF FIBROSIS AND OTHER AFFECTIONS OF THE LUNGS AMONGST MINERS.

Before the causes of the various abnormal conditions described in the earlier parts of this report can be understood it is necessary to obtain a clear idea of the nature of the structural changes that have taken place in the lungs and which produce the combinations of symptoms and signs already discussed.

The most important of the clinical conditions is undoubtedly fibrosis, and to this the greatest amount of attention will be paid. There is no necessity for speculation upon the pathological changes present in an advanced case of fibrosis, for these have been minutely and exactly described by Dr. F. W. Andrewes (Annual Report of the Chief Inspector of Factories, England, 1900). The description given by him will therefore be adopted, and the following paragraph from the report quoted will be reproduced, as it contains a condensed account of the pathology of fibrosis:—

"The inhaled mineral particles are in the first place deposited uniformly in the pulmonary parenchyma. They are at once taken up hence by the lymphatics and carried along by the lymph stream. The lymphatics have a perivascular, peribronchial, and subpleural distribution, and in these situations the mineral matter specially accumulates because the amount is greater than can be got rid of by the lymphatics. It is here chiefly found enclosed in cells (phagocytes), and exercises an irritant action leading to the production of new fibrous tissue in these situations. The fibroid areas increase at the expense of the adjacent lung in part at least by the development of a localised broncho-pneumonia, and in part by thickening and induration of the alveolar walls. When the fibrous tissue is fully formed the cells containing the mineral particles break up and degenerate, and the particles again lie free amongst the fibrous tissue. By the spread and coalescence of the fibroid areas, the lung tissue in the most advanced areas completely disappears. A secondary tubercular infection has now taken place, and miliary tubercles appear in scanty numbers in the fibroid areas."

Plates 13 and 14 illustrate well the collection of the dust particles around the vessels and the bronchi. These plates are micro-photographs from slides in the collection in the laboratory, and are not specimens prepared by myself.

The later stages of the disease are therefore clearly understood, and all that is necessary is a comprehension of the earlier and intermediate stages. No reference could be found which threw any light upon the pathology of these earlier stages, and therefore an attempt was made to obtain some information experimentally. The methods used and the results obtained will now be described. In setting out these results the restricted scope of the experiments, and the limitations of the deductions are fully realised, and an endeavour will be made to keep within the bounds of legitimate deduction.

*Experiment* 1.—As Calmette and others have shown good grounds for their contention that the avenue of infection in cases of tuberculosis of the lungs is the intestinal tract, it was thought desirable to commence by endeavouring to ascertain whether the digestive canal was the route followed by particles of mineral dust at their entry into the body on their way to their ultimate resting place—the lungs. (Dr. Andrewes' observations were accepted as sufficient warrant for assuming that late fibrosis was produced by mineral dust in the lungs.)

29-12-09.—A rabbit was fed on a mixture of bread and grated carrot well moistened to form a semi-liquid mixture. With the bread and carrot was well mixed some fine quartz dust (meshed through 100 to the inch mesh). There was little likelihood of any of this dust finding its way into the lungs by inhalation. This food was given at 12.45 p.m.

30-12-09.—All the food was consumed and as additional argument against the contention that any of the food might have entered the lungs direct it was found that the dish containing the food was still moist.

30-12-09.—Noon. Animal killed.

*Post-mortem.*—

Mesenteric glands.—These glands were found to be very heavily charged with particles of the dust—this dust being partly within leucocytes but mostly extra-cellular.

Thoracic duct.—This duct was found to contain a fairly large amount of dust particles, mostly within leucocytes.

Blood from the right ventricle.—Enclosed within leucocytes in this blood was about the same relative amount of dust as was seen in the lumen of the thoracic duct.

Section of the lungs.—There were undoubtedly seen in the lung tissue small collections and isolated particles of dust. These were within the alveolar walls, but there were none within the alveoli, and there was no evidence of any local reaction caused by their presence.

Liver.—Sections of the liver showed no particle of dust.

The deduction warranted by this experiment therefore is that dust particles swallowed and passing into the intestines can find their way within twenty four hours to the lungs, but only in very small quantities and not within the alveoli or causing local reaction. It may of course be that if the treatment

was continued for prolonged periods other results might follow. It became of interest then to ascertain whether this method—the digestive, or the direct respiratory method was the more important in respect of the production of fibrosis. Experiment 2 was therefore carried out.

*Experiment* 2.—A box was constructed of the following dimensions: 12 inches long, 11 inches broad, and 9 inches deep, with an inlet and an outlet opening. The top of the box was of window glass in a wooden frame which could be screwed down so as to exclude all air and prevent the escape of dust. Close to the inlet opening was placed a receptacle containing dust which by means of a bellows connection to the inlet opening could be blown into the interior of the box.

The dust used in this and in all succeeding experiments was quartz dust meshed through a 100 to the inch mesh. I am indebted for this graded dust to the courtesy of the authorities of the Kalgoorlie School of Mines.

At 11.30 a.m. a rabbit was placed in this box and at intervals the dust was sprayed freely into the box by means of the bellows. This was continued until 4.30 p.m. of the same day when the animal was killed. That is, the animal had been exposed to the action of the dust for five hours, and the only abnormal factor operative besides the dust was the impurity of the air from the rabbit's own respiratory products. These respiratory impurities were removed with each application of the bellows, for the pumping was vigorous.

*Post-mortem.*—

Trachea.—The mucous membrane of the trachea was highly congested, and the lumen was almost filled with a blood-stained mucus. In the plate (Plate 6) there can be seen (marked A) a collection of what was practically pure blood.

Lungs.—All the bronchioles were in the same condition as the trachea, *i.e.*, contained mucus and blood. Microscopic sections showed that the alveoli over a large portion of the lungs were filled with an exudate which consisted almost entirely of red corpuscles, accompanied by a much larger proportion of leucocytes than is normal.

The walls of the alveoli were marked out prominently even under a low magnification by the excessive number of leucocytes.

Within the alveoli were numerous particles of dust many of which were enclosed within leucocytes, the remainder lying free amongst the red cells.

The leucocytes within the alveolar walls also were packed with dust particles, but there was no evidence of any attempt at depositing these dust particles in the peri-vascular or peri-bronchial lymphatics.

All the blood vessels contained an excessive proportion of leucocytes.

Mesenteric glands.—No dust particles could be identified within these glands.

Therefore the deduction that appears to be justified from these two experiments is that the conditions of Experiment 2 are more likely to produce dust irritation of the lungs than the conditions of Experiment 1.

So that reading these experiments with those that follow it may be concluded that the miner is affected through the direct inhalation of dust particles to a very much greater extent than through the ingestion of the dust, if indeed this latter method plays any part at all.

*Experiment* 3.—A guinea-pig was placed in the box and subjected to the same conditions as the rabbit in Experiment 2. The treatment of this guinea-pig commenced on 1-8-10 and was continued for an hour each day (one day—Sunday, excepted) until 8-8-10, when the animal died.

*Post-mortem.*—

Lungs.—The description of the lungs in the rabbit in Experiment 2 may be taken as accurate for this guinea-pig. There was no attempt at deposition of the dust in the peri-vascular and peri-bronchial lymphatics as is described by Dr. Andrewes for the advanced stages of dust irritation.

As this animal was being subjected to treatment for another purpose than ascertaining anything about the avenue of entry of the dust, the mesenteric glands were not examined.

In view of remarks that will be made later on it is of importance to note here that neither of these two animals (Exp. 1 and 2) showed the slightest evidence of any pleuritic reaction.

At this point attention must be drawn to the notes in connection with *post-mortem* No. 2 (page 63). This was a lad of 20 years of age who had been working as battery-hand for two years and met his death suddenly by an accident on the mine. The microscopic examination of the lungs from this body had shown exactly the same pathological conditions as has been described for the rabbit in Experiment 1, except that collections of dust are just beginning to be laid down in the peri-vascular and peri-bronchial lymphatics.

*Experiment* 4.—A rabbit was placed in the box for an hour each day and for the first 15 minutes the dust was blown freely into the box, for the rest of the period the dust was allowed to subside. This was continued daily from January 14th, 1910, until March 13th, 1910 (Sundays excepted).

After the latter date the rabbit was allowed to run in the yard with the other animals under normal conditions and without being further subjected to the dust until August 5th, 1910, when it was killed. For a month prior to its death it had been getting progressively thinner and weaker. The trachea bronchi, and large bronchioles, showed no evidence of irritation. The external aspects of the lungs showed a distinct mottling from aggregations of the dust under the pleura. This is portrayed in Plate 7, where the collections of the dust are plainly visible.

The pleura was otherwise both macroscopically and microscopically absolutely normal.

On making sections and examining them microscopically, it was found that the dust had affected the lungs in a patchy distribution. Fine particles of dust were still to be found in great numbers in the alveoli, but the most of the dust had become collected into deposits. These deposits were invariably found around the periphery of either a bronchiole or a small blood vessel. In those patches of the lung where the dust had produced some reaction the alveoli were found to be filled with red blood cells, exudate and leucocytes. In the leucocytes there were abundant particles of dust and in each of the alveoli there were seen to be some fibroblasts and occasional epithelioid cells. Evidently therefore the alveoli were becoming obliterated and their place being taken by organised fibrous tissue.

In those places where the dust had been deposited around the vessels or the bronchioles, the dust was seen to be collected into small circumscribed masses —these masses being separated by, and the whole col-

lection being surrounded by, collections of fibroblasts and scattered epithelioid cells; many of the fibroblasts had developed into spindle-shaped cells giving parts of the section a definite fibrillated appearance.

It has been said that the local reaction was patchy in distribution throughout the lungs—it was noticeable that these patches of reaction were invariably situated in the neighbourhood of the larger bronchioles.

Those collections of dust which have been described as occurring around the vessels and the bronchioles were to be found about equally frequently in association with the vessels and with the bronchioles.

The deductions from this experiment are that the dust inhaled by this rabbit produced a marked exudate into the alveoli, which later became partially organised and which, if left, would have become definitely organised fibrous tissue. At the same time the leucocytes had been busy surrounding the dust particles and carrying them off along the lymphatics. They progressed along these lymphatics at first as far as the bronchial glands (for these glands were found to be deeply pigmented) and then at a later stage they had only managed to get as far as the lymph-vessels around the blood vessels and the bronchioles, in which places they had been deposited to form small localised collections of dust. These small collections of dust had set up a local irritation which produced leucocytic invasion and later the production of fibroblasts, resulting ultimately in organisation. This organisation was actively going on in spite of the fact that the rabbit had not been exposed to the action of dust for five months before examination. This fact alone is almost sufficient to throw a doubt on the statement frequently made that provided a man stops working in dusty places the progress of the disease is arrested. It is certain that in this rabbit the process of organisation was still actively going on.

There is another point brought out by this experiment. Dr. Andrewes says (*loc. cit.*, page 487):—"The development of the fibroid nodules appears to take place in the first instance around the small arteries, veins and bronchi. . . . It is not possible to be sure that all the young fibroid nodules have this peri-vascular or peri-bronchial origin."

But the examination of the fibrotic process in this rabbit makes it clear that the development of fibrous tissue takes place in the affected alveoli *simultaneously* with that around the vessels and bronchi.

*Mice from the Fingall mine.*—These mice had been obtained for the purpose of ascertaining whether they had any signs of tuberculosis amongst them. This was not found to be the case, but the state of their lungs otherwise was interesting. With the exception of one of the five all showed the same condition. All were of about the same age and presumably all had been living under the same conditions. On opening the chest it could be seen that the surface of the lungs showed dark spots to the number of three or four on each lung. The pleurae were absolutely normal.

On section on microscopic examination it was found that these spots were collections of dust, showing through the pleura and that there were principally collected round the large vessels and bronchi, which formed the hilum of the lungs.

There is no need to describe in detail the actual conditions found for these were identical in every respect with those which have been already described for the rabbit in Experiment 4.

It may safely be concluded from the identity of the changes in these lungs with those seen in the lungs artificially affected that the experiment faithfully represents the actual working conditions in the mines.

## MINE INFECTION.

It was considered desirable to ascertain whether there was any foundation for the hypothesis that the workings of a mine were infected by the sputum from a tubercular person. This was attempted in two ways:—

A. In each of two mines in which it was known that there had recently been tuberculous miners at work some of the surface dust at the crib places was taken into a sterile bottle. In each of the mines the samples of dust were taken from several of the crib places.

   This dust was then thoroughly mixed with sterile water and, after allowing subsidence of the heavier particles to take place and lightly centrifuging, some of the water with its suspended particles was injected into a guinea-pig. For each mine there was a separate guinea-pig.

   These guinea-pigs were killed, one after six weeks and the other after two months, and very carefully examined. In neither was there any sign of tuberculosis.

B. From the Fingall mine, where there were known to have been cases of tuberculosis recently working, five mice were trapped and examined, and about a dozen cockroaches from the workings were also examined. In none of the mice or the cockcroaches was any sign of tuberculosis. The mice, however, gave indications of having inhaled considerable quantities of dust, as has just been described.

Had there been any infection of the soil in the mine some indication of it might possibly have been found in the dust at the crib places, and it is almost certain that, if the mine workings had been producing tuberculosis amongst the miners to any extent, they would have produced tuberculosis amongst the mice living in the mine. As both methods of investigation gave negative results, even in spite of the limited number of observations, it is reasonable to conclude that mine infection is not so important a factor in the production of tuberculosis as personal infection has been shown to be.

## CAUSATION OF THE PLEURISY MET WITH IN MINERS.

An endeavour was made to obtain some indication of the causation of the pleuritic adhesions common amongst miners. The two factors considered likely to have influence in this direction were cold and dust. Several facts became available from other sources than those experiments directly performed for the purpose:—

1. The five mice in the Fingall mine showed, as has been described, obvious deposits of dust under the pleura; and as they were all adults it is reasonable to assume that they had been in the mine, and therefore exposed to the intermittent action of dust for at least a year. The pleurae, however, were absolutely normal.
2. The rabbit in Experiment 4 had been subjected to the action of dust daily for 60 days and afterwards was allowed to live under normal conditions for five months. As has been stated, there were large deposits of dust under

the pleura sufficiently large to be clearly visible in the illustration (Plate 7). The dust had also produced considerable reaction in the lung tissue. The pleurae were, however, absolutely normal.

3. Coal miners who are exposed only to the action of a dust which is generally supposed to be almost, if not entirely, free from irritative properties, showed a percentage of 22.5 affected with pleurisy.

   It must be considered, therefore, as sufficiently demonstrated that dust alone does not produce irritation of the pleura leading to adhesions.

4. A guinea-pig was taken, and an area of about half an inch square was shaved over the anterior of the chest wall. The guinea-pig was then subjected to the following rapid changes of temperature:—

   July 21st—30 minutes in incubator at 37 deg. C., and at once transferred to the ice-chest and left there for 10 minutes.
   July 22nd—30 minutes incubator; ice-chest 15 minutes.
   July 23rd—30 minutes incubator; ice-chest 15 minutes.
   July 25th—45 minutes incubator; ice-chest 25 minutes.
   July 26th—45 minutes incubator; ice-chest 30 minutes.
   July 27th—45 minutes incubator; ice-chest 30 minutes.
   July 28th—60 minutes incubator; ice-chest 30 minutes.
   July 29th—60 minutes incubator; ice-chest 30 minutes.
   July 30th—60 minutes incubator; ice-chest 30 minutes.
   August 1st—Killed.

   The post-mortem showed both lungs and pleura to be absolutely normal. So far as this one observation goes, then, it seems to indicate that rapid and extreme changes of temperature do not of themselves inevitably produce pleurisy.

5. The account of the post-mortem findings in the case of post-mortem No. 2 includes the statement that there was abundant exudate from the pleura at the apex of the lung, and that was accompanied by marked reaction in the lung tissue. The exudate is clearly shown in Plate .

6. The following is the account of an experiment performed with the object of finding out what would be the result of the combined action of dust and rapid changes of temperature upon a guinea-pig:—

   *Experiment* 5:—

   A guinea-pig of weight 26oz. was taken and for one hour each day (Sundays excepted) it was subjected to the action of dust in the box, in a similar fashion to that described for the other animals. This treatment was continued from August 9th, 1910, until August 22nd, 1910. On the latter date an area of about half an inch square over the base of the right lung was shaved clean, and thereafter the animal was placed each day for an hour in the incubator at 37 degrees, and at the end of the hour was transferred at once to the ice-chest, the dust treatment being continued all the while. This continued exposure to dust and to cold was continued until September 9th, when the animal was killed.

   On post-mortem examination there was no evidence of any affection of the pleura. The lungs were more solid than normal and were "congested." There were no collections of dust under the pleurae, though there were some spots darker than the rest of the lung which may have been the beginning of such collections.

   On microscopic examination the lungs showed changes intermediate between those of the guinea-pig in Experiment 3 and the rabbit in Experiment 4. There is no need to describe these changes in detail; there was early fibrosis in the affected alveolar areas, but as yet no appearance of fibro-blasts around the blood-vessels or bronchioles.

The distribution of the friction sounds heard during the examination of the men is in favour of the hypothesis that the pleuritic inflammation is largely produced by the action of the cold, for the friction sounds are heard most frequently in those situations where there is least muscular covering for the thoracic viscera, and where the clothing worn by the men offers the maximum of exposure to the same viscera.

The causation of pleurisy, then, must be considered as somewhat obscure, inasmuch as the evidence available does not throw any light upon the causation of this condition amongst miners. It may be provisionally considered that dust and cold both play a part, though the relative importance of these two factors cannot at present be assessed. The possibility of these pleuritic changes being tubercular in origin was considered; but it was found very difficult to either eliminate or substantiate this possibility. It would seem to be probable, if these friction sounds all owed their origin to tubercular infection, that there would have been a much larger number of cases of pulmonary tuberculosis met with. The rarity of the latter disease amongst coal-miners, when considered together with the frequency of pleurisy amongst those men, favours the hypothesis that pleurisy amongst miners is non-tubercular in origin.

Dr. Landry arrives at the following conclusion, based on an analysis of 1,374 consecutive post-mortem examinations:—

"It is, we think, impossible to escape the conclusion that there are two approximately equal orders of cases of pleural adhesions—one of tuberculous, the other of non-tuberculous origin—a conclusion which, after all is the more rational, the more in line with our experience of chronic inflammation affecting other regions of the body." *

It has been stated frequently in this Report that exposure to rapid changes of temperature is responsible for some at least of the damage to the lungs and pleurae in miners. It is necessary to show that such extremes of temperature exist in the mines in which the men work.

In Appendix K will be found actual observations taken by myself and by the Inspectors of the Mines Department in some of the mines of the State.

From these it is at once apparent that extremes of temperature do exist. For example, in the Black Range mine at Sandstone, observations taken on June 24th showed that the temperature in one part of the No. 5 level was 81 degrees, while at the same time the temperature at the No. 3 plat through which the

* Transactions Sixth International Congress on Tuberculosis, Washington, 1908, Vol. I., Part I., Page 339.

men would have to pass on their way to the surface was only 65 degrees, while the surface temperature on the same day was 63 degrees.

Also, observations taken by myself showed the following temperatures:—

South Kalgurli mine.—Surface temperature 52 degrees; dead-end lowest level temperature 70 degrees.

Great Boulder mine.—Surface temperature 55 degrees; plat (2,650 level) temperature 70 degrees; South end (2,650 level) temperature 77 degrees; North end (2,650 level) temperature 76 degrees.

A miner on coming to the surface, therefore, is subject to a fall in temperature of as much as 21 degrees.

From the facts ascertained by these experiments, then, some light is thrown on the nature of the fibrosis clinically seen amongst miners. In the main they are in entire accord with the observations of Dr. Andrewes made from the study of lungs affected with an advanced stage of the disease. Dust in the lungs always irritates the lungs, setting up the development of fibrous tissue which acts in three ways inimical to the person affected:—

1. Comparatively large areas of lung tissue are solidified, and therefore cannot take any part in the aeration of the blood.
2. As the fibrous tissue around the bronchi organises, the lumen of each bronchus becomes contracted and ultimately obliterated, so that less air can enter the lungs.
3. As the fibrous tissue round the arterioles organises, the lumen of these vessels becomes contracted and ultimately obliterated, so that less blood reaches the lungs.

There is to be found here, then, an obvious explanation of the shortness of the breath which is one of the earliest symptoms in this disease. The constriction of the arterioles leads to increased energy on the part of the right side of the heart and produces the hypertrophy and other signs of right-heart involvment including the cyanosis.

None of the facts revealed by these experimental results throws any light on the causation of the rigidity and contraction of the chest-wall which is an almost universal accompaniment of the early fibrosis. Nor does it explain why, while the majority of the fibrosis cases amongst machine men were of the contracted type associated with rigidity, yet some of these cases were of the emphysematous type with a "barrelness" of the chest.

The first question to be answered is, "Can fibrosis of the lungs produce a rigidity and lack of expansion of the chest-wall?" To answer this, the question must first be raised, "What is the physiological reason why the lungs expand?" It is clearly established that the lungs expand because the chest-wall is first expanded. It is therefore somewhat idle to expect that because the lungs are fibrotic that the chest-wall will not expand. As a matter of fact what would be likely to happen would be that the chest-wall would go on expanding as usual, but the lungs by reason of the loss of elasticity consequent on the fibrosis would be passively dilated by the air-pressure inside the alveoli and the pressure induced by coughing, and therefore a condition of emphysema would result. This is what is actually seen in the minority of cases. On the other hand, in the majority of cases seen there is no "barrelling" of the chest-wall, but a flattening and contraction. In these cases there is almost inevitably found dense pleuritic adhesions, which will explain the rigidity, the flattening, and the lack of expansion. It will be seen on page 41 that non-machine miners are the subjects of emphysema four times as frequently as machine men, and the reason is probably that these men are very much less exposed to dust than the machine men and are exposed less to extremes of temperature.

The kernel of all this argument is that the normal clinical type of fibrosis is the emphysematous, and the fact that the common type is the rigid and contracted one is due to the supervention of another factor—the pleuritic adhesions resulting from exposure to rapid changes of temperature. That the lungs which are in the early fibrotic stage are more susceptible to the harmful action of sudden cold, there can be little doubt, for these pleuritic adhesions are seen most typically in the men who are most often the subjects of early fibrosis; and it is a significant fact in this connection that the machine men show their early fibrosis and their pleuritic friction at exactly the same stage in their machine work, *i.e.*, the third year after they have commenced machine work (page 43). That dust alone does not produce pleuritic adhesions has been sufficiently shown on page 67.

Herein is also found the explanation of those cases which I have grouped in the early fibrosis group, viz., those cases in which there is definite shortness of breath but in which there is no pleuritic friction and in which the expansion though generally not very great is yet of the normal type and does not show the characteristics which I had already on clinical grounds laid down as indicating a rigidity which may be considered as normal, and as indicating the presence of early fibrosis. As has been said (page 73), the actual amount of expansion in inches is not of so much importance as the *manner* in which the chest-wall behaves when an attempt at expansion is made.

In those cases in which there is shortness of breath but no rigidity, the explanation is that the lungs have become fibrosed but there has been no great amount of pleuritic adhesion and therefore no rigidity, and in the single case in which there was shortness of breath and pleuritic friction, this friction was only observed over a small area over the right upper lobe and was not sufficiently extensive to cause rigidity. The amount of friction was not enough to produce any effect on the expansion of the chest.

In short, pleuritic adhesions, with their consequent rigidity and contraction of the chest-wall, are not to be considered as an integral part of the fibrotic process, but as another condition generally associated with, but distinct from, the fibrotic process.

I am inclined to think that that one case which showed shortness of breath with a small localised patch of friction over the right upper lobe represents a transition case between the cases with shortness of breath alone and the cases showing both shortness of breath and the rigidity which I have described as typical of the rigid type of early fibrosis. For, as has been explained, the rigidity is observed most noticeably within the triangle which corresponds to the upper lobe of the lung and there is no rigidity over the lower ribs, where it is exceptional to find pleuritic friction on clinical examination.

The normal march of a case of fibrosis is as follows:—The dust first produces the fibrosis of the lung, and then the next step depends upon whether pleuritic adhesions supervene or not. If they do not supervene then the case goes on to become emphysematous: if they do occur then the case becomes one

of the rigid type described. This latter is the most common, but the fact that the emphysematous type does sometimes occur is an additional argument in favour of the hypothesis that it is not the dust alone which produces the pleuritic manifestations, but that there is some other factor at work.

It may here be briefly stated that the normal *clinical* type of early fibrosis is the rigid; while the normal *pathological* type is the emphysematous.

The reason for the secondary cardiac manifestations are now clear. The fibrotic process in the lungs produces a marked diminution of the available aerating space in the lungs, and at the same time the lumen of the bronchioles is constricted so that the net result is that there is not sufficient aeration of the blood. Add to this that the lumen of the blood-vessels is so constricted as to have a marked effect on the amount of blood reaching the lungs and there is at once a sufficient explanation of the hypertrophy of the right ventricle.

The experimental evidence is clear on one point, viz., there is no arrest of the fibrotic process when the animal is removed from the dusty environment. This throws considerable doubt on the commonly accepted idea that when a miner stops mining his condition is arrested though not cured. The clinical evidence is in favour of this arrest, so that on the whole the question of what happens when a man already in the early fibrosis stage ceases mining and takes up some other work, farming for example, must still be regarded as *sub judice* with the balance of theory in favour of the continuance of the fibrotic process up to the point when all the dust has been surrounded by a firmly organised ring of fibrous tissue. Whether attacks of "colds" will induce a renewed activity of the inflammatory process is entirely a matter of speculation, but is a point upon which further evidence would be very desirable.

*Pneumonia.*—The experiments throw a good deal of light upon the frequency with which pneumonia attacks miners. The guinea-pig in Experiment 3 died after eight days' exposure to dust from what can only be described as acute congestion of the lungs. It is to be presumed from this, as well as from the rabbit in Experiment 2, that when a young man first becomes exposed to the action of dust his lungs quickly develop very much the same condition as was seen in these animals, and therefore he is very liable to the attacks of the organism of acute pneumonia, which are known to be very frequently present in the normal lung. This will explain why it is that pneumonia as a cause of death is on the decrease among miners in this State, for in the first years of the last decade many men took on machine work for the first time, and therefore the death-rate from pneumonia was unduly high. But now that the susceptible individuals have been weeded out there remain the men who have successfully passed through the stage when they were liable to pneumonia, and there are therefore, as might have been expected, in the stage of early fibrosis.

We are now in a position to understand the fact pointed out on page 16, viz., that those who died from pneumonia were for the greater part under 45 years of age, while those who died from asthma and the other chronic diseases were mostly over 45 years of age, and the facts given above explain the reference on page 17.

*Effect upon the miners of alterations in the barometric pressure of the air in which they work.*

It occurred to me as possible that the rapid alteration in the air pressure to which men are subjected on coming to the surface from deep mines might have some effect on the lungs.

Observations were taken to determine what amount of change in the air pressures actually existed.

Without going into detail, it may be at once said that from numerous observations it was found that the generally accepted rule was approximately correct, viz., that the pressure of the air increases to the extent of one inch of mercury for every 900 feet of descent.

In such a mine as the Great Boulder where the lowest level is at 2,650 feet the men will be rapidly decompressed on coming to the surface to the extent of about 3 inches of mercury, *i.e.*, about one-tenth of an atmosphere.

I was not able to find any evidence that such changes in pressure were accompanied by any effect on the health of the men or on the structure of the lungs; and the only reference in the literature of the subject that I can find that has any bearing on this point is the following extract from an article by Dr. Boycott and Lieutenant Damant.*

> "It is a fact well known to those practically acquainted with work in compressed air that even with very rapid decompression there is no risk of caisson disease unless the pressure has exceeded a certain amount. It seems perfectly clear that no symptoms occur with less than one atmosphere of excess pressure, however long the exposure may be. Whether any distinct symptoms ever occur with less than about 1.25 atmosphere seems very doubtful; at any rate they are very exceptional."

It will be noticed that the above quotation refers only to the general effects produced by the absorbed gases on the body. Whether there is any effect produced on the lungs by the alteration of the pressure of the air, there does not seem to be any evidence.

To sum up briefly the deductions arrived at from the evidence detailed: It seems clear that dust, and dust alone, is responsible for fibrosis; that the causation of pleurisy is somewhat obscure, but that here dust and cold both probably play some part; that there is not forthcoming any evidence to show that there are any other factors producing abnormal conditions in the lungs (except, of course, the tubercle bacillus), though the possibility of the rapid alterations of air pressure having some effect has been considered. It may be that these alterations of air pressure have some effect in the direction of producing emphysema, but this is pure supposition.

Finally, there is no evidence forthcoming that "mine infection" plays any part in the production of tuberculosis.

* Journal of Hygiene, Vol. VIII., No. 3, June, 1908.

## APPENDIX A.

### Circular sent to Medical men asking for details of any cases of Lung Diseases amongst Miners known of by them.

*Western* *Australia.*

ROYAL COMMISSION ON MINERS' PHTHISIS.

Perth, 11th April, 1910.

To.....

.....

With a view to obviating the necessity for summoning a large number of medical witnesses before the above Royal Commission, the attached form is being circulated among medical practitioners who, it is believed, are in a position to afford information likely to be of service to the Royal Commission as to the prevalence of lung diseases amongst miners.

Information is desired from you respecting any cases which have been under your care of miners' phthisis, or any other complaint of the lungs, amongst those following mining vocations.

If you will be good enough to furnish this information by completing the form and returning same to the Commissioner at your earliest convenience, there should be no necessity for your personal attendance before the Commission.

J. H. L. CUMPSTON,

Royal Commissioner.

| Name. | Age. | Occupation. | Mine employed at. | Address. | Clinical Type. | Probable Causation. | Tubercular or Otherwise. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

(Date).....

(Signed).....

## APPENDIX B.

### Card used in the Series of Examinations amongst Miners.

NAME..... Age.....
At present employed at.....G.M.....
Followed mining occupation for.....years at the following mining centres:—

.....Goldfield,.....State.
..... „ ..... „
..... „ ..... „
..... „ ..... „
..... „ ..... „

How long have you been mining in W.A. ?.....
Have you ever worked or lived with a phthisical subject ?.....
If so, give particulars (name of mine, etc.).....
Particular class of mining you have followed.....
Has any member of your household exhibited any symptoms of phthisis ?.....
Can you quote specific cases of phthisis directly attributable to mining ?.....
(SEE BACK.)
Would spraying, in your opinion, make the working conditions underground too onerous ?.....
Have you any objection to wearing a respirator underground ?.....
If so, state your reasons.....
.....
In your experience, are the mines in W.A. sufficiently ventilated ?.....
Are the working conditions here less satisfactory than those obtaining on mining fields elsewhere ?.....
If so, in what respect ?.....
Which occupation in a mine appears to you to be most prone to disseminating infection ?.....
Give your views on the subject of "change houses" ?.....

---

Result of sputum examination.....

[BACK OF CARD.]

To the best of my knowledge and belief the following cases of phthisis originated as the result of the patient following the occupation of a miner:—

| Name. | Mine at which disease was discovered. | Present Address of Patient. | Period of Mining. | | If dead, place of demise. |
|---|---|---|---|---|---|
| | | | In W.A. (years.) | Elsewhere. (years.) | |
| | | | | | |

*RESULTS OF CLINICAL EXAMINATION:*

## APPENDIX C.

## Clinical Standards upon which Lung Affections were Diagnosed and Classified.

The conditions found amongst miners were as follows:—

Early fibrosis.
Intermediate fibrosis.
Advanced fibrosis.
Pleurisy.
Tuberculosis of the lungs.
Emphysema.

The first of these was the one found to be numerically the most important.

*Early Fibrosis.*

This heading has been made to include four kinds of cases.

(a.) The first subdivision includes those cases in which the only indication of any departure from the normal was a subjective one. The man on being asked whether he had ever had anything wrong with his lungs replied that he had at the time of examination and for some time previously been noticeably short of breath. In this group of cases the examination of the chest revealed nothing abnormal. There were 15 of these cases.

(b.) The second subdivision includes those cases in which there was no very marked lack of expansion of the chest wall, and no sign at all of the rigidity of the type described below. Yet there was some lack of expansion of the chest wall, some "barrelness" of the chest wall, some lessening of the areas of cardiac and liver dulness, some dyspnœa, and often some degree of cyanosis. In short, the condition was one of early emphysema. In these cases there were no pleuritic signs. There were only three cases of this type.

(c.) The third subdivision included only one case. This case presented two distinct features, there was noticeable shortness of breath, and pleuritic friction over the front of the right upper lobe.

(d.) The fourth subdivision is the one which is to be considered as the one most likely to be met with. In this group the first indication is likely to be that the man notices that he is very liable to "colds," and that when these "colds" have been contracted he is unable to get rid of them for a long time, and not as quickly as he thinks he should do. Then he begins to find that his wind is not as good as formerly and that he cannot work so hard as before. He will still deny that there is anything the matter with his chest, but at the same time recognises well that his wind is "not too good." In these cases there is little or no expectoration except when a "cold" is present, and the man's general condition is excellent. He may have noticed at this stage that not infrequently he gets attacks of "stitch" in one or other side, most often along the sternum or in the axillæ. Upon examination of these cases the first thing to attract attention is the behaviour of the chest wall when the man is asked to expand his chest. There then appears a characteristic feature. In the normal chest the expansion upon full inspiration proceeds according to a regular series of steps. At the beginning of inspiration, when this is slowly performed and carried through to its completion it is seen that the lower ribs, from the sixth downwards travel upwards, forwards, and outwards, and presently become more or less stationary, then the sternum appears to be lifted upwards and forwards, and finally the upper ribs, i.e., the second to the fifth, travel upwards, forwards, and outwards, the final stage of full inspiration being represented by a sort of bulging movement of the triangle, whose angles are at the sterno-clavicular articulation, the acromio-clavicular articulation, and the nipple. It is not intended to suggest here that the expansion of the chest actually follows the above cycle, but it so appears to the observer.

Now, a very great amount of importance is to be attached to the behaviour of the triangle above described. Throughout the investigation it was found that no importance was to be attached to the expansion of the chest wall when this was judged by a tape measure, but the manner of expansion rather than the amount was the criterion to be valued.

In the cases of early fibrosis now being discussed the attempt at full inspiration induced the first stages of the above cycle as far as the termination of the sternal movement, but there the motion ceased. The triangle invariably remained almost rigid and the attempt at full inspiration brought forth instead a strong contraction of the muscles attached to the base of the skull, the cervical vertebræ, and the pectoral girdle.

When the term "rigidity" is used hereafter, it must be understood that the behaviour of this triangle is referred to.

For the rest, in these cases, examination of the lungs by auscultation revealed little, but on percussion there was frequently found an area of resonance over the upper part of what should have been the area of cardiac dulness, i.e., percussion dulness began in the fourth intercostal space. This latter, however, was not by any means a constant feature. No moist sounds were ever heard unless the man had recently been the subject of a bronchitic attack when the breath sounds were "rough" and occasional moist sounds could be heard.

When the man had recently had attacks of "stitch" there could be heard friction in one or other of the regions specified under the heading "pleurisy."

In such cases also there was not infrequently to be noticed a slight amount of dulling of the percussion note, generally of the axillæ, and generally over a very small area.

Such were the standards upon which the presence of early fibrosis was diagnosed.

*Intermediate Fibrosis.*

Included under this heading was a group of cases which is capable of subdivision into two sets of cases according to their signs and symptoms.

Both types of cases show a lack of expansion and poor mobility of the chest wall. In both there is noticeable shortness of breath, generally a cough which is almost continuous. In both there is frequently some cyanosis, and there may be evidence of hypertrophy of the right side of the heart produced by the effort either to send more blood to the lungs to compensate for the defective aeration, or to overcome some peripheral resistance to the circulation in the lungs. In both there are frequently attacks of what the men call "asthma," i.e., brief paroxysms of difficulty in breathing, but these attacks are in this stage rare during the sleeping hours.

While the two types have the above features in common there are distinct points of difference.

The one type shows on examination a rounded chest in which the intercostal spaces are obliterated, a fair degree of mobility but a poor expansion, a distinct diminution in the areas of cardiac and liver dulness, and rather "poor" breath sounds all over the

chest. There were no indications of pleuritic inflammation in any of the cases met with of this type.

This type is clearly emphysematous in its characteristics.

The other type shows on examination of the chest a flattened chest wall, the intercostal spaces being distinct, the subclavicular fossae being depressed, the chest wall also being almost absolutely immobile, and the expansion being at a minimum. That is, the chest is rigid according to the description given under the heading "early fibrosis," but this rigidity has reached its maximum. The breath sounds are in this type rather "rough," the roughening being noticeable both in the inspiratory and expiratory sounds. The area of liver dulness is not as a rule affected, but the area of cardiac dulness frequently shows a diminution from above downwards, the resonance being obtainable as far down as the fifth rib.

Of the twenty-three cases met with of this type six showed well marked friction sounds, while others had had pains in the chest.

These cases exhibit a characteristic feature at the end of an attempt to make a full inspiration. The muscles attached to the scapula come into play as well as those specified under the heading of "early fibrosis," and the action of these muscles gives a characteristic "hunching" to the shoulders.

In both the types of lung affections included under the heading of intermediate fibrosis there is a characteristic expectoration, the subject expectorating a large quantity of darkish-coloured sputum very soon after rising from bed. It may be that no more will be expectorated that day, except when the man is attacked with a "cold." Such attacks of "cold" are very frequent in these cases.

With all the above conditions the man is still able to do an average day's work, but he finds that his strength is now quite taxed to its full limit in doing an amount of work that formerly he could have done with ease.

*Advanced Fibrosis.*

In this condition, or stage, as it would be better termed, there is a progression of the two types described under the heading "intermediate fibrosis," but there is also a blending, as it were, of the emphysematous and the "contracted" types. There may be a progression of the condition along the typical lines of the classical emphysema, but with an increased immobility of the chest wall, and with increase in the circulatory difficulty; or there may be seen an almost perfectly rigid chest wall, but in this latter case there appears to be generally a development in the emphysematous direction as indicated by a progressive diminution of the areas of cardiac and liver dulness, but without any other alteration of the chest wall, except that the intercostal spaces may become to a certain extent filled out, but the flattening of the subclavicular fossae remains.

In both types the obstruction to the circulation is evidenced by the prominence of the superficial veins of the upper arm, by the hypertrophy of the right heart and the accentuation of the second pulmonary sound, and by the pronounced cyanosis. As the condition progresses the left heart shares in the hypertrophy, leading to displacement of the apex beat.

In this advanced condition both types display a persistent cough, and the asthmatical attacks become pronounced during the sleeping hours. The violence and persistence of the cough may bring on streaks of blood with the sputum, but there is nothing in the nature of a free haemoptysis, and in the only cases in which these streaks of blood were recorded, the existence of tuberculosis was excluded by the tuberculin test (von Pirquet).

The weight in these cases steadily falls, perhaps two or three stone, but there is not in this condition, as in tuberculosis, any loss of appetite, there is on the contrary an unduly large, almost excessive, appetite. Night sweats are in this condition unknown.

Friction sounds are almost invariably met with, but are more common with the contracted type than with the emphysematous type, and the bronchitis which is almost always present produces moist sounds, generally at the bases.

*Pleurisy.*

When the term pleurisy is used it signifies that on the examination of the man there was found some evidence of inflammation of the pleura indicated by the presence of friction sounds at some or other point on the chest wall.

The most common places for these friction sounds to be discovered were

(a.) The axillae—almost always in the middle line, at the level of the fifth and sixth ribs.

(b.) Over the triangle on each side, having for its sides the border of the sternum, the clavicle, and a line drawn from the third sterno-chondral articulation to a point on the clavicle about an inch from the sterno-clavicular articulation.

(c.) The apices.

(d.) The region of the nipples.

These regions are given in the order of the frequency with which friction sounds were there discovered.

It must further be pointed out in this connection that many men other than those recorded here gave a clear history of having had "pleurisy," "stitch pains in the side," rheumatics in the ribs," "muscular rheumatism," and other conditions which were in all probability pleuritic in nature.

But following the principle that is being followed right through this inquiry—of not considering anything that was not actually ascertained and verified by myself, such cases are not included in this list. Only those who at the time of examination had friction sounds in their chests were recorded under this heading.

There is another matter that must be referred to here. It has been said when early fibrosis was being discussed that many of these cases showed some slight dulling of the percussion note (on one side generally) and a certain amount of poorness of the breath sounds, also generally on one side.

It is probable that these two phenomena represent the indications of old exudate which has formed into adhesions so firm that they do not move on inspiration, and therefore do give an indication of their presence by friction.

*Tuberculosis of the Lungs.*

A complete enumeration of the standards by which a case was adjudged to be tubercular would involve a recapitulation of the well recognised features of that disease. The signs of consolidation, the indications of excavation, the presence of pyrexia, or of haemoptysis, the occurrence of night sweats, the general lassitude, the loss of weight, which are characteristic of tuberculosis were not found to be present in a typical fibrosis case.

The examination of the sputum, the tuberculin reaction (von Pirquet), the existence of a "family history," the history of definite contact with some pre-existing case, the existence of anaemia or of a malar flush were all taken into account.

A striking difference between the advanced fibrotic case and the advanced tubercular case was that the former never complained of feeling ill—the statement always was "I would feel first class, if I could only get my wind." On the other hand, the tubercular case always complained of feeling "seedy" for some time past.

*Emphysema.*

Emphysema has been referred to several times in connection with the various stages of fibrosis, but the heading now being used includes only emphysema of the classical type without any other superadded symptoms.

## APPENDIX D.

### Classification of men, in Occupational Groups, according to the Class of mine work engaged in.

When the men were asked what class of mine work they were employed at, a fairly large variety of answers was received. These have been classified as follows:—

Under the heading "*machine miners*" are included all men who were at the time of examination employed below ground in getting out the ore, and who had at some time in their mining lives been at work upon machine drills.

"*Non-machine miners*" includes all those men who were at the time of examination engaged below ground getting out the ore, and who had never at any time worked machine drills.

"*Truckers*" were those who had never been anything else but truckers.

"*Dry treatment hands*" includes all those who at the time of examination were engaged upon the sections of mining enumerated below, irrespective of whether they had at any time been engaged in other branches of mining.

The following were included under the heading of Dry treatment hands:—

Mill hands.*
Raveller hands.
"Firing roasters."
Ore conveyer.
Cracker hand.
"Sampler on surface."

"*Wet treatment hands*" includes all those enumerated below, and the heading is subject to the same interpretation as the term "dry treatment hands":—

Filter-press hand.
Cyanider.
Amalgamator.
Concentrates.
Sands.
Trucking residues.

All the other headings of occupation explain themselves, and they are all subject to the reservation that the men may have been at some other time engaged in a different branch of mining.

* In the case of "mill hands" only those working on dry mills were considered.

## APPENDIX E.

*Details regarding the individuals engaged in each class of Mine work, showing the reasons why certain of these individuals were excluded when compiling the corrected Table (Table D.)*

### BRACEMEN.

Five. One pleuritic. Two years a braceman.
Four normal—

1.—One two years braceman.
2.—One four years braceman.
3.—One three years braceman and three months machine work.
4.—One seven years a braceman, and 15 years mining in Victoria previously.

### TIMBERMEN.

Eleven. Two pleuritic.

One timberman two months. Previously mining in other States. No machine.
One timberman six years. Previously mining for 22 years. 19 of which on Coal mining.

Nine normal—

One three years timberman.
One six years timberman.
One seven years timberman.
One eight years timberman.
One nine years timberman.
One ten years timberman.
One eleven years timberman.
One fourteen years timberman.
One fifteen years timberman.

### PLATMEN.

Twenty-one.

Pleuritic—*Two* :

1.—One plat eight years.
2.—One plat eleven years.

Early Fibrosis—*One*—

Underground miner for 17 years ; plat last three years.

Tuberculosis. *One*—

Underground miner for eleven years ; not more than two months machines.
Plat four months.

Normal—*Seventeen* :

1. One 2 years
2. „ 4 „
3. „ 6 „
4. „ 6 „
5. „ 7 „
6. „ 8 „
7. „ 9 „
8. „ 9 „ All of these on plats only for periods given.
9. „ 10 „
10. „ 10 „
11. „ 10 „
12. „ 10 „
13. „ 11 „
14. „ 12 „
15. „ 14 „
16. „ 14 „
17. One three years on plats and 12 years Coal mining previously

ASSAYER—

One. Four and a half years Assay-office. Normal.

HORSE DRIVER—

One. Five years horse-driving. Normal.

CARPENTER—

One. Six years carpentering. Normal.

FETTLER—

One. 37 years fettling. Normal.

ELECTRICIANS—

Two normal. One eight years electrician
One ten years „

LAMP TRIMMER—One.

Tuberculosis.—Lamp-trimmer underground for five years.

ENGINE DRIVERS—

Seven, all normal—

2 years Engine-driving
30 „ „
13 „ „
25 „ „
14 „ „
8 „ „
14 „ „

APPENDIX E—*continued.*

DUMP MEN—

Six—One definitely tubercular. Seven years mining in W.A., at Fingall. Coal mining previously. Duration of disease two years.

Three normal—

1.—One two months on dump.
2.—One five years on dump.
3.—One two years on dump and ten years underground ; no machine work.

Two, Early Fibrosis—

One seven months on dump, and fourteen years underground ; eleven of these fourteen in W.A., and four years previously at Broken Hill.

One four years on dump, and ten years underground. Never mined elsewhere than in W.A.

SKIPMEN—

Four. All normal—

1.—One seven years on skips.
2.—One seven years on skips.
3.—One four years on skips.
4.—One four years on skips, and three years in mining previously. No machine work.

From the consideration of the details of the men engaged in the various occupations, it is clear that the following only can be considered :—

Assayers.
Carpenters.
Fettlers.
Electricians.
Lamp Trimmers.
Engine Drivers.
Horse Drivers.

All of these have been engaged upon no other work than that upon which they were engaged at the time of examination. Therefore, the figures remain unaltered.

DUMP MEN—

Of these, only two had done nothing else but work upon the dumps They are both normal. (Nos. 1 and 2.)

SKIPMEN—

Of these, three are retained. They are all normal. (Nos. 1, 2, and 3.)

BRACEMEN—

Of these, three are retained.

| | |
|---|---|
| Pleuritic (No. 1) .. .. .. .. | 1 |
| Normal (Nos. 1 and 2) .. .. .. | 2 |

TIMBERMEN—

Of these, nine are retained. They are all the normal men.

PLATMEN—

Of these, 18 are retained as follows :—

| | |
|---|---|
| Pleuritic (Nos. 1 and 2) .. .. .. | 2 |
| Normal (Nos. 1 to 16 inclusive) .. .. | 16 |

HORSEDRIVER—

The one horse-driver is retained. He was normal.

SURFACE MEN—52.

Normal—45 cases.

36 had done surface work only.

The remaining nine as follows :—

1.—Six years Coal mining. Surface 13 years.
2.—Underground four and a half months, shovelling ; surface two years.
3.—Underground six years. Surface seven years.
4.—Underground five years. Surface five years.
5.—Underground one-and-a-half years. Four-and-a-half years surface.
6.—Underground three years. Surface work 14 years.
7.—Two years underground (only six months underground in this State) ; 15 years surface.
8.—Underground 8 months. Surface, two years and four months.
9.—Underground two years. Surface 31 years.

Early Fibrosis—Two cases :

1.—Eighteen years mine work. Six years underground, no machine work. Twelve years on surface, shovelling and horse-driving.
2.—Fifteen years mining—all on surface. At mill work for two years, fitter's labourer and greasing for the rest.

Pleurisy—Three cases :

1.—Six years, all the time on the surface.
2.—Twelve years, all the time on the surface.
3.—Fifteen years total—eight months underground.

Tuberculosis—Two cases :

1.—One had only nine months work of all kinds, during the whole nine months trucking on the surface. Has been affected for 18 months.*
2.—One, eighteen years mine work, eight years on the surface, rest underground. No machine work.

* As this tubercular case had been clearly affected before he took up mine work of any sort, it must be excluded.

APPENDIX E—*continued.*

None of the above affected men were ill when they came to this State.

From these data it is clear that amongst the surface hands only the following can be included as in any way likely to be affected, as the result of the conditions under which they work. All the others are excluded by reason of the fact that they have worked at other branches of mining for longer or shorter periods:

| | |
|---|---|
| Normal .. .. .. .. .. | 36 |
| Pleuritic (Nos. 1 and 2) .. .. .. | 2 |

DRY TREATMENT HANDS—

Early Fibrosis. 36 Total.

1.— 3 months—surface work only.
2.— 2 years " " "
3.— 8 " " " "
4.— 8 " " " "
5.— 8 " " " "
6.— 9 " " " "
7.— 9 " " " "
8.— 9 " " " "
9.—10 " " " "
10.—10 " " " "
11.—11 " " " "
12.—11 " " " "
13.—11 " " " "
14.—12 " " " "
15.—12 " " " "
16.—12 " " " "
17.—13 " " " "
18.—13 " " " "
19.—15 " " " "
20.—15 " " " "
23.—15 " " " "
24.—16 " " " "
25.— 4 " " " "
26.—Surface work 5 years. 11 years underground.
27.—Surface work 10 years. 5 years underground. 2 years machine work.
28.—Surface work 7 years. 4 years underground. No machine work.
29.—Surface work 4 years. 7 years underground. No machine work.
30.—Surface work 3½ years. Half year underground. Half year machine work.
31.—Surface work 5 years. 6 years wet treatment. No underground.
32.—Surface work 13 years. 2 years underground.
33.—Surface work 14 years. 6 years underground. No machine work.
34.—Surface work 4½ years. 13½ years underground. Some machine work.
35.—Surface work 4 years. 22 years underground. 1 year machine work.
36.—Surface work 1 year. 13 years underground. No machine work.

Pleurisy. 16 Total.

1.—Surface work only, one year.
2.—Surface work only, two years.
3.—Surface work only, two years.
4.—Surface work only, four years
5.—Surface work only, six years.
6.—Surface work only six years.
7.—Surface work only, nine years.
8.—Surface work only, ten years.
9.—Surface work only, ten years.
10.—Surface work only, eleven years.
11.—Surface work two years. Underground four years. No machine work.
12.—Surface work 11 years. Underground, one year.
13.—Surface work 13 years. Underground, seven years.
14.—Surface work two years. 12 years coal.
15.—Surface work three years. Wet surface 16 years. No underground.
16.—Surface work nine years. Underground one year.

Intermediate Fibrosis—

Four years surface work. 56 years underground.

By "surface work" in this Table, is meant dry surface work.

From these data it is obvious that it is only possible to include 25 of the early fibrosis cases, and 10 of the pleurisy cases, when considering the possible harmful effects of dry treatment work.

WET TREATMENT MEN—

Early Fibrosis. Total 10.

1.—14 years mining, of which the last six years only on surface (cyanides all the time) remainder underground. No machine work.
2.—24 years total mining. Last nine years on cyanides, previously underground (six months machines).
3.—39 years total mining. Now on slimes pump. Has been a total of 26 years on surface work; has done 13 years underground, of which four years on machine work.
4.—14 years mining total. Six years cyanides. 7 years underground, all on machine work; one year underground, no machines.
5.—12 years mining total. Five years amalgamating, remainder underground.
6.—20 years mining total. Seven years on filter presses, remainder underground. (Three years machines).
7.—18 years total mining. 13 years filter presses, remainder underground. No machines.
8.—23 years total mining. Four years filter presses, remainder underground. No machines.
9.—38 years total mining. Five years slimes plant. Remainder underground. No machines.
10.—10 years mining, all surface work, filter presses and roasters, mostly latter.

None gave any history of being affected on arrival in this State.

APPENDIX E—*continued.*

Pleurisy. Total 10—

1.—Surface work only, 18 months.
2.—Surface work only, eight years.
3.—Surface work only, 10 years.
4.—Surface work only, 10 years.
5.—Surface work only, 13 years.
6.—Surface work 5½ years, and six months underground.
7.—Surface work nine years. Three years underground. No machine work.
8.—Surface work four years. 24 years underground. No machine work.
9.—Surface work three years. Five years underground. No machine work.
10.—Surface work five years. Two years underground. No machine work.

None affected on arrival in this State.

It is clear from these data that of 20 cases detailed above, not one of the early fibrosis cases, and only five of the pleuritic cases (Nos. 1-5) can be taken as in any way associated with the work upon the wet treatment plant.

COAL MINERS—

Early Fibrosis. 16 cases:

1.—Mining for 40 years, of which, 30 years were spent in gold mining. He states that he had miner's complaint, but that this ceased troubling him when he commenced coal mining.
2. Mining for ten years, two of which were spent silver mining in Tasmania, and the other eight at Collie.
3. Mining for 46 years, of which, eight gold mining.
4. Mining for 42 years, of which, 2 years gold mining.
5. Mining 41 years, of which, 15 gold mining (10 years at machine work.)
6. Mining 14 years, of which, nine years gold mining, and four years tin mining (total of two years on machines).
7. Mining 18 years, one year gold, remainder coal mining.
8. Mining 25 years; 12 years coal, rest diamonds and gold.
9. Mining 11 years; gold 9 years (five years machine work).
10. Mining 29 years; gold seven years, rest coal.
11. Mining 16 years; coal 13 years, rest copper and gold.
12. Mining 10 years; gold one year, rest coal.
13. Mining 23 years; two years gold, rest coal.
14. Mining 34 years; two years gold, rest coal.
15. Mining 21 years; 20 years gold (10 years machine work), one year coal.
16. Mining 12 years; two years, lead and silver, and 10 years coal.

Intermediate Fibrosis—One case:

Mining 27 years—one year coal, six years lead and silver, 14 years gold, six years copper (total of 13 years on machine work).

NOTE.—Machine not used unless specified.

It is obvious that it is impossible to consider that these cases, or any single one of them, can have been entirely due to coal mining, and it is even open to question whether any of them can have been to any extent due to coal mining with the possible exceptions of Nos. 4, 7, 12, 13, 14, in the group of the early fibrosis cases.

So that the only permissible course when considering the harmful effects of coal mining is to exclude these cases entirely from consideration. This course has been followed.

## APPENDIX F.

### Details regarding cases of early Fibrosis amongst machine miners who have been engaged upon machine work for (a) less than two years, (b) more than fifteen years.

*Cases of Early Fibrosis which have been working on Machines for less than two years.*

Of these there are 20 cases. The histories of 16 are given:—

1. On machines for three months, but mining for eighteen years.
2. Machine work for three months; mining, fifteen years.
3. Machine work three months only; mining, fifteen years.
4. Machine work six months; mining thirty years.
5. Machine work two months only; mining, thirty-eight years.
6. Machine work six months; mining seventeen years.
7. Machine work ten months; mining for twelve years.
8. Machine work one year; mining sixteen years.
9. Machine work three months; mining ten years.
10. Machine work seven months; mining two years.
11. Machine work eight months; mining two and a half years.
12. Machine work one year; mining three years.
13. Machine work four months; mining four and a half years.
14. Machine work fourteen months; mining three years.
15. Machine work six months; mining ten years.
16. Machine work seven and a half months; mining nine years.

These details show that the occurrence of early fibrosis in men who had been less than two years on machines may be explained in many of the cases by the fact that the men had been mining underground for long periods before they began machine work. The fact, however, remains that fibrosis does occur as a result of machine mining, and very soon after machine work is commenced, although very little mining has been done before the machine work is begun.

*Cases of early Fibrosis which have been for more than fifteen years on Machine Work.*

Of these there were a total of 13 cases, and the histories of 12 of these are given below:—

1. The machine work was done in stretches, with intervals between. These intervals were spent in prospecting.
2. Only on machines at intervals; intervals spelling.
3. Machine at intervals for twenty years, but none for last twelve years.
4. Machine for fifteen years, but very broken during the last twelve years.
5. During the last fifteen years prospecting frequently in intervals between working for wages.
6. Machine work continuous for nearly twenty years.
7. Machine work continuous for nearly twenty years.
8. Machine work continuous for nearly fifteen years.
9. Machine work continuous for nearly twenty years.
10. Machine work continuous for nearly twenty years.
11. Machine work continuous for nearly twenty-two years.
12. Machine work continuous for nearly seventeen years.

These details show that the explanation of the delayed onset of early fibrosis in men who have been more than fifteen years on machines is found for some of the cases in the fact that intervals away from machine work have been frequent or long, and that therefore, presumably, partial recovery, or at any rate arrest of the progress of the disease, has occurred.

## APPENDIX G.

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**Extracts from—**

**(a). Report of Royal Commission on Miners' Phthisis—Transvaal.**
**(b.) Report on Miners' Phthisis—Bendigo. Dr. Summons.**
**(c.) Report on the Health of Cornish Miners.**

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The Transvaal Commission obtained the co-operation of the Transvaal Medical Society, some members of which examined 1,210 miners actually working on the mines at Johannesburg.*

They have set the following standards of what, in their opinion, constitutes a case of fibrosis:—

"1. The usual symptoms in a typical case are in the earlier stages recurrent and obstinate bronchial "colds," which may attract little attention, for the patient, being for a long time quite able to work, is apt to regard his earlier symptoms as of little moment.

"Gradually, as the disease progresses, shortness of breath on exertion, cough and spit, a more frequent liability to contract colds and a greater difficulty in throwing them off, and sometimes flitting pleuritic pains, are the symptoms which usually first attract serious notice.

"Gradual loss of weight and strength, and more urgent breathlessness, which may be of the asthmatic type, follow, as an increasing area of breathing space becomes disabled. Expectoration may or may not be a prominent symptom; haemoptysis is exceptional, and when present is usually slight; night sweats are not as a rule noticeable, and pyrexia may be altogether absent throughout. Three of the characteristic signs of tubercular phthisis are thus frequently absent.

"Finally, towards the end the patient rapidly loses ground in all directions.

"The most striking feature brought out by *physical examination* in a typical case is the diminished expansion of the chest, which in many cases is very striking, and is accompanied by rigidity of the chest-wall, so that the breathing becomes mainly abdominal. The lungs are not, however, emphysematous in the sense that their area of resonance is increased; often, indeed, it is noticeably diminished. Hollowing of the supra-clavicular, supra-scapular and intercostal spaces, together with general emaciation is noticeable in the more advanced cases.

"Percussion and auscultation often give very indefinite results, owing no doubt to the diffuse nature of the disease. The dyspnœa seems frequently quite out of proportion to the evident organic changes. In the more advanced cases there is definite evidence of consolidation, and even in some cases of cavity formation; but in many some impairment of percussion, here and there perhaps more frequently at the bases than at the apices, with harsh, interrupted or bronchovesicular breathing and sometimes crepitation and pleuritic friction, are the most that can be made out. The disease is bilateral, but one lung is frequently affected to a greater degree than the other.

"2. It is not common to find the typical physical signs of tubercular phthisis present, and this observation, together with the confirmatory fact that, out of the series of over 30 sputa from cases of disease of the lung of miners examined by a member of your Committee only two or three were found to contain tubercle bacilli, leads us to conclude that while in some cases a true tubercular phthisis may co-exist or may be super-added, the conjunction is only seen in a minority of cases. Where tuberculosis does co-exist or becomes super-added, the disease assumes more of the typical tubercular character, with pyrexia, sweating, hectic symptoms, and the characteristic expectoration. The type becomes more of a "moist" one. The disease is primarily a local one, and is at first confined to the respiratory organs; secondary disorders of the heart, liver, stomach, and kidneys are late accompaniments. The heart is not as a rule dilated, but the pulse-rate may be accelerated.

"3. In the more chronic forms seen perhaps more typically in the miners of many years' standing, who as a rule are not rock-drill workers, chronic bronchitis and asthmatic symptoms are perhaps more prominent, and in them dilatation of the heart and accelerated pulse-rate are more common.

"We may therefore perhaps usefully distinguish from a clinical standpoint three types of "Miners' Phthisis":—

"(1.) The pure fibroid non-tubercular type, the commonest and most characteristic form of the disease;

"(2.) The mixed fibroid and tubercular type, where the two processes co-exist.

"The very chronic type seen in miners of many years standing where secondary changes in the heart and kidneys are more prominent."

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Dr. Summons gives the following description of the symptons met with in the cases examined by him†:—

"The clinical histories of the above and other cases show the disease is most insidious in its onset, and, as a rule, only after years of work do definite symptoms present themselves. By this time, however, damage to the lungs has taken place, and the condition is irremediable. The early symptoms are frequently recurring coughs and mild attacks of bronchitis, in which the ciliated epithelium of the bronchial tubes is destroyed, and thereby greater facilities are afforded for the absorption of the dust particles. The general health is good, or the feelings of malaise so slight as not to interfere with the men's capacity for work. The primary irritating cause continues, and the bronchial tubes are progressively more and more damaged. This condition may last for years, and the only symptoms are those of a frequently recurring or of a continuous bronchitis.

"The dust particles inhaled are, for the most part, caught in the mucus of the respiratory passages, and spat out again, giving rise to what is popularly called the 'black spit.' Even years subsequent to working underground, the expectoration may have at times a bluish black discoloration, especially when there is a caseation and necrosis of the lung tissue. Even without any infection with the tubercle bacillus, the expectoration may be profuse and muco-purulent in character, which, on microscopic examination, is found teeming with staphylococci and many putrefactive organisms. In other instances the dyspnœa may be extreme, but the patient has practically no spit, or some only first thing in the morning.

"Sooner or later, however, the miner notices he becomes more readily short of breath than formerly, especially so if he has any bronchitis; and this is characteristic of attacks of bronchitis to which the miners are liable—that they become much more dyspnœic than ordinary patients with bronchitis. The breathlessness increases *pari passu* with the amount of harm done to the lung, till, finally, though constitutionally his health is good, the man is compelled to cease working; and at this stage, even while resting, there is wheezing with prolonged expirations, while on the slightest exertion there are marked stridor and hurried breathing. This dyspnœa is unassociated with any signs of cardiac incompetence, and, therefore, is purely respiratory. In no case was the interference with respiration so extreme as to cause cyanosis.

"Such is the history of a case of pure fibrosis. The general health may be in every way satisfactory, digestion good, sleep sound, and there is freedom from pain.

* Report of the Miners' Phthisis Commission, Pretoria, p.p. vii., and ii., iii., iv.
† Report on Miners' Phthisis, Bendigo, by Walter Summons, M.D., B.S. (Stillwell & Co., Melbourne, 1907).

"Associated with the frequently recurring bronchitic attacks the men complain of flitting pleuritic pains—"stitches in the side," as they term them. These pains may last from a few hours to a few days, or may be so severe as to confine the patient to bed. Some few cases examined gave a history of fluid being withdrawn from the chest. . . . . Rarely, however, was a case moderately advanced examined without finding evidence of old or present pleurisy, as a rule of the dry chronic type. Notably was this the case in the region of the fifth and sixth ribs in the axillary regions. Here, also, where the parietal pleura is nearest the root of the lung, and where the interlobar septum comes to the surface, the early pleuritic rubs are heard.

"Upon physical examination, the breathing may be hurried, but more commonly there is simply prolongation of expiration. On the slightest exertion, however, the breathing is distressed, and, occasionally, the facial aspect anxious; but no case presented any cyanosis until in the final stages, when there was a tuberculous infection, and the heart was commencing to fail.

"On inspection, diminished chest expansion was evident. There seemed to be no greater proportion of malformed chests than is to be found amongst the average adult males—many being broad shouldered and deep chested, but, in a few cases, there was a tendency to be "barrel-shaped." In accordance with this, none of the lungs examined were of the large lunged emphysematous type, but there was much coarse emphysema in normal sized or contracted lungs. Mensuration showed the average expansion in 30 cases to be 1½ inches, 1 inch or less being all some patients could manage. Frequently an inspiratory drawing in of the intercostal spaces was noted, especially towards the bases, often bilateral.

"Percussion showed scattered areas of impaired resonance. This dulness being often towards the bases, and in the axillary regions, was considered partly due to thickening of the pleurae with adhesions, and partly to fibroid lung changes. In some cases from fibroid contractions, the area of superficial cardiac dullness was enlarged, and the heart drawn out of its normal position. Increase in tactile fremitus over the lungs was common, but localised diminution not infrequent.

"By auscultation, however, the greatest knowledge was gained of the lung condition. The usual evidence of bronchitis, emphysema, and fibroid lung was universal, and, prior to the full development of these conditions, much alteration in the respiratory murmurs was noted, as diminution, prolongation of respiration, raised pitch, and different grades of bronchial breathing. Creaking sounds, perceptible both on inspiration and on expiration, and cardio-respiratory murmurs along the left cardiac border and in the region of the apex beat—notably a series of short puffs synchronous with the heart beat, and equally well heard on expiration as on inspiration, with crackles and fine pleural friction, in this region are common.

"The main symptoms are those of a chronic and obstinate bronchitis. Associated with this condition sooner or later the lungs become emphysematous. They are not emphysematous in the sense that their area of resonance is increased; often in fact it is diminished. There are no distinctive signs by which one can say that this is a miners' lung, but all point to a chronic irritation of the lung and pleuræ, and the results in addition to being non-remediable are to a greater or less extent steadily progressive.

"Associated with the symptoms already given there is little or no constitutional disturbance. The disease is a purely local one of the respiratory organs, and the symptoms point absolutely to these. Though secondary disorders of the heart and other organs are to be expected, such were late accompaniments, and in every instance subsequent to infection with tubercle bacilli, and thus resulted from the combined action of both the fibrosis and the tuberculosis. Sooner or later—very soon in some cases—there is progressive loss of weight and weakness. The appetite diminishes, and there is a feeling of malaise, with acceleration of the pulse rate. The miner notices that he perspires more easily at work below, and also while exerting himself at the surface.

"Drenching sweats at night are frequent. The temperature taken at this stage will show a slight rise above normal some time during the 24 hours, and, though a simple bronchitis may produce a febrile reaction, the majority of cases that have a slight evening rise will soon give unmistakable evidence of the tuberculous nature of the illness. The temperature, when taken at regular intervals for a few days, with the patient confined to bed, gives assistance in arriving at the correct diagnosis hardly second to the results of a tuberculin reaction.

"The expectoration may be scanty unless there there is an associated bronchitis, when it is mucopurulent, with possibly a bluish black tinge. On microscopic examination, if not the first time, with repeated search, a sample of sputum will be found to contain tubercle bacilli.

"To the physical signs already given, additional ones may now be found—those of consolidated and breaking-down lung. Then the symptoms progress, and the course is similar to that of pulmonary tuberculosis in a previously undamaged lung, requiring the same mode of treatment. If prior to this, there have been no signs of pleural involvement, pleuritic signs will now be found, both along the interlobar septa and elsewhere, and this involvement is secondary to lung infection.

"The physical signs in some cases, however, were those only of a simple fibrosis, yet examination of their sputum showed bacilli abundant. This emphasises the necessity for examination of the sputum in every case, especially those in which the dyspnœa was extreme.

"The symptoms present some slight variations from the ordinary phthisis. Hæmoptysis is rare, but in one case it was found the final ending (see p.m. No. VI.).

"The dyspnœa is, as would be expected, quite out of all proportion to the tubercular involvement of the lung. This is even the case when there has been no evident respiratory embarrassment prior to the superadded tuberculous infection. Pneumothorax seems to be extremely uncommon. In many of the chests examined at autopsy it would be an impossible condition, as the pleural cavities were totally obliterated by adhesions."

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*Extract from a Report on "The Health of the Cornish Miners," by J. S. Haldane, M.D., J. S. Martin, and R. A. Thomas.* 1904.*

*Summary:*—

1. The death-rate amongst miners living in Cornwall, which has always been very high in the case of men over about 40, has very greatly increased during the last few years among men of from 25 to 45.

2. The excessive death-rate is shown by the statistics to be due entirely to phthisis and other lung diseases.

3. The recent increase in the death-rate is also shown to be due to the deaths of men who have worked rock-drills. The great majority of these deaths are attributable to the effects of rock-drill work in the Transvaal or elsewhere abroad; but a considerable number are attributable to work in Cornwall.

4. Nearly the whole of the deaths of rock-drill men were due to "phthisis," and of the cases examined at least 74 per cent. were tubercular.

5. The predisposing cause of the present excessive mortality among metalliferous miners from lung diseases is evidently the inhalation of stone dust.

* Report to the Secretary of State for the Home Department on the health of Cornish miners, by J. S. Haldane, M.D., F.R.S., Joseph S. Martin, and R. A. Thomas, London, 1904.

## APPENDIX H.

# The Frequency of Human Infection in Tuberculosis.

By J. H. L. Cumpston, M.D., D.P.H., Medical Officer to the Central Board of Health, Perth, Western Australia.
("Public Health," June, 1910.)

It has been found that a State like Western Australia offers many advantages for the study of the epidemiology of infectious diseases. The centres of population are comparatively scattered, and as a general rule the movements of individuals from place to place are known, or can be ascertained, with a considerable degree of accuracy. Added to that is the useful fact that in general the communities are small enough for the existence of any infectious disease to be known to the whole population.

An attempt was made to utilise these advantages in the direction of gaining some accurate information on the subject of pulmonary tuberculosis. Primarily the object in view was the collection of facts that might assist in the settlement of the vexed question of the relative importance of human or bovine infection in the causation of human tuberculosis.

Pulmonary tuberculosis has been for some years a notifiable disease in Western Australia, and all cases have to be notified both to the local and to the central health authorities.

The method adopted was as follows:—Upon receipt of the notification of a case of pulmonary tuberculosis, a printed form of inquiry was sent to the Local Board of Health in whose district the case had occurred. The health inspector visited the case and obtained the required information.

The form used was as follows:—

*Tuberculosis Patient.*

Name. Sex. Age.
Date notified. Occupation.
Attended by (name of medical practitioner).
Patient's present address.
Patient's former addresses for past 10 years.
Has patient any knowledge of how he might have contracted infection? (State details very particularly.)
Has patient ever resided in same house with a tubercular person?
Cause of death of patient's parents.
If alive, what is the state of their health?
Any brothers and sisters—what is the state of their health.
Has any relative ever had tuberculosis?
Ascertain as far as possible what sources of milk supply the patient has had access to during the past 10 years.
Ascertain from medical attendant—
As nearly as possible the duration of the illness, fixing as accurately as may be the appearance of the first symptoms.
Whether the lesion is "open" or "closed," *i.e.*, is capable of spreading infection by means of sputum or not.
Describe the present circumstances of the patient from a public health point of view.
Has the patient been instructed how to prevent the infection spreading to others?
Is the patient able to spend his time out of doors?
Has he been provided with the means and instructions to have his sputum disinfected and destroyed with safety?
Is he able to maintain himself and provide for himself all necessary nourishment and treatment, and can he afford to make provision (canvas, etc.) for sleeping out of doors?
Have arrangements been made for periodical disinfection by the Local Board of the room occupied by the patient?

The total notifications received by the Central Board was 188.

The number of inquiry sheets returned to the central office was 153.

That is to say, inquiry sheets were returned in about 81 per cent. of the cases notified.

These 153 returns were analysed at the end of the year. It was then found that 26 had to be discarded, for the reason that there was not given about these cases sufficient information to enable any reliable deductions to be drawn.

The reasons for which these 26 cases had to be discarded were:—

| | |
|---|---|
| Death before investigation .. .. | 12 |
| Left institution or address given, before investigation .. .. .. | 11 |
| Unknown in district .. .. .. | 2 |
| Senile dementia .. .. .. | 1 |
| | 26 |

This reduced the number to 127, or 67 per cent. of the cases notified.

In any investigation the data must almost necessarily be to a certain extent incomplete. Still, in this instance the number of useful returns is sufficient to provide some information. The percentages must of course be calculated on the reduced total.

The 127 returns have been grouped as follows:—

*Group A.*—Cases in which there is no evidence of human infection. The number of these was 75, or 59 per cent.

*Group B.*—Cases in which a possible source of human infection appears to have existed, but in which the probability of that source having acted as the origin of the disease is doubtful. The number of these was 9, or 7 per cent.

*Group C.*—Cases in which the disease was probably due to human infection. The number of these was 43, or 33.8 per cent.

Tables 1 and 2 are given showing in detail the cases in Groups B and C.

It will be noticed that of the nine cases in Group B, six had been in contact with infected members of their own family, and one was a nurse, whose occupation must have necessitated at some time an exposure to infection; the other two had almost certainly run the risk of infection. So that these nine cases definitely proved the possibility of infection.

In an inquiry of this kind, however, the greatest care must be taken to avoid sources of error. It has been thought desirable therefore to group these uncertain cases together.

Group C, however, as the table shows, is composed of cases about which there is little reasonable doubt. Very careful consideration was given to each one, and each was only included after all the facts relative to it had been critically weighed.

The fact revealed by this table is that of 127 cases about which details are available, 33.8 per cent. show such exposure to infection as to make it probable that their disease originated in this way.

The only deduction legitimate from this result is that already stated, viz., that 33.8 per cent. of the cases investigated probably contracted the disease by human infection directly from other cases.

What light does this throw on the question of bovine infection? As it stands, the only preliminary deduction is that at the most bovine infection is probable in 66.2 per cent. of all the cases in the series.

It will appear that this maximum of 66.2 per cent. is open to reduction. In the first place it is reasonable to exclude Group B. If this is done it reduces the "probable bovine percentage" to 59 per cent.

Further, a consideration of the table giving the cases collected in Group C brings prominently into view the fact that in the large majority of cases the infecting person was a near relative of the patient under consideration.

Two explanations of this fact would appear to be permissible:—

(1.) That the range of activity of tubercular infection is limited, and that close and continued association with a consumptive is necessary for infection.

(2.) That the existence of tuberculosis in a near relative is an obvious and, unfortunately too-easily remembered fact; and that while a patient would not forget such a likely source for his own disease, other less obvious or less prolonged sources may have been forgotten, or likely enough never have been realised.

Both these explanations are probably to a certain extent correct; but while there are no known facts supporting the former, the latter theory will commend itself as being at least reasonable.

So that inasmuch as Group C reveals sources of infection all of which are strikingly obvious, it would seem to be permissible to assume that some at least of the cases in Group A (those in which no human source of infection is revealed by the inquiry) have derived their disease from pre-existing cases.

One instance stands out clearly in this connection—that of a male aged 30, whose occupation was second-hand furniture dealing. It is justifiable to assume that one who is constantly handling second-hand furniture runs a large risk of contracting a disease such as tuberculosis, the infectivity of which is known to be of long duration.

The position, finally, is as follows:—About 34 per cent. of the cases investigated during 1909 were probably due to human infection, and a large balance of cases is left in which it is possible that bovine infection was the determining factor.

A little light is shed on the question by the answers as to what source of milk supply the patient has had access to during the past ten years. As some of the patients had lived during all that period in the remoter districts of the Northern and Eastern Goldfields it was thought that probably it would be found that tinned milk was the only source of milk supply.

It was found that in Group A there were 15 who definitely stated that for the last ten years they had been either "entirely" or "principally" dependent on tinned milk.

So that the 59 per cent. above referred to becomes susceptible of reduction to the extent to which importance is attached to this fact, viz., that the milk supply was entirely or principally tinned.

In only one case was there definite evidence of the possibility of bovine infection. This was the case of a male, aged 16 years, who had been employed in milking cows in his father's dairy in Victoria, and who ascribed his infection to affected cows.

*Occupations.*

Unfortunately it was assumed that the occupations of the patients would be stated on the original notifications, and therefore this item was omitted from the inquiry form. The records of the occupations are, therefore, incomplete. Such, however, as are obtainable are given, but only for males; there did not seem any useful purpose to be served by analysing the occupations of the females:—

| | |
|---|---|
| Total males investigated | 98 |
| Occupations specified | 58 |
| Occupations unspecified | 40 |

The separate occupations were as follows:—

| | |
|---|---|
| Miners | 9 |
| Clerks | 3 |
| Postal employees | 3 |
| Carpenters | 3 |
| Youths | 3 |
| Clergymen | 2 |
| Bush labourers | 2 |
| Photographers | 2 |
| Generals at hotels | 2 |
| Shop assistant | 1 |
| Electrician | 1 |
| Bootmaker | 1 |
| Dairyman | 1 |
| Caretaker | 1 |
| Draughtsman | 1 |
| Furniture dealer | 1 |
| Cook | 1 |
| Military instructor | 1 |
| Accountant | 1 |
| Foreman | 1 |
| Fisherman | 1 |
| Shipbuilder | 1 |
| Bricklayer | 1 |
| Steel trunk maker | 1 |
| Restaurant keeper | 1 |
| Groom | 1 |
| Billiard marker | 1 |
| Butler | 1 |
| Woodcarter | 1 |
| Timber stacker | 1 |
| Printer | 1 |
| Mill hand | 1 |
| Inspector | 1 |
| Baker | 1 |
| Painter | 1 |
| Station hand | 1 |
| Assayer | 1 |
| Engine-driver | 1 |

The proportion of miners to total males whose occupations were specified was 9: 58, *i.e.*, 15.5 per cent. The figures are incomplete, however.

An interesting series of cases was that of children reported as suffering from tuberculosis in regions other than the lungs. These cases are not compulsorily notifiable, but through an arrangement with the Children's Hospital authorities the Central Board of Health received notification of all cases of tuberculosis of any anatomical region treated in that hospital These cases are not included in any of the foregoing tables. Six cases were reported under the arrangement described as follows:—

| Sex. | Age. | Disease. | Source of Infection. | Milk Supply. |
|---|---|---|---|---|
| M | 11 | Tub. Hip | Sister has hip disease with weak chest | Mostly tinned. |
| M | 6 | Tub. Meningitis | Unknown | Unspecified. |
| M | 5 | Tub. hip | Mother suffers from consumption | Fresh milk. |
| M | 12 | Tub. glands | Unknown | Mostly tinned. |
| M | 4 | Tub. hip | Unknown | Fresh milk. |
| M | 2 | Tub. Meningitis | Mother died from consumption. One of the cases in Group A, lived in the same house | Mostly tinned. |

It is interesting to note that in half of the cases an obvious human source of infection is present, and that only two of the five cases in which information as to the milk supply was forthcoming had had fresh cow's milk at all regularly.

The fact prominently revealed by this inquiry is the danger to the community of cases of phthisis. This applies in a very special way to members of the same family as the sufferer. Exact methods of inquiry forbid the use of speculative deductions, and therefore an attempt has been made to draw only such conclusions as are legitimately permitted by the facts ascertained. For this reason no statement can be made as to the frequency of bovine infection as a cause of tuberculosis.

I have been unable to find any direct reference, in the literature at my disposal here, to the frequency of possible human infection in case of pulmonary tuberculosis. Carstairs Douglas, however, quotes, without giving the reference, a result obtained by C. J. B. and Theodore Williams that "a history of the disease in the parents, brothers, and sisters of the patient occurs in about 33 per cent." (Laws of Health, 1908, p. 196.)

This figure of 33 per cent. agrees remarkably with the figure of 33.8 per cent. obtained in Group C in this inquiry.

The results recorded above are sufficient in themselves to call attention to the need for supervision of, and provision for, infectious human tubercular cases.

This has hitherto been a somewhat neglected field of operations in all countries.

APPENDIX H.—*continued.*

GROUP B.

| No. | Sex. | Age. | Duration of Illness (years.) | Source of possible Infection. |
|---|---|---|---|---|
| 1 | F | 32 | 5/12 | Trained nurse. Has not to her knowledge nursed a tubercular case for . . over two years; was district nurse in Perth nine months prior to . . inquiry. |
| 2 | F | 30 | .. | Aunt died of phthisis when patient was 18 months old, until this aunt's . . death, patient was in close contact. |
| 3 | F | 35 | 1·6/12 | Lived with tubercular patient 16 years ago. |
| 4 | M | 23 | .. | Two aunts died from phthisis, unascertained whether contact or not. |
| 5 | F | 65 | .. | Mother died from phthisis when patient was a young girl. |
| 6 | M | 49 | 1 9/12 | An uncle died from phthisis, no contact with him for many years. |
| 7 | F | 26 | 2 (at least) | Two uncles died from phthisis. No contact for several years. |
| 8 | F | 40 | 3 | Occupied a house recently occupied by a person suffering from phthisis. |
| 9 | M | 27 | 1·6/12 | One sister suffering from phthisis whom patient has not seen for several years. |
| | | | | GROUP C. |
| 10 | F | 40 | .. | Lived with mother and sister, who had phthisis, and with husband who died from phthisis. |
| 11 | F | 38 | .. | Husband and husband's father died from phthisis. |
| 12 | F | 36 | 2/12 | Father suffered from "miner's complaint." |
| 13 | M | 22 | .. | Father at present under treatment for phthisis. |
| 14 | F | 24 | 4 | Father died from "miner's complaint." |
| 15 | F | 39 | .. | Washing for family of No. 49 for five years. Father died of phthisis. |
| 16 | M | 45 | 3/12 | Frequent and close association with half-caste girls, who died from phthisis. |
| 17 | F | 9½ | 3/12 | Sister, aunt, and cousins of patient's mother died from phthisis. |
| 18 | F | 10½ | 2/12 | |
| 19 | M | 20 | .. | Mother consumptive. |
| 20 | F | 21 | 6/12 | Sister died four years ago from phthisis. |
| 21 | F | 24 | .. | Two years ago lived in same house with a tubercular patient. |
| 22 | M | 37 | .. | Two brothers died from phthisis. |
| 23 | M | 30 | Over 7 | Brother died from phthisis. |
| 24 | M | .. | 3 | Lodged in same bedroom for long periods on two occasions with a known consumptive, a little more than three years ago. |
| 25 | M | 40 | .. | Brother aged 36, died from phthisis, this case is father of No. 27. |
| 26 | M | 49 | 1 | Became caretaker at Railway latrines at Workshops a year ago, succeeding a man invalided for phthisis. |
| 27 | M | 14 | .. | Father (No. 25), suffers from phthisis, brother died from same disease four months ago. |
| 28 | F | 34 | 4 | Proprietress of an hotel in which lived a lodger known to have phthisis. Gave up hotel four years ago. |
| 29 | M | 32 | 4 | Worked in same shop as a man who had phthisis. |
| 30 | F | 8 | .. | Mother suffers from phthisis. |
| 31 | F | 28 | .. | Sister suffers from phthisis. |
| 32 | F | 17 | .. | Father died from "miner's complaint." |
| 33 | F | 18 | 6/12 | Lived with cousin who died from phthisis. |
| 34 | M | 50 | .. | Lived with father who died from phthisis. |
| 35 | F | 27 | .. | Lived with cousin who suffers from phthisis. |
| 36 | F | 19 | .. | Father died from phthisis. |
| 37 | M | 44 | 3 | Lived with mother who died from phthisis. |
| 38 | F | 15 | 8/12 | Lived with consumptive just before the onset of her disease. Mother died from phthisis eight years ago. |
| 39 | F | 44 | .. | Father died from phthisis. |
| 40 | M | 27 | "Advanced" | Mother died from phthisis eight years ago. |
| 41 | M | 17 | .. | Mother and sister died from phthisis. |
| 42 | M | 38 | 1 | Consumptive friend used frequently to visit patient. |
| 43 | F | 22 | .. | Father died from phthisis. |
| 44 | M | 25 | 3 | Two sisters suffer from phthisis. |
| 45 | M | 22 | .. | Lived with mother, until her death from phthisis. |
| 46 | M | 13 | 2/12 | Two months ago lived in a house with a tubercular patient. |
| 47 | M | 32 | .. | In close and constant association with case 16, above. |
| 48 | F | 31 | "Some years" | Patients brother died from phthisis under her care six years previously. |
| 49 | F | 28 | .. | Brother died from phthisis. |
| 50 | F | 26 | .. | Mother suffers from phthisis. |
| 51 | M | 24 | .. | Was working for some time with a consumptive mate. |
| 52 | .. | .. | .. | Lived in same house with a tubercular patient. |

It may not be out of place here to refer to another phase of the tuberculosis question, more especially in its relationship to the vexed question of the relative importance of bovine and human infection.

It will be instructive to place in two columns the quinquennial death-rates from tuberculosis in Western Australia, and the ascertained numbers of cattle in the State for the same periods:—

| | Death rates from Phthisis per 1,000 of mean population. | No. of Cattle in the State. |
|---|---|---|
| 1873 .. .. .. | — | 47,640 |
| 1878 .. .. .. | — | 56,158 |
| 1883 .. .. .. | .768 | 64,558 |
| 1888 .. .. .. | .993 | 95,822 |
| 1893 .. .. .. | .713 | 173,747 |
| 1898 .. .. .. | .669 | 269,947 |
| 1903 .. .. .. | .651 | 497,617 |
| 1904 .. .. .. | .837 | 561,490 |
| 1905 .. .. .. | .647 | 631,825 |
| 1906 .. .. .. | .820 | 690,011 |
| 1907 .. .. .. | .781 | 717,377 |

This table shows that during 25 years the death-rate from phthisis remained about the same for the whole period, while the number of cattle increased during the same period from 64,558 to 717,377, *i.e.*, the total was multiplied more than 11 times in that time. If tuberculosis in animals played any considerable part in the production of tuberculosis in man, then it would appear to be reasonable to assume that with this rapid rise in the number of cattle in the State, there would be a corresponding rise in the incidence of human tuberculosis in the State, and therefore a progressive rise in the death-rate from phthisis.

This table shows that this has not been so.

Of course the contention that there has been a diminution in the amount of bovine tuberculosis might be raised, but there are no data on this point.

Unquestionably the facts revealed by the inquiry reported in this paper direct attention to the grave importance of human infection in tuberculosis.

## APPENDIX J.

## Ankylostomiasis.

Although the prevalence of this disease was not one of the duties entrusted to me, yet it seemed advisable in view of the excellent opportunities afforded, to bear this disease in mind. When ankylostomiasis has been present in a person for any extended time it frequently reveals its presence by producing in the person a marked degree of anæmia. While the examination of the men was being conducted, therefore, a careful watch was kept for any indication of the existence of this disease.

Two men only showed any evidence of the characteristic anæmia—both of these men had been working in the mines in Cornwall. In one of these instances, Dr. Boyd very kindly made the necessary examinations, and there seemed to be good reason for coming to the conclusion that ankylostomiasis was not present. In the other a blood film revealed a marked excess of eosinophile cells. A careful search of the fæces by both Dr Davies and myself failed to reveal any indication of the presence of the worms in the intestines. However, the characteristic anæmia, and the marked excess of eosinophile cells, together with the fact that the man had been working in one of the Cornish mines, were taken as sufficient evidence of the existence of ankylostomiasis.

There was no other even suspicious case met with.

The affected man was working on the Oroya mine at Sandstone.

## APPENDIX K.

## Temperature Readings in various mines.

SOUTH KALGURLI—JULY 16TH, 1910.

Surface temperature, 52 degrees.
Bottom level (dead end at top of winze), 70 degrees.

GREAT BOULDER—JULY 22ND, 1910. .. ..

Surface temperature, 55 degrees.
Bottom level (2650ft.), south end 77 degrees.
Bottom level (2,650ft.), plat 70 degrees.
Bottom level (2,650ft.), north end 76 degrees.

## VENTILATION.

*State of Atmosphere in principal Mines throughout the Coolgardie, Yilgarn, and Dundas Goldfields.**

| Date. | Mine. | Dry Bulb. | Wet Bulb. | Degrees of Humidity. | CO. 2. | Remarks. |
|---|---|---|---|---|---|---|
| | DUNDAS. | | | | | |
| 6-3-09 | Acme G.M. .. .. .. | 70 | 70 | 100 | .. | Taken at 194 feet level, 10 feet from South face. |
| 6-3-09 | Do. .. .. .. .. | 71 | 71 | 100 | .. | Taken at 194 feet level, 20 feet South of Main incline |
| 12-3-09 | Princess Royal .. .. .. | 72 | 69 | 84 | .. | Taken at No. 2 level. |
| 14-7-09 | Cumberland .. .. .. | 70 | 68 | 88 | .. | Taken at 800 feet level, air returning through same workings, attention drawn, Reg. 13. |
| 15-7-09 | Mararoa .. .. .. .. | 56 | 50 | 65 | .. | Taken at No. 5 level. |
| 15-7-09 | Do. .. .. .. .. | 59 | 54 | 71 | .. | Taken at No. 6 level. |
| 16-7-09 | Princess Royal .. .. .. | 64 | 59 | 72 | .. | Taken at No. 5 level. |
| 16-7-09 | Do. .. .. .. .. | 52 | 49 | 89 | .. | Taken at 950 feet level. |
| 23-10-09 | Valkyrie .. .. .. .. | 61 | 59 | 88 | ·053 | Taken at top of up-cast winze from No. 2 level. |
| 23-10-09 | New Moon .. .. .. | 57 | 56 | 93 | ·061 | Taken at 15 feet from face of No. 3 level. |
| 26-10-09 | Princess Royal .. .. .. | 72 | 69 | 84 | ·070 | Taken at North end of No. 5 level; worst place in Mine. |
| 25-10-09 | Mararoa .. .. .. .. | 69 | 64 | 73 | ·053 | Taken at 180 feet, North of main incline, No. 6 level; worst place in Mine. |
| | COOLGARDIE. | | | | | |
| 29-7-09 | Griffiths G.M. .. .. .. | 60 | 58 | 88 | .. | Taken at No. 2 level. |
| 21-9-09 | Burbanks Birthday .. .. | 55 | 54 | 93 | .. | Taken at No. 3 level, "C" shaft intake. |
| 21-9-09 | Do. .. .. .. .. | 67 | 66 | 94 | .. | Taken at 150 feet level, 500 feet South of "B" Shaft. |
| | YILGARN. | | | | | |
| 10-11-09 | Frasers G.M. .. .. .. | 65 | 62 | 83 | ·070 | Taken at South end of No. 5 level. |

* Facts recorded by Inspector Crabbe. *See* Notes of Evidence, question 273.

## BLACK RANGE MINING COMPANY, SANDSTONE.

*Table of Tests made of Temperature Underground, 24th June, 1910.*

| Point at which Tests were made. | Temperature, Deg. F. | | Degree of Humidity. (Glaisher's Scale.) | Remarks. |
|---|---|---|---|---|
| | Dry. | Wet. | | |
| (1.) 63ft. level, footwall stope, North of No. 1 rise | 56·0 | 53·5 | 84·0 | Present, three men and lights. Stope dry, and clean; air fresh. |
| (2.) No. 2 level, Vertical Main Shaft .. .. | 70·0 | 69·0 | 94·0 | Ladder compartment forming up-cast; very wet. Drives stopped. |
| (3.) Stope over Main South drive, No. 2 level | 79·0 | 78·0 | 95·0 | Present, three men and lights. 30ft. above level. Rock very wet. |
| (4.) No. 3 level. Stope over main South drive | 77·0 | 76·0 | 94·0 | Present, four men and lights. 15ft. below No. 2 level. Ground wet. |
| (5.) No. 3 Plat, main shaft .. .. | 65·0 | 64·0 | 94·0 | Present, three men and lights. Air pump not at work. |
| (6.) Stope over No. 4 level South .. .. | 76·0 | 75·0 | 94·0 | Present, three men and lights. 40ft. above level. No perceptible air current. |
| (7.) Stope over No. 5 main South drive .. | 75·0 | 74·0 | 94·0 | Present, three men and lights. Smoke from two shots on No. 6 level. Slight air current. |
| (8.) Main underlay winze at No. 4 level .. | 71·0 | 69·0 | 88·0 | No plat; drives opening off each side. |
| (9.) Stope over No. 4 North drive .. .. | 79·0 | 79·0 | 100·0 | Present, five men and lights. Connected with No. 3 level. No air current 20ft. above level. |
| (10.) Stope over No. 5 level, North .. .. | 75·0 | 74·0 | 94·0 | Present, six men and lights. Open stope. 30ft. above level. No current. |
| (11.) No. 5 level, main North drive .. .. | 81·0 | 81·0 | 100·0 | Present, five men and lights. No current. |
| (12.) No. 6 level. Plat in main underlay winze | 71·0 | 70·0 | 94·0 | Three men and lights. |
| (13.) Stope over No. 6 level, South .. .. | 74·0 | 74·0 | 100·0 | Five men and lights. |
| (14.) No. 7 level. main North drive .. .. | 76·0 | 75·0 | 94·0 | Three men and lights; rock drill not working. |
| (15.) No. 8 level South, 60ft. from winze .. | 78·0 | 78·0 | 100·0 | Three men and lights; slight leak of compressed air. |
| (16.) No. 8 level North, 34ft. from winze .. | 78·0 | 77·0 | 94·0 | Not being worked. |

E. DAVENPORT CLELAND,
Inspector of Mines.

## APPENDIX L.

# ROYAL COMMISSION ON LUNG DISEASES AMONGST MINERS.

## Notes of Evidence.

PERTH, TUESDAY, 5TH APRIL, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

E. S. HUMPHRY, District Medical Officer, Southern Cross, examined:

1. *By the Royal Commissioner*: How long have you been in practice on the Goldfields?—Eight years; all the time at Southern Cross.

2. Are there correct records of all the cases treated by yourself at the Southern Cross hospital, to be found in the books of the hospital?—Yes.

3. Is there any appreciable amount of deep mining at Southern Cross?—The deepest mine is 300ft.; no others as deep as that.

4. Have you noticed anything in the nature of a cough amongst the general population at Southern Cross?—A mild form of cough appears among the non-mining population, especially the children, as a rule each winter.

5. Do you think that the dust, which is more or less common in that district, plays any part in the causation of any degree of bronchitis amongst the non-mining population?—The dust blown about in the atmosphere produces a distinct irritation of the upper air-passages.

6. Do you think that dry-blowing produces any result on the air-passages of those engaged in that form of mining?—I am not prepared to express an opinion.

7. Can you recollect any definite cases of lung diseases amongst your patients who have been engaged in mining?—There have been under my care seventeen cases of tuberculosis.

8. Can you give me details?—A boy named McQuade, aged 14, died from pneumonia. His complaint started with typical pneumonia, but there were undoubted tubercular signs. His father, who had not been working long in the district also had a bad cough; he had the cough when he came to the district. At the same time I had a man named Searle, a miner, who also died from pneumonia. It is questionable whether he had previously had tuberculosis; he was a miner, but I could not say which form of mining he followed. An old man named Muir, who had miners' disease, also died. He contracted his complaint in the Eastern States; he had never been mining in this State. Another patient, named Ireland, went away to Coolgardie, and, I believe, died at the sanatorium. He had undoubted miners' phthisis, and had been mining in the Southern Cross District for eight or ten years, and was known to have a cough when he came there. A man named Stephens went to Coolgardie a short time ago. He had been working in Southern Cross for only a short time, but I could not say exactly how long, and he was already affected when he arrived at Southern Cross. Whether he worked underground or not I could not say. A man named Fisher who, I think, had miners' phthisis, went to South Africa. Other patients were a man named Davis, a non-miner, a police constable named Bruce, and a man named Turner, who worked in the railway department.

9. Have you performed any *post mortem* examinations of miners, after death from accident or disease other than diseases of the lungs?—I cannot recollect any.

10. Are you in a position to make any statement as to the relative frequency of diseases of the lungs amongst miners at Southern Cross?—My impression is that there is less tuberculosis or other lung diseases amongst miners than amongst the general population.

(*The witness retired.*)

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LEONORA, TUESDAY, 3RD MAY, 1910.

Dr. WILLIAM ERNEST O'HARA, District Medical Officer, Leonora, sworn and examined:

11. *By the Royal Commissioner*: How long have you been in practice here?—Two years and nine months.

12. How many cases can you call to mind of chest trouble amongst miners?—I should think ten would cover the lot; that is, cases apart from ordinary colds.

13. Would you say from your experience that miners' phthisis is at all common in this district?—No.

14. What effect has the recent epidemic of influenza had on miners as compared with the general population?—I do not think it has had any greater effect on them than on the general population.

15. Has there been any prevalence of bronchitis?—No.

16. Would you say that a miner is more liable to contract pneumonia or tubercular disease?—I think you could say that.

17. What about his resistance to pneumonia when contracted?—The mortality has been exceedingly low.

18. The result generally is not serious?—I do not think it is. I have lost only two cases of pneumonia since I came here.

19. Are you in a position to say anything about the sanitation of the mines here?—I do not know anything about Gwalia.

20. Of the men you know of as being phthisical, we have the names?—Yes; of all those at present available. One other, O'Flaherty, went to Sydney a fortnight ago.

21. Does the dust circulating in the atmosphere here affect the general population at all?—I do not think so. The dust may be the cause of occasional cases of asthma; but taken on the whole I do not think that phthisis cases do well here.

(*The witness retired.*)

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GWALIA, WEDNESDAY, 4TH MAY, 1910.

Dr. D. H. W. MACKIE, Medical Practitioner, Gwalia, examined:

22. *By the Royal Commissioner*: Can you tell us anything regarding miners' phthisis here?—I do not know of any cases which I am certain have originated here. All the cases I know of have come here from the Great Boulder, Ivanhoe, or Great Fingall. I have had only six fatal cases of phthisis since I came here five years ago.

23. All miners?—Yes; and everyone of those men had been working in the Great Fingall before they got bad.

24. How long?—From a year upwards. They were all machine men.

25. They were tubercular cases?—Yes. I know of four other cases of men spitting blood. Those men had never been on the Fingall; they were on the Great Boulder, Ivanhoe, and Perseverance.

26. They were tubercular, too, probably?—Probably; but I do not know as to that. They had lesions in their lungs. I know of a good many cases of lung lesions, but not distinctively tubercular. These four men were in active work, and though not losing weight, they occasionally spat blood.

27. Can you form any numerical estimate of men who have been "dusted"?—No; but I have noticed that all the old miners, who have worked underground for, say, 20 years, suffer very distinctly from "dusting."

28. I have seen Leoni and Duncan; could you say, therefore, that I have examined all the tubercular

cases here known to you?—They are the only tubercular cases that I am absolutely sure of. I have two or three other men under me whom I have ordered to knock off work underground.

29. Have you seen much "dusting" amongst the Italians?—Yes; more amongst them than amongst the British miners. Nearly all the cases that came from the Fingall were Italians.

30. Do you think that the personal habits of the men have anything to do with liability to the disease?—Drinking habits might. Generally my impression is that this mine (Sons of Gwalia) is not productive of miners' phthisis. Every chest I have noticed here as being diseased has come from some other place. The Fingall cases have always been the worst.

31. Do you think the dust in the atmosphere causes any form of bronchitis amongst the general population here?—I am sure it does; in the summer especially. Colds are much more general here in summer than in winter, though the temperature varies only slightly in the summer.

(*The witness retired.*)

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MALCOLM, 6TH MAY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

SYDNEY CULLINGWORTH, Inspector of Mines, examined:

32. *By the Royal Commissioner*: Can you give the Commission any information as to cases of chest complaint amongst miners in your district?—I do not know of any.

33. There has not been a case of a consumptive patient having gone away from this district to Coolgardie?—Not that I have heard of.

34. Are you aware of any complaints as to the sanitation or ventilation of mines in this district?—There have been no complaints by miners since I have been here. There was previously a complaint as to the Gwalia South, that no provision was made for sanitation at the No. 4 level.

35. You know the Sons of Gwalia mine, do you not?—Yes.

36. I went down to the Nos. 9, 10, and 11 levels and found the air in each to be particularly good. Is that the normal condition of the atmosphere on those levels?—Yes. The ventilation is not at all bad in that mine; though it is getting a bit hot now they are deep down.

(*The witness retired.*)

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MEEKATHARRA, 15TH MAY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

WILLIAM CONRAD SMITH, Secretary of the A.W.A. at Meekatharra, sworn and examined:

37. *By the Royal Commissioner*: Does your union extend beyond Meekatharra?—Yes; it includes also Yalginda.

38. You have had a fair experience of the goldfields, have you not?—Not of the other fields in Western Australia. The only other experience I have had was in Queensland.

39. With regard to chest diseases here, have I seen, do you think, most of the cases known to you?—I posted notices intimating that you would be here on the 21st, which is as near as I could get to the date. I tried to get all the men I could to come in, and also asked that the names be sent in to me of all men suspected to be suffering from lung diseases. Some of the men claimed to know a few who should be examined; McKeown is one, Coleman another, and the two Pritchards who worked in the Consols.

40. Have those men been in?—I think so. They came up with McKeown.

41. There is also, I believe, a man named Osborne. Are you going to try and bring him up?—He has been mining off and on, but I do not think he has been following mining only. He is a blacksmith and farrier.

42. So far as you can say, then, all the cases known to you I have seen?—Yes; so far as I know.

43. Has your union discussed the question of the desirability of excluding men suffering from consumption from work in mines?—Yes. We have often discussed it. We believe such men are a menace to other miners. Drinking vessels are supplied below ground, and if there is any contagious disease, such as consumption, amongst the men it would be easy to contract the disease by drinking from those vessels. Then, again, the consumptives spit about when the men, at crib and other times, are sitting in a row in the drive, say, smoking after crib. Fairly dry spots are picked. If consumption is as catching as it is said to be, we consider it is dangerous for men to work with a consumptive, especially in double-handed work, in which the men have to work very close together.

44. Have you seen respirators in use by men working on drills?—No.

45. What do you think would be the attitude of the men; would they use respirators?—No; they would prefer the water spray.

46. Have you seen the spray in use?—No; but I believe it is in use in Victoria, and miners to whom I have spoken about it consider it preferable to respirators. The objection the men have to using respirators is that there is sufficient difficulty in breathing down below without impediments to the nostrils and mouth.

47. So far as the local mines are concerned, is there any of them about which the men complain as being particularly bad?—I have not heard any serious complaints—only that some of the levels are rather dirty.

48. Of the ventilation of the mines, or the heat?—Some men would complain of the heat when others would not. Taken on the whole, the mine-owners here are very fair with regard to giving the men air; they always try to get a winze down where practicable, and do not try to "rise" too high. I think the practice of high "rises" should be condemned. The mine staffs include surveyors who know exactly where to put a winze down, and good air can be got that way. If you go down a winze and then up a rise you will find the temperature 30deg. higher in the latter. A "rise" is always put up where air is wanted to be got through, and therefore "rising" is a pretty deadly sort of job. Here they only "rise" from 20 to 30 feet; a winze is always put down to that distance.

49. Then, on the whole, the mines here are fairly well ventilated?—Yes.

50. And not too hot?—No.

51. Some of the men examined last night said that the air in the mines sometimes became very hot?—That is only to be expected; you must get hot air in every mine. When a shaft is put down and a drive put in, a winze is put down at from 100 to 150 feet from the shaft; therefore the men must go from 100 to 150 feet from the shaft before a winze is put down or a rise put up.

52. Is there anything else you would like to bring under the notice of the Commission?—The most particular thing I consider you should take notice of is the "rises."

(*The witness retired.*)

CLIVE SHIELDS, District Medical Officer, Meekatharra, sworn and examined:

53. *By the Royal Commissioner*: I have been appointed to inquire into the question of pulmonary diseases amongst miners. Will you state what your experience has been in that regard?—Some forms of chest complaints are fairly common amongst miners.

54. Has that been your experience here and at Davyhurst as well?—Yes; here and at Davyhurst and Mulline.

55. What is the probable causing factor, dust or fumes?—Fumes, I should say, chiefly.

56. Here is another point which is interesting in this connection. Dr. Humphreys, of Southern Cross, tells me that he has found among the non-mining males at that place a good deal of what he described as tracheitis during the summer months. How does that tally with your experience?—Yes; he is probably making a similar remark to mine.

57. Of those cases of lung disease amongst miners which you have seen since coming to Meekatharra, have I examined all of them to-day?—No; I think you have not seen one man, named Watson, of whom I was suspicious. He came to me about half-past five one evening and after examining him I told him I was a bit suspicious, but I have not seen him since.

58. Which mine is he on?—He is working on prospecting shows. He had a bad bout of typhoid, since when he has had a cold which has clung to him for four or five months.

59. Did you see much of true lung disease at Davyhurst?—No.

60. The cases you have seen here are all advanced cases?—All except the man Coleman.

61. Have you seen much of a true early fibrosis?—I think the cases we have been speaking of are definite tuberculosis. Taking fibrosis, some of the cases show no evidence of fibrosis as such; for instance, I would not swear to fibrosis in the case of Coleman. Charman I take to be fibrotic. Apart from those definite cases I have met several cases of early fibrosis, but I could not give you the names of them. Fibrosis in some of them may be an age change of a trouble which commenced with mining work—a fibrosis which need not necessarily shorten life. For the purposes of your inquiry, I think the cases I have mentioned are the only ones worth considering.

62. Is there anything else which occurs to you, with your experience of mining men, which should be of interest or importance to this inquiry?—My experience is that, as a class, miners are very careless. Almost invariably you will find men working below taking no precautions whatever about covering themselves up when coming up the shaft or out of the mine; and almost always they come up from below with nothing covering their chest but a sweaty singlet. In my opinion, they give themselves no chance. Before coming to Meekatharra—that is while I was at Broad Arrow and Davyhurst—I was rather astonished at the scarcity of lung trouble amongst miners. Here, on the other hand, in a short space of time compared with my experience in other places, I have met what might be termed quite a crowd of cases, and that is within only three months. That may probably be deceiving as to the actual conditions here, for these men look upon me more or less as a new broom—particularly in my case on account of my having sent the man Maher away to the Eastern States. The men saw that I was taking an interest in the question of chest trouble, and consequently I have seen most of them who are ill.

(*The witness retired.*)

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CUE, TUESDAY, 17TH MAY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

FRANCIS JOHN LANDER, Inspector of Mines for the Central District of the Murchison Goldfield, sworn and examined:

63. *By the Royal Commissioner*: What has been your experience as to the prevalence of lung disease amongst miners?—I have not met many such cases.

64. That is to say, in your experience, lung diseases are rare amongst miners?—So much so that I remember only one case in this district, Walter McNerney; and I do not know, even, that that was a case of miners' phthisis.

65. I presume that is not to say that lung diseases do not exist amongst miners in this district?—They may exist without my knowledge.

66. But your work brings you into contact with men who are not affected?—With men who are healthy and strong. I do not go round my district very often because of its size and in my absence some men may have gone off work ill and other men taken their places.

67. What has been your experience regarding complaints by the men or their representatives?—They have made no complaints to me.

68. With regard to ventilation, particularly?—I have received no complaints personally.

69. Nor from the union officials?—I do not think there has been one.

70. As I understand the position, the men have a perfect right to lodge complaints with you?—They have; and in no case is the name of the complainant divulged.

71. And under the Act you are obliged to investigate all such complaints?—Absolutely; but I have never had one case reported to me. There was, I believe, certain complaints made to the Minister that the "shrinkage" system was bad.

72. I do not understand the "shrinkage" system; you might explain it?—There are different ways of stoping up ground. When stoping is begun under the shrinkage system, everything is blown down but only sufficient taken out to provide a space large enough between the top of the ore and the back for men to work in safety.

73. Practically, then, the men are working in a minimum space?—Yes; there is no mullocking up, for they have the ore which has been broken down to stand on. If this system be worked as it should be there is much to commend it. In the first place the men are always convenient to their work; and in the next place the stopes are always well ventilated.

74. In this particular instance complaint was made by somebody?—By the officers of the union.

75. To someone else who was not yourself?—To the State Mining Engineer I think; the State Mining Engineer wrote and instructed me to hold an investigation.

76. The complaint, I think, did not originate in respect of the Day Dawn mine; it originated at Kalgoorlie, did it not?—Yes; I remember the circumstances rightly now.

77. So far as you are concerned, the question arose with a request from the State Mining Engineer to confer with the men at Day Dawn as to the shrinkage system?—That is right. Following on that a meeting was held, and after discussing the matter an adjournment was made to Day Dawn, and the men's representatives declined an invitation to inspect the stopes for themselves.

78. So that the position in the end was that they objected to the system of shrinkage working, but declined to go underground and inspect the system at work?—That is right. Serious complaint was made as to the danger under the system incurred by the truckers in taking ore out of the chutes. Large blocks of stone often fell and blocked the passage; and dynamite had to be used so often in order to remove these rocks that the levels were frequently filled with dynamite fumes. Again it was objected that these stones blocking the passage were sometimes so high that it became necessary for men to get into the chutes when preparing to fire and were thus in danger of losing their lives; in fact, one man did lose his life in that way. That, however, was really his own fault. The men are provided with sticks from 20 to 30 feet long; and if the stone to be removed covers a large area of ground they adopt the practice of placing dynamite on the end of these sticks and push it close up to the edge of the stone and fire it.

79. Holding the stick in their hands?—No; they jamb the stick and then run away. The particular objection was that the fumes and dust vitiated the atmosphere to such an extent that it became a big factor in inducing miners' phthisis.

80. With regard to the mines in the Cue district, does the use of drills produce dust?—There is no doubt about that.

81. An appreciable quantity?—A very large quantity.

82. How does the amount of dust produced in the Fingall mine compare with that in other mines?—Mines of the same kind produce the same amount of dust. Very hard quartz, such as that in the big mine at Day Dawn, will produce no more dust than hard quartz in the mines at Kalgoorlie.

83. I take it, then, the amount of dust produced depends on the class of rock being dealt with?—Exactly.

84. You have had experience on other fields?—Yes; at Kalgoorlie and Coolgardie.

85. Do you know the Gwalia?—No.

86. Some mines are schistose?—Yes.

87. How does the amount of dust produced in schistose mines compare with hard quartz mines?—There is very much more in the hard ground.

88. Is the rock being dealt with in the Fingall mine more typically quartzy than in other mines?—Yes.

89. So that the Fingall will always, from a dust point of view, be worse than other mines?—It is quite possible; but it compares well with any quartz mine. It is as well ventilated and well managed as it can possibly be.

90. And the only difference between it and other mines with which it may be compared in this State is that there is more quartz.—Yes.

91. And therefore the work would be more dangerous than in a safe mine?—From the dust point of view, yes; it is purely a quartz mine, and in boring into the dry face you have fire, dust, steel, and quartz flying around; in a few seconds after the machine is started the place becomes filled with these particles. The space in which the machines are worked is only 6ft. wide by 6ft. high. In boring downwards, after the hole is sunk six inches the dust is not so bad.

92. Have you had experience with machines provided with jets or sprays?—No.

93. And you have not seen any type of respirator in work?—No.

(*The witness retired.*)

CUE, TUESDAY, 17TH MAY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

ROBERT STANLEY TAYLOR, District Medical Cue, sworn and examined:

94. *By the Royal Commissioner*: Do you hold any office in connection with the mine (Great Fingall)?—No; but they generally call me in.

95. Then in all probability you see a majority of the cases of sickness amongst miners in and about the Fingall?—Yes.

96. What proportion of the cases you have seen would the statement which you sent down to Dr. Hope embrace?—About two-thirds.

97. During what period?—I have been here since June 1st last year; before that I was for 18 months at Nannine.

98. That statement includes both places?—Yes.

99. Is there anything in the statement to indicate which cases were at Nannine and which at Day Dawn?—No.

100. Can you form any numerical estimate as to the approximate number of lung diseases you have seen amongst miners in Cue and Day Dawn?—I should think about twenty.

101. Of those, how many true tubercular cases have you seen?—McNerney, Trefry, James, Brown, Bull, and McCrae (whom I saw originally at Nannine and sent on here)—those are all I can remember.

102. Those names are not included in the statement.—I did not include any names in the statement.

103. Is there any considerable prevalence of non-tubercular cases here?—If so, they do not come to me; I have not seen them.

104. You mean, that so far as you know there is not?—So far as I know there is not. I have, of course, seen men who claimed to be suffering from miners' complaint, but on examination were found to be suffering from something quite different. I will give an instance. A man named Lang came to me saying he was suffering from miners' complaint, who was in reality suffering from carcinoma of the stomach, as proved by operation and microscopic examination.

105. Are there any other cases?—There are other cases of true tubercular nature whom Dr. Blanchard saw, but they were never brought to me. I have heard of Hosken and others, but have not seen them.

106. I understand that there is a considerable amount of dust about Day Dawn, particularly in the summer months. Have you noticed that dust produces any effect among the non-mining population?—No, I have not. The only thing I have noticed the dust to produce is sore eyes.

107. Amongst those cases of tuberculosis which you have seen, have you observed any infection to other members of the family, the children and so on?—In only one case, McNerney.

107a. Is that the child who has St. Vitus's dance?—So have the other children. He had one older boy who had a trouble in the cervical region. I wanted him to have the boy operated on. I could not, however, swear that they were tubercular. McNerney's brother stated to me that one other brother had already died of phthisis. McNerney himself had at least two hæmorrhages before coming to Day Dawn.

(*The witness retired.*)

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DAY DAWN, THURSDAY, 19TH MAY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

THOMAS CHESSON, Secretary Miners' Union, Day Dawn, sworn and examined:

108. *By the Royal Commissioner*: With regard to the question of lung diseases amongst miners, are all the cases known to you included in the list which has been supplied to me?—Yes; with the exception of the Italians. I have known all the Cararas and the Colombis. Of course, I cannot give you any evidence of their cases, other than that I knew them as strong, hearty men who worked in "rises"—one of the worst places in a mine—and when they left here I would not give twopence for their lives; and they have since been reported to me as dead.

109. Many or few?—I have known a great number.

110. Could you fix the number at all approximately?—Say 70 or 80.

111. Seventy or eighty cases have been reported to you?—Yes. I kept a list at one time, and on that list were the names of eighty Italians.

112. During how many years?—Between three and three and a-half years.

113. The main point I want to make sure of is that I have not missed any men now here, known or suspected to be suffering from lung troubles?—There may be one or two—for instance, I wanted a man named Taylor to come down and see you. These men are now working on the surface, but they have worked underground. A lot of the men do not care to come up for examination. You have seen the greater portion of those men; I have made inquiries at the office and find that that is so. There are a few other men who are falling away.

114. How many, do you think?—I suppose there would be half a dozen.

115. Whom I have not seen?—Yes.

116. All those whom you know to be ill I have seen?—Yes. I think you have gone into the matter thoroughly, and it is now the men's own fault if they do not come up for examination.

117. With regard to the mine itself, the Fingall, you are in a position to hear complaints from the men. Have any complaints reached you?—Yes. Numerous complaints have reached me, especially when they were working on the "shrinkage" system—they are not working on that system at present—of the fumes from dynamite. The Italians are great believers in dynamite.

118. You have heard complaints about the ventilation of the mine, and about dynamite fumes?—Yes. Men have come to me after a week or two in the mine and said, "This is my last shift; I have had enough"—hundreds of them in twelve months have made the same complaint, continuous fumes and dust.

119. Chiefly in "rises"?—The ventilation depends on the wind. Sometimes the ventilation of the mine is not bad, but at other times it is not fit for anybody. I could always know three or four days before that an inspection of the mine was to be made.

120. So far as you are able to judge, I have examined the men here fairly comprehensively?—That is right. So far as the men are concerned you have done it well.

121. And with regard to the mine you have had complaints?—I have had numerous complaints with regard to ventilation and the continuous smoke during shooting—especially when the mine was worked on the shrinkage system.

122. What about recently?—Recently down about the 14 level it is very bad; in fact, on the plat also.

123. It is better now than it has been?—Yes.

124. Have you had any experience of the use of respirators?—No; but I have no time for respirators. They might be right enough for machine work, but with hammer and drill work the trouble is that you do not seem to get enough air.

125. You mean that a respirator would not allow the men enough air for breathing?—Yes. I think the best way over the dust trouble is by using the jets.

126. Do you think the men would use the jets if they were provided?—I think their use should be made compulsory, as in Broken Hill and other places. There are, of course, men who would bore dry holes rather than wet ones.

127. What do you think of the question of excluding from mines men who are affected with tuberculosis?—I think it would be absolutely the best thing that could be done. Such men would then look for something else to do, and would probably get it. I think, however, that some provision should be made by the mines and also by the Government—a similar arrangement as at present exists in the coal mines of New South Wales, where one half-penny per ton of coal broken is put into a fund. The men contribute to that fund, and also the Government. They financed the Bulli disaster, and also the Kembla disaster from that fund.

128. The companies, the men, and the Government all pay into the fund?—Yes. I think there is a similar provision in Germany.

129. That is an insurance fund?—Yes; so as to make provision if a man contracted this complaint and had to go into the sanatorium he would know that his wife and family would not be in want. If that worry could be taken off their minds there are a lot of men in the first stages of the disease who would probably be cured by

treatment if they could be relieved from financial worries of this nature.

130. Has the question of establishing a sanatorium up here ever been discussed?—We have discussed it on more than one occasion, and we consider it would be a really good thing if we had some such establishment in this district. Most of the miners when the sanatorium is mentioned ask, "What is to become of the wife and family?" Most of them are married; and after a number of years of mining work a man is not fit for any other occupation. Supposing a man had been on hammer and drill work and took on the machines for a few years. He could not go back to hammer and drill work again; he would not have sufficient wind.

131. Is there any other aspect of this question which you would like to bring forward?—I do not know of anything else. I consider the jets are the best means of dealing with the dust trouble and also with fumes. Men who have used respirators claim that they are not a success because the wearer cannot get enough air. In the cases of men working on machines, however, respirators would prevent the dust trouble. If everything is going smoothly on machine work it is not hard work.

132. It does not require very much effort?—No; but hammer and drill work is hard work all the time. In coal mines there is plenty of ventilation all the time.

(*The witness retired.*)

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CUE, 19TH MAY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

DAVID ALLAN WATSON, Secretary Miners' Union, Cue, sworn and examined:

133. *By the Royal Commissioner*: So far as you know, is there much lung disease amongst miners in and around Cue?—Very little, not including Day Dawn. We claim as a reason for that there are no machines here, the mines are shallow, and they have all good ventilation.

134. Practically no machines are being used here?—None at all. There were one or two at the Cue 1, but that mine has not been working for some time now.

135. About how many men have you in your union in Cue proper?—I should say about 60.

136. They are mostly wages men?—Yes; there are also a few prospectors.

137. Do you know of any complaints which the men have to make about the mines they are working on?—The only complaint I know of is that the Princess Royal is the hottest mine on the Murchison.

138. That it is dusty?—No dust; it is sloppy, soft ground. I may say that, as district secretary, I have found in travelling around that a good many men are affected. I have found them at Day Dawn, Meekatharra, and Sandstone.

139. Can you recollect the names of the men at Meekatharra?—One man whom I knew there is Con. Maher.

140. I have full particulars of his case; but as he is now in Sydney I cannot see him. I shall be glad to learn of any man here whom you know as possibly affected?—There is a man here named Struefett whom I believe to be affected, but I cannot induce him to come and see you.

141. Other than he, have I examined all the affected men known to you?—Yes. As I have said before, I think it would be difficult to find a sounder body of men anywhere in the Commonwealth than the miners here.

(*The witness retired.*)

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GEORGE CHARLES KLUG, Superintendent of the Great Fingall Consolidated, Limited, sworn and examined:

142. *By the Royal Commissioner*: How many men are now employed on your mine?—We have a total of 411 on the books at the present time.

143. Can you split the number up into sections?—We have 186 on the underground books, of whom there are 176 actually employed underground. The other men are blacksmiths, tool sharpeners, tradesmen, etc. That total includes the two "cracker" (rock-breaker) men whom you examined.

144. Have you paid off any men who were likely to be suspected of having any lung complaint?—No.

145. The men, as I saw them on the mine, were the normal staff?—Yes; the normal employees.

146. And of the men whom you knew were suffering from chest troubles?—I personally arranged that they should come along and be examined. On receipt of your telegram that you would be in Day Dawn on Wednesday I had notices posted instructing all employees to attend at the change-room to be examined by you, between the hours of 8 and 11 a.m. for the night shift; 1 and 4 p.m. for the afternoon shift; and 4 and 7 p.m. for the day shift.

147. With regard to the Fingall, have you tried using respirators on the mine during your period as manager?—Only on the rock-breaker; we had one man there who uses a respirator.

148. And your own personal experience of its use, here or elsewhere?—I have had experience of respirators at Broken Hill. There the men were forced to use them; but after a time it was found that they absolutely refused to do so. The respirator was of the normal type, with outlet and inlet valve and sponge nostril-piece, and readily and easily cleaned. Nevertheless, the men found when exerting themselves beyond normal, when making any strenuous effort, that it retarded their breathing. Rather than use respirators when engaged in lead baling they used to put handkerchiefs over their nostrils.

149. So that the respirator system is not entirely a success?—I do not consider it so.

150. What is the recognised custom with regard to the boring of holes with machines; are the men supposed to keep them wet?—Yes; certain holes. The use of a spray would minimise dust.

151. Where there are no sprays, are they supposed to throw water into the holes?—Yes.

152. Do they do so?—That is one of the difficulties with which our shift bosses have to deal; they have to keep on forcing the men in that matter, even though in some instances the water is only a few yards away. It is to the men's own advantage to bore water holes, for the drill will not only bore truer but will remain sharp for a longer period; and it also minimises the dust. I know personally of an instance which occurred only the other day. The underground boss and myself were on the bottom level, and a man was boring what was really a water hole, but he was making it a dry hole—and the water was only two yards from him. The result was that the underground manager "got on" to him very severely.

153. Some of the union officials have mentioned to me that the "shrinkage" system was the cause of a good deal of complaint amongst the men. Would you give me the position from the mine manager's point of view of what happened?—We are working the "shrinkage" system in places now. The question was discussed at a conference. Mr. Watson, secretary of the union at Cue, Mr. Oates, and Mr. Chesson, union secretary at Day Dawn, were appointed by the unions to confer on the question with the inspector of mines. The mine representatives were Mr. Curry, underground manager, and myself. They represented to us that the shrinkage system was one with which they were not in accord. They did not complain of the shrinkage system causing an abnormal amount of dust, other than that the "shoots" would have to be fired more than would be necessary under the other system; but as we pointed out, that was brought about by conditions over which we had no control. When the shrinkage system was started in the Fingall they had excellent standing walls. To get over the air difficulty, as was explained at the conference, we put in auxiliary shafts. That minimised the difficulty. Since then there has been very little of the trouble complained of, but we admit that it took a fair amount of shooting to get the ore out at the time.

154. That, I take it, was the cause of the unusual amount of fumes?—I do not think so, under present conditions—I cannot speak of my predecessor's experience. I had only a fortnight's experience of getting out ore for the 100-head mill. There were then more fumes than at present—that I must admit. I have had considerable experience in mining, and I can honestly say of the underground conditions in the Fingall that, so far as fumes are concerned, it is one of the best ventilated mines I know of. The outcome of the conference was that Mr. Watson made several rash statements concerning the underground conditions in the Fingall, which

were absurd within my own knowledge. I put the question to him direct whether he had been down the Fingall recently, and he said he had not. I asked the others the same question, and they said they had not been down the mine for twelve months or so. I then threw out a challenge to them to come down the mine and see the conditions for themselves. Mr. Watson and the others unanimously accepted the invitation, and an appointment was made for the following Wednesday morning. At 9 o'clock on that day the treasurer of the union, Mr. Chesson, rang me up and said, "I suppose, Mr. Klug, that the conference to-day will be off." I asked, "Why do you say that?"; to which he replied, "Oh, it is pay-day." I replied, "That won't make any difference to me, Mr. Chesson, I do not pay the men; come right along." He then said, "All right; 10 o'clock." At 10 o'clock the inspector of mines and myself were ready. The other gentlemen turned up presently and entered into conversation with the inspector on the verandah. Thinking they were a long time coming in, I went out on to the verandah and enquired what was the matter. The inspector then told me the men did not care to go underground. Mr. Watson explained that since the meeting at Cue on the previous Monday they had discussed the matter further with the union, and as they were unanimous in disapproving of the shrinkage system no good could result from their going underground, and therefore they did not wish to take up any more of my time.

155. Before my visit to the mine this afternoon was any preparation made to ensure that any part of the workings was in a better condition than is usually present during the working of the mine?—No. And so far as the treatment of the men is concerned, the men Hutchins, Trefry, and Highmore can bear me out that, recognising that they had been old employees of the company—they were here before I came on to the mine—whenever a light job came along I gave those men the preference; and they are working for us to-day.

156. Is there any other phase of the question?—I think the men themselves could minimise the dust nuisance to a great extent by paying strict attention to the boring of water holes. The shift boss may do his best to that end; but although it is to everybody's interest, the men will not do this, for some reason or other. I do not think it is due to laziness, but to thoughtlessness rather. We provide special means for ventilation of the mine at the bottom level, and I think I am right in saying that a winze connects right the entire depth of 2,200 feet from the surface.

157. You mean that long galvanised iron tube?—Yes; that induces a draught. On several occasions the underground manager and shift bosses have had to give the men severe talkings to for neglecting to turn the air off. That is no reflection on the administrative staff; we know that they have to be continually at the men.

(*The witness retired.*)

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SANDSTONE, TUESDAY, MAY 24TH, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

THOMAS JAMES ROCHESTER, Secretary A.W.A., Sandstone, sworn and examined:

158. *By the Royal Commissioner*: Are all the cases of lung troubles among miners in this district of which you are aware included in the list supplied to me?—All the cases I am aware of are on that list.

159. Have there been any other cases in this district who have gone away from here?—Yes.

160. Can you form any estimate as to the number?—I was calling them to mind, and these are a few of the names I could remember. During the last two years these men have stated to me that the doctor had said they were suffering from miners' complaint. (List handed in.)

161. I have seen all of these men with the exception of Daniells. Do you know whether he has been to a doctor?—He has been attending at the hospital. It may have been for a complaint of the teeth; he has had a number of teeth drawn. I was going more by the look of the man than by actual knowledge when I placed his name on the list.

162. Have you received any complaints from men here as to the ventilation or sanitation of any of the local mines?—I have had innumerable complaints about one mine, Hack's.

163. Complaints about the ventilation?—Complaints of the lack of ventilation.

164. What is the primary cause of complaint?—The men consider that the air in the mine is rendered bad owing to the lack of ventilation and the fumes from dynamite.

165. Have you worked in Hack's yourself?—Yes.

166. As a miner, what is your opinion of that mine?—I can only speak of about four years ago.

167. Was it bad then?—Yes.

168. But it has been improved since that time?—Yes.

169. It is difficult for me to form an estimate of Hack's mine, because several new rises have been put in, besides other ventilation. It may not be so bad now as a few months ago. The men complain that it is not a good mine?—They complain to me frequently of the mine, in my capacity of secretary to the union; and they have asked me to call the attention of the Mines Inspector to it.

170. Was that done recently?—The inspector has been here, and I believe he has ordered several alterations.

171. That was a result of your representations?—I cannot say. I saw the inspector of mines personally, and spoke to him on the matter. I also saw Mr. Coupar, the manager of the mine, before speaking to the inspector; but Mr. Coupar said the camps in which the men live are responsible for the cough.

172. What about the Oroya and the Development; have there been complaints about them?—No; there have been no complaints. They provide everything desired by the men, especially at the Oroya.

173. Have the men dwelt on the fact that in the shaft at Hack's the air is very cold, and suggested that that has had anything to do in causing the cough?—I believe it has been suggested, but not frequently.

174. There must be a cause for a cough which is prevalent amongst a body of men. Many of those men are old miners, and they might be able to assign a cause. You have not heard anything definite on that point?—No; except that the air does not circulate freely in the mine. About three years ago it was stated that while the air was good down the travelling way, you could see a thick mist of smoke in the levels.

175. Is there anything else which occurs to you as desirable of being brought forward as evidence?—I do not think so.

(*The witness retired.*)

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PERTH, WEDNESDAY, JUNE 1ST, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

DONALD CAMERON, District Medical Officer, Sandstone, sworn and examined:

176. *By the Royal Commissioner*: How long have you been in practice at Sandstone?—Since August last.

177. And before that?—I saw a little coal mining in the Old Country; then, after being in Victoria a short time, I went to the Mount Morgans (Queensland) hospital for two years, and then to Cloncurry, Queensland.

178. That is also a mining centre, is it not?—Yes. Prior to coming to this State I was for a time at Winton, Queensland—that is a pastoral centre.

179. As regards your experience at Sandstone, have you seen many cases of lung diseases?—Yes.

180. Mostly of which form?—Bronchitis.

181. Acute bronchitis, lasting for a short time?—Acute, and chronic, too; the chronic lasting some few months.

182. Associated with fibrosis?—Very few cases.

183. Chiefly not?—Chiefly not.

184. So far as fibrosis is concerned, have you met many cases at Sandstone?—Not very many.

185. And tuberculosis?—A few; not many.

186. Can you give me any sort of numerical estimate?—Roughly, about eight cases of tuberculosis.

187. And fibrosis?—It is difficult to say off-hand. Some of the tubercular cases were fibrosis become tuberculosis—of fibrosis, say, the same number—that is, eight.

188. Of the bronchitis cases, was the incidence greater in any one mine than in the others?—Yes; by the men who consulted me the incidence was greater in one mine than in the other two.

189. Which one?—The one known as Hack's—The Black Range Mining Co.

190. There is no doubt in your mind that the men working in Hack's mine have suffered more frequently from bronchitis than the men working in the other mines?—Many of my patients at Hack's suffered more than the men in other mines.

191. Did you note any factor in producing that?—I have never been over the mine, and I do not profess to be an expert in mine ventilation. Many of the men themselves put it down to bad ventilation of the mine, but whether that is correct or not I cannot say. Others, again, on the other hand, say it is due to the living conditions of the men—their camps. My answer to that is, why should the effect of the camping conditions at Hack's be different from those at the other mines; they ought to be the same. Again, I heard one man assert that it was due to the amount of beer the men drink. That might have a tendency in the direction asserted; but beer is consumed by miners everywhere and that tendency should be uniform throughout the State. Up there the mines get the name of being of the wet nature as compared with the mines at, say, Kalgoorlie. When I went first to Sandstone the mine was at its dampest, after the rain; and there were far more men coming to me then than later on in the summer; just before I left there were very few coming along. Another evidence of some condition in or about the mine—preventable or not I do not know—is that some men suffering from what is commonly called "Hack's cough" have come to me, and I have advised them to take a week or two off, and during that week or two the cough has markedly diminished, and in some cases ceased altogether; but on their resuming work at the mine it has immediately started again.

192. That "cough" is purely bronchitic; there is no tuberculous element in the majority of cases?—In the majority of cases I do not think there is. There are a few cases of asthma; but I do not think that it is primarily tubercular. Whether it might lead to that I do not know.

193. Contrasting your experience in this State and in Queensland, what is your impression of the comparative prevalence of chest diseases amongst miners in the two States?—In Queensland (Mount Morgans), where I got most of my experience, there is very little chest trouble. It is an excellent mine, and the conditions and climate are good. It is perhaps not quite right to institute a comparison with Cloncurry, for most of the men who went there would probably be healthy.

194. Cloncurry is more a shallow-mining centre, is it not?—Yes.

195. It is, therefore, more comparable with Sandstone?—Yes. Except, of course, that it is all dry mining there. It certainly would, I think, be more comparable with Sandstone.

196. Have you noticed during the summer at Sandstone any effect produced amongst the non-mining population by the dust in the atmosphere; that it produces trachaeitis, bronchitis, or laryngitis?—I do not think the general population suffers to any extent from the dust in the atmosphere.

197. Reverting to "Hack's cough," has there been, since you have been in Sandstone, anything in the nature of a bronchitic epidemic among the general population?—Yes. We had an outbreak of influenza, and after that bronchitic cases. There were also one or two cases of broncho-pneumonia, if I remember rightly, from the other mines as well; it seemed to be general then. You could trace the influenza through Hack's. Hack's men, one after the other, all came to me with influenza. Then it seemed gradually to spread among the men on the Oroya, right through them and through the Development men, in turn.

198. Do you think that epidemic prevalence would account for the undue incidence at Hack's mine, for the time being?—For that particular time, I think it would.

199. But it does not explain the whole of the bronchitic troubles among the men at Hack's?—Not the whole of them.

200. Would your answer be that chest troubles are more prevalent amongst miners at Sandstone than at Mount Morgans (Queensland)?—Yes; but, of course, Mount Morgans is a much larger place, with a population of some 12,000 persons. Some of the fibrosis cases at Sandstone, I am sure, came there from elsewhere.

(*The witness retired.*)

NORSEMAN, JUNE 15TH, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

RICHARD RICHARDS HARVEY, District Medical Officer, Norseman, sworn and examined:

201. *By the Royal Commissioner*: How long have you been practising here?—Fourteen years.

202. Were you previously on any other mining field?—I was practising in Ballarat and the surrounding district for about three years.

203. Any other mining field in Western Australia?—No.

204. What is your opinion of the prevalence of lung diseases amongst miners in Norseman as against Ballarat?—Ballarat was an old mining field, and you could not walk down the street there without seeing someone hopping along with a stick, with bent shoulders—old before their time; they were old at 50. Here you do not see anything like that; we have not had time yet. As a matter of fact, I have not seen any cases here of what is known on the other side as miners' phthisis.

205. By that you mean fibrosis as against tuberculosis?—Yes.

206. Have you seen here cases of tuberculosis amongst miners?—I have not seen any case that has arisen here. I have seen one case, but he did not do any mining here.

207. What happened to him?—He died.

208. He had never been mining here?—No. He had tuberculosis.

209. Do you know whether he had ever been mining anywhere in this State?—I do not think he did much more than a little prospecting in this district.

210. He was a miner from the Eastern States?—Yes.

211. Bendigo or Ballarat?—New South Wales, I think.

212. You feel inclined, then, to say that so far as your experience in Norseman goes, lung diseases are uncommon?—In miners they are very rare, I think.

213. Have you found that the mining population—that is the male mining population—are more susceptible to lung disease than the male population amongst non-miners?—No. As regards tubercle I think there is much more among the other portion of the population than amongst the miners. Of course, the total number of cases of tubercle which have occurred in this district is very small indeed.

214. As many as a dozen?—No.

215. Is there anything else you can think of which may be useful in this inquiry?—I could tell you about the case of the man of whom I spoke just now (Paterson). Harry Brown was a miner from the other side—Bendigo, I think, speaking from memory—who came here with his complaint already developed; and he gradually got worse, of course. His case was non-tubercular, and mostly of the type described as chronic bronchitis.

216. He was distinctly non-tubercular?—He had no bacillus in his sputum; he was of the chronic bronchitis type. My experience of miners' complaint is that it differs in type.

217. Chiefly divisible in two main types, fibrotic and tubercular?—There is a class of case in which it seems that heart failure has been the origin of the trouble.

218. That is, a secondary lung condition, and primary heart?—Yes.

219. Are such cases at all common?—I have seen them; but I cannot say they are common. A very characteristic case of this class is a bronchial case, such as Harry Brown's.

220. In these advanced bronchial conditions would you get what appears to be bronchiectasis?—No.

221. It would be difficult to diagnose between bronchiectasis and tubercular cases?—Yes; it is very difficult to say. You do not get a large quantity of air breathed into the lungs, and you do not get many of the sounds you look for and expect, and the absence of those sounds makes you suspicious.

222. Have you found it at all in consolidation and bronchitic conditions?—No; I found the absence of sounds mostly the characteristic.

223. Of the bronchitis type, or of both?—In different conditions; in the bronchitic type I found absence of sounds very common. There is also a class of case which has become tubercular, such as you would have called secondary 30 years ago. Then, of course, there are specific cases, which are more common than is usually believed.

224. How do they show themselves as pulmonary conditions?—They greatly resemble cases of tubercle.

225. Do they show themselves with a cavity, mostly at the base?—Yes.

226. Have you any differential basis on which you rely in these cases?—General clinical symptoms.

227. Do you do the tuberculin test at all?—Only the sputum tests.

228. Did you do it in Brown's case?—Yes.

229. What was the result?—The Bacteriological Department, in Perth, made the sputum test.

230. And in the case of Paterson?—No. I decided his case was tubercular from the symptoms and the temperature test.

231. Do you know Hooker, Roscoe, and Wilson?—Yes.

232. Can you recall particulars of them, particulars as to their chests?—I did not see anything wrong with their chests. Hooker always had a peculiar pallor, which creates the suspicion that he may be tubercular. His chest symptoms, however, were not brought before me; he had influenza when I saw him. He is a man very frightened of himself.

233. And Wilson?—I have not had anything to do with Wilson.

234. And Roscoe?—He has been in hospital several times with sciatica; he does not complain of his chest.

235. What are the particular symptoms you have found in cases of fibrosis?—I have been trying to recall a typical case of fibrosis. I think they must be rare here.

236. Shortness of breath is a subjective symptom; and as objective symptoms, rigidity of the walls, together with weakness of the breath sounds?—Yes; that is it.

237. And very little less power of expansion, poor mobility, weak breath, with possibly some prolongation of the second sound; as a rule the heart seems to be good until pretty late?—Yes. The heart seems pretty good, but still you suspect the chest shows something wrong.

238. In such cases, are you in accord with the theory that they are dust-produced?—I think so; dust and atmospheric pressure acting on men working at high pressure causes a strenuous physical action of the lung.

239. That is abnormally heavy work under abnormally bad conditions?—Yes.

240. Anything else?—I might say that emphysema complicates a lot of these cases, and makes them very much worse than they would otherwise be. Again, there is the density of the atmosphere. No doubt miners are very careless about changes of atmosphere; after being hauled up out of the mine they are not careful how they cool themselves.

241. Have you had any cases brought to you for treatment as the result of fumes intoxication?—Some cases of chest trouble occur after pleurisy.

242. Some men claim that pleurisy is always tubercular; what is your opinion of that?—I cannot give you any opinion on that, except that a number of cases start with pleurisy. As a matter of fact this place is remarkably healthy.

243. Now about fumes, have you ever had cases of men brought to you?—Certainly.

244. Acute or chronic?—Mostly acute.

245. What symptoms, chiefly?—I get a hurried message to come to the mine. For instance, at the Norseman mine, when it was working, three or four times I had hurried messages, and on arrival I found three or four men affected, sometimes more, but mostly about four men.

246. Unconscious?—Yes; some having convulsions.

247. Was there any unusual dilatation of the superficial vessels; I am thinking more of nitrous fumes?—I cannot say whether there was any dilatation.

248. Recovery, I suppose, in a large percentage of the cases?—Every case recovered eventually; sometimes after a few days. I have found that the use of oxygen has converted a very desperate trouble into quite a simple thing. By leaving some of the oxygen cylinders at the hospital and running the cases in as quickly as they can be got out of the mine, it became quite a simple thing to effect a complete recovery. Sometimes, however, a man would be so badly poisoned with fumes that you could not get him to the hospital. Therefore, I think it would not be a bad plan for the mines to keep oxygen.

249. Did those cases leave any predisposition to lung trouble?—After oxygen treatment there did not seem to be any trouble.

250. Recovery was absolutely perfect?—Yes.

251. They did not get any subsequent bronchitic trouble?—I have never seen any trouble afterwards. The oxygen seems to clear the poison out of the blood thoroughly.

252. Have you anything else to bring before the Commission?—No. The absence of chest troubles here is remarkable; this place must be something like the Swiss valleys, for chest troubles are rare.

(*The witness retired.*)

WILLIAM HANTHORNE, Secretary Norseman Branch W.A.F.W.U., sworn and examined:

253. *By the Royal Commissioner*: Do you keep any record of illnesses amongst the members of your union?—We pay only in respect of accidents; we keep no record of illnesses.

254. Or of deaths?—Yes; there is a record of deaths.

255. My object is to learn, if possible, of men affected, or likely to be affected, with chest troubles?—I could give you some names, but it would be only surmise on my part that they are affected.

256. That would be valuable to me, because a man working with other men is quickest to recognise any probable affected men?—F. Hooker I always suspected of suffering from chest trouble; you saw him this morning.

257. And Roscoe?—Yes. Wilson (he will be on the mine at 4 o'clock); Richards (he was in this morning). I do not know of any others; this district is free from miners' complaint.

258. There might be some cases here from Coolgardie or from Bendigo?—Brown is an old Bendigonian.

259. Taking the names on this list, do they cover all the local cases you are aware of?—All that I am aware of. J. Snell is another on day shift.

260. Are the mines here wet or dry?—I would call them dry mines; there is very little water in any mine here.

261. Are they well ventilated?—Yes; very well. Regarding the Mararoa, although the mine is well ventilated the smoke seems to travel from one level to another, and never goes through to the surface. There are a lot of openings to the surface, but whether there are too many such openings or not I cannot say.

262. Has any member of your union made complaint about the working conditions in the mines here?—Never. They are considered to be good; no one could take any exception. There is, however, one thing I should like to bring under notice. I think the mines should be compelled to provide change houses. At present the men have to walk to and fro between their homes and the mines, and very often after coming off shift the men have to walk home in clothes which are saturated.

263. Has any mine here a change house?—No. Myself and one other young fellow are the only ones to change at the mine, in the cracker engine house. I think the men should do so for their own safety, but I also think it should be made compulsory for men to change at the mine. It is unhealthy for men to come up from a mine in the middle of the night and walk home in wet clothes.

264. Where is the mines inspector for this district stationed?—I think the district inspector is Mr. Crabbe, at Coolgardie. He was here last week.

265. What about the sanitary conditions of the mines; have they pans and so on down below?—At the Mararoa the men have to go to the surface; there are no pans underground. At the Princess Royal there are pans underground; the local board of health looks after them, and they are well kept.

266. How deep is the Mararoa?—350ft. vertical, I think.

267. On the underlay?—Yes; and the deepest working in this district, so far as I am aware, is the Princess Royal No. 5 level, 500ft. vertical. The central shaft is down 960ft., but is full of water and not working; the lowest working is at the 500ft.

268. Have you anything else to bring before the Commission?—Not that I recollect. I would like to explain that no one made complaint to me in my capacity as secretary of the union about change houses; but personally I think it should be compulsory here, as it is where I come from.

269. As to respirators?—I have seen them, but do not think them suitable.

270. Would the men use them?—Yes, in rises; that is the only place in a mine where it is very dusty. I think the companies should carry water jets right through a mine.

(*The witness retired.*)

COOLGARDIE, FRIDAY, 17TH JUNE, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

JOSIAH CRABBE, Mines Inspector for the Yilgarn, Coolgardie and Dundas Goldfields, sworn and examined:

271. *By the Royal Commissioner*: Do you know of any men within your district who are affected with lung disease of any sort?—No.

272. How long have you been stationed here?—About nine years.

273. Have any complaints been made to you, either by miners individually, or by the union officials, with regard to the ventilation of the mines in your district?—Not one. I have taken the temperature at all the principal mines at the points at which I think it is worst, and the results go to show that the ventilation is very good. I have also taken carbon dioxide tests, and also the humidity of the atmosphere. (Copy of results put in.)

(*The witness retired.*)

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COOLGARDIE, SATURDAY, 18TH JUNE, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

ROBERT MACFARLANE MITCHELL, District Medical Officer, Coolgardie, sworn and examined.

274. *By the Royal Commissioner*: How long have you been practising in Coolgardie?—Four years.

275. You have been in charge of the sanatorium since it has been established?—Yes; and for the rest of the time I was in charge of the hospital.

276. In your experience is tuberculosis of the lungs more common amongst miners than amongst the rest of the community?—No. My opinion is that the miners merely represent a section of the community.

277. Does the same hold good of the other lung diseases?—I think miners are more prone to catarrhal conditions particularly.

278. You mean in Coolgardie?—Yes. My reason for saying that is that the majority of the men live away from their work and cycle to and from the mines, and are therefore liable to colds, etc.

279. Amongst miners, what types of lung diseases have been met with?—They do not seem to be prone to croupous pneumonia; but on the other hand I have frequently get catarrhal conditions of the lungs, with accompanying roughness in the breath and definite alterations in the physical sounds.

280. That is, chiefly roughness in breath?—Yes; and no adventitious sounds.

281. Is the distribution of that general or local?—I think it is fairly general, especially in winter.

282. Has there been, in your experience, much difficulty in diagnosing between an advanced condition of fibrosis which has reached the bronchial stage and genuine tuberculosis?—I think such cases are few and far between. In spite of inability in a few cases to find definite evidence I am inclined to think they are tubercular.

283. And that the cases difficult of diagnosis, which I have just mentioned, are rare?—Yes. As a matter of fact, in by far the greater majority of cases one is able to get the bacilli.

284. I presume you agree that an early fibrosis is a quite different thing from tuberculosis?—Certainly. I should say that an early fibrosis, pure and simple, is entirely distinct from tuberculosis.

285. What is the ordinary termination, so far as your experience goes, of fibrotic cases? Does the patient invariably become tubercular, or does he die from the ultimate development of the fibrosis?—I think he dies from tuberculosis supervening on fibrosis. My own personal feeling is that a miner leads a more strenuous life than the ordinary individual, and he has no reserve strength to call upon to fight the fibrotic or tubercular infection.

286. Would you not say that some fibrosis cases die never having become tubercular?—I think so; but such cases are in a great minority. One must assume the probability of it.

287. Do you agree that tuberculosis cannot supervene without tubercular infection?—Certainly.

288. Is there here a catarrhal or other condition of the lungs amongst the general population associated with either dust in the atmosphere or other climatic conditions?—Yes; I think there is. Undoubtedly the climate lends itself to catarrhal conditions, especially in winter. I do not think that in Coolgardie tubercular disease is any more common than in other districts of the goldfields, except for the cases coming here from other districts.

289. To make it clear, you do not think that locally-produced tuberculosis is more common here than in other districts?—That is right.

(*The witness retired.*)

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BOULDER, WEDNESDAY, 20TH JULY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

HENRY OFFLEY IRWIN, Medical Practitioner, Boulder, sworn and examined:

290. *By the Royal Commissioner*: In your opinion, has any form of lung disease amongst miners increased since the Commission on Sanitation and Ventilation of Mines sat?—I have certainly had more cases of genuine phthisis.

291. That is, tuberculosis?—Yes.

292. Amongst miners?—Amongst women, really.

293. But amongst men actually engaged on mine work?—No.

294. About fibrosis or any result of dust?—I am occasionally meeting cases which I think are due to dust, but after three or four weeks' treatment I come to the conclusion that I have made a mistake, and that the trouble is only chronic bronchial catarrh.

295. Before the previous Commission you said you did not think that miners were more liable to pneumonia than the rest of the population. Does that still hold good?—Yes.

296. There has been no development since the mines became deeper?—No. Pneumonia is very much less frequent since the conditions of living have been improved. Formerly at one time of the year—about October, I think—we could always look forward to an epidemic. That has ceased now. Certainly during the last four or five years pneumonia is very much less frequent than it used to be.

297. Have you been in practice on any other mining field?—No.

298. Have you noticed here lately—that is, within the last four or five years—any number of men coming from other countries, who have been bad?—No.

299. Of the men here a fair number represent cases which have come from other countries?—No; we do not see them now. Most of the men have been here for years, or have grown up here from boyhood. At the time of the last Commission it was noticeable that the men came from other fields, Bendigo especially.

300. In *post mortems* have you noticed the lungs to be affected by dust to any extent?—Not markedly. In *post mortems* here in accident cases the lungs are usually very healthy.

301. Amongst miners who die from any diseases of the lungs, what would you say was the most common cause of death?—Apart from pneumonia?

302. Including pneumonia?—Of course, pneumonia.

303. And apart from pneumonia?—Tuberculosis.

304. Chronic bronchitis, with secondary failing heart?—No. Of course, you get bombarded all the year round with coughs; but I always think that a cough that will yield to treatment after a few weeks is more a bronchial catarrh.

305. Do you get more coughs amongst men than women?—Yes. They have to wait for the cage at the plat; that is the usual explanation. When you examine them you can find nothing, and after two or three weeks' treatment they are right again, with few exceptions. One man who has miner's phthisis has gone away on to a farm—that is fibroid phthisis.

306. What would be his symptoms?—A cough, of course; profuse expectoration in the morning, and not much for the rest of the day; and what he called indigestion. It may have been indigestion, a feeling of compression in the chest, and a really marked shortness of breath.

307. And pleuritic pains at all?—No; shortness of breath is the most marked symptom.

308. On examining that man you did not notice much pleurisy?—No.

309. How long have you been in practice here?—Thirteen and a-half years.

310. Then you have had a wide experience of the men on this field in that time. Would you say that lung diseases, excluding pneumonia, are common here?—No; they are not common.

311. And tuberculosis?—I should say that tuberculosis here is under the average for Sydney.

312. And fibroid phthisis?—Not common. I have not practised in Sydney; but I should think that tuberculosis is distinctly under the average for Sydney.

313. Apart from the question of dust, is there anything else in the varied processes of mining that should affect the lungs, fumes for example?—Yes; temporarily only. It may be that fumes cause the catarrhal effects which I have found on examining the lungs. They put it down to the draughty plat, but I put it down to the defective ventilation in the ends.

314. Catarrh is prevalent, then?—Yes; it is just as bad in summer as in winter.

315. Do you notice any effect during the very dusty period of summer amongst the general population, as producing trachoma or laryngitis?—No.

316. Has the dust any effect on the eyes?—Not any marked effect. I had a letter from a medical man in Sydney the other day, asking me to give him my opinion as to the prevalence of trachoma; but I think it is less prevalent here than in Sydney. Therefore, I do not think that the dust has any effect in that direction. Trachoma cases here are largely inherited.

(*The witness retired.*)

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BOULDER, THURSDAY, 21ST JULY, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

FRANK LESLIE POWNALL SAWELL, Medical Practitioner, Boulder, sworn and examined:

317. *By the Royal Commissioner*: With regard to the question of lung diseases amongst miners, has your experience altered in any way the views you held at the time of the sitting of the last Royal Commission?—Before the last Commission I expressed the opinion that we would in time have cases of silicosis.

318. How has that worked out?—Well, we are getting cases.

319. Of genuine silicosis as opposed to tuberculosis?—Yes; but I scarcely know whether to call all the cases genuine silicosis, because after a certain stage the type of disease seen here becomes acute, and then appears to be a progressive and long-standing thing—something between anthracosis and silicosis. Silicosis runs a course of about five years, but as a matter of fact it runs a much longer course here.

320. How do the advanced cases manifest themselves?—An emphysema condition, not very much expectoration.

321. In the secondary part?—Yes. Dilation and asthma, with a marked inability to do any prolonged exertion.

322. Is the main course what you would call silicosis?—Yes.

323. How about tuberculosis?—I find it very hard to say that tuberculosis comes on in these cases. There is so frequently a history of tuberculosis in the family, and I could never swear they had not a tubercular condition due to contact with other tubercular people.

324. What do you think about this? You say that tuberculosis is more infectious than is usually considered. Do you think it necessary to have a sort of bombardment of infection?—Yes; I do. Of course, a man with silicosis at any stage is prone to get tuberculosis; but I think he could throw off one infection, and it is when you get a bombardment, as you call it, of infection that the trouble occurs. There is one family here—Refeld—of whom two brothers have died of tuberculosis and the third one is dying of it. One other brother is pretty sound. I am treating one now as tubercular; but I did not get any reaction.

325. Do you think tuberculosis of the lungs is more common amongst the mining community than amongst the general population?—It is difficult to say; *pro rata* I do not think there is as much tuberculosis here as there is in other parts of the world, in manufacturing centres. That, of course, may be because you get a better class of men in mining than in, say, a clothing manufactory. I do not think the percentage of tuberculosis is anything like so high here as elsewhere. I have not worked it out, but that is how it strikes me.

326. You have had experience in England. How does the frequency here strike you in comparison with England?—There is nothing like the frequency here that you find in the pottery districts there. In pottery working some men seem able to stand the dust while others go down as tubercular. That position is the same here. I think it is not so much underground as on the treatment plants you will find most of the trouble.

327. That is, dry plants?—Yes; dry crushing plants.

328. Does the dust floating in the air have any effect in producing any trouble of the mucous membranes?—I have not found it so.

329. Does it affect the eyes at all?—When I first came up here I used to get more cases of iritis than now. Of course, the dust is not so great a trouble now as formerly.

330. Do you find pleuritic pains at all common?—Yes.

331. Have you seen any ankylostomiasis?—No. I had one case which I was pretty certain was ankylostomiasis; I treated him for that in the hospital, but he made no improvement.

*Witness*: When you consider the strenuous nature of the work which men engaged underground here have to do, they are a healthy lot. It is only when they have "rising" to do that you find trouble; and then you find a lot of them able to throw off the trouble. It is only bronchial catarrh they contract; the dust does not seem to be able to penetrate into the lungs.

332. About *post mortems*?—I do not do many *post mortems*.

333. In those you have done have you noticed any deposit of dust?—No. I have done, I suppose, 50 to 60 *post mortems*, and have often looked into the lungs, but I cannot say I have noticed extensive tuberculosis; the lungs are always dark in colour.

334. I gather you think "rising" and surface working the two worst features of the industry?—They are; that is where the trouble is. Of course, men emptying stone from passes into trucks get a lot of dust. I believe that on the Kalgurli they even provided respirators for the men, but the men will not wear them. You can understand a man on contract not wishing to wear these.

335. Men whom I have seen who have used respirators say that when the respirators get damp it is a distinct effort to breathe through them?—That is so. Whilst boring through to upper levels it is worst.

336. What about pneumonia; that is a condition which appears very frequently in the death statistics?—We do not get anything like the amount of pneumonia here now as formerly; and I do not think pneumonia here is any more frequent amongst men than amongst women. Frequently when a man dies from pneumonia you get complications in the shape of a heart; most of these men have a dilated heart.

337. The more or less rapid change of temperature does not cause an undue incidence of pneumonia?—I do not think I have had more than three or four miners with pneumonia; so it cannot be so very prevalent.

(*The witness retired.*)

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BOULDER, FRIDAY, JULY 22ND, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

WALTER ALFRED BRIDGFORD, Medical Practitioner, Boulder, sworn and examined:

338. *By the Royal Commissioner*: You gave evidence before the Royal Commission which sat in 1904 on the Ventilation and Sanitation of Mines. If I remember aright you made the statement then that you had not seen very much locally-produced miners' silicosis. Since then, has any material alteration taken place in the

position?—I cannot say that there has been any change in the position. Tuberculosis here is amongst miners and amongst women. A lot of cases have come here from the other side. People have not yet been here long enough to make any change as to locally-produced cases. There may be one or two cases amongst Bendigonians.

339. Would you say that tuberculosis is more common amongst miners than amongst the general population?—That is a very awkward question to answer. I suppose it may be said to be a little more prevalent.

340. How does it compare with Venezuela?—You cannot compare with Venezuela. Tuberculosis and pneumonia are both very prevalent there. As I have told the people here, you would see as many funerals there in a day as you would here in a month.

341. Has pneumonia become more or less common, or how does it compare with a few years ago?—It appears to me to be very much the same.

342. And silicosis; do I understand you it has not become more prevalent?—I have seen very few cases.

343. And are they mostly advanced?—Yes; old cases. I might say that I can remember only two cases. One of these had not been working in a mine; the other had been tributing for years, but I do not know that he had worked for wages in a mine. It is not an easy thing to diagnose until a few years. It is in the pure silicosis only that you get the friction.

344. It is not characterised, so far as I know, by any clear physical signs?—No.

345. Have you seen amongst surface hands any lung trouble at all, men engaged in the dry treatment plants amongst a lot of dust?—No; I do not think so.

346. They claim that men handling the ore in those plants seem to find it very uncomfortable working in the dust?—I suppose they do. But there are people who have been amongst the dust for years. It does not appear to affect people who live on the mine leases adjacent to the dumps. The Perseverance dump especially used to be very bad formerly, and the South Kalgurli dump used to be shocking; they are now pumping their tailings away from that mine.

347. Ankylostomiasis exercised the mind of the Commission in 1904. Have you met that here?—I have not had a case. There have been suspicious cases, but I do not think there has been an authenticated case. Of course many lung cases go away from here. If you tell men what they have they get away.

348. Do men working on mines consult you for ordinary colds?—Yes. But that may be because it is necessary for a man who is away from work for more than one shift to produce a certificate.

349. Do they contract colds frequently?—They do come down frequently with colds; but I do not know that they are as common as all that.

350. And pleurisy, do you see much of that?—No; it is not prevalent. I do not think we get anything very prevalent in this place. I think it a remarkably healthy place, and the men are healthy, too.

(*The witness retired.*)

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KALGOORLIE—SATURDAY, JULY 23RD, 1910.

Dr. J. H. L CUMPSTON, Royal Commissioner.

GEORGE WALTER BARBER, District Medical Officer, Kalgoorlie, sworn and examined:

351. *By the Royal Commissioner*: Have you, since 1904, noticed any increase in the incidence of lung diseases amongst miners, directly attributable to mining processes, leaving out for the time being pneumonia?—No.

352. Is tuberculosis more common amongst miners than amongst the general population?—According to my experience here, no; because I have seen a good deal of it amongst the general population. There has been an increase of tuberculosis here, but a large number have been sent up here on account of their lungs. I do not think it is any more common amongst the mining population than amongst the general population.

353. Do you think there is anything in these mines, locally, to produce tuberculosis?—No.

354. So far as you are able to say, there is nothing in the way of a mine infection here, I mean of infecting men?—I do know that tubercular men do work in mines and that they are a cause of infection.

355. With regard to silicosis locally contracted, I gather from what you have stated that these are rare, so far as you know?—I have not been able to satisfy myself that they have been contracted in the local mines.

356. Would you feel inclined to quote a single instance?—Are you referring to the whole of the goldfields or to Kalgoorlie?

357. Take it separately?—With regard to this place, I have been unable to satisfy myself that the disease has been contracted here, that it has not been already contracted in quartz mines elsewhere.

358. Have you come across cases that seem to you to have been contracted in other mines in this State, on the Murchison or Northern Goldfields?—Yes; quartz mines.

359. Can you give instances?—The only case I can remember now is one from the Siberia Reward. That was undoubtedly contracted there; he worked there 14 years.

360. Working below, I take it?—Yes.

361. Do you know whether he ever did machine work?—I do not know.

362. Have you ever met cases here, either in or out of hospital, that might have been contracted at Fingall, for instance?—There might have been; but I cannot remember a case now which unquestionably began at Fingall. I cannot say I have met one such; but I have never asked them about Fingall.

363. That man whom we have just examined (Gilleland), would you consider that an early silicosis or fibrosis uncomplicated with tubercle?—Yes. That case, so far as I am able to judge, looks very much as if it had been contracted working in tributes in this district, tributes mostly being quartz.

364. The principal feature of early cases like that is breathlessness?—And a diminishing expansion; sometimes a cough, but the chief thing is breathlessness.

365. Do you find pleurisy common in these cases?—Yes.

366. In what situations commonly?—Either at the base or the region of the axillae.

367. Do you think men with early silicosis are more liable to catch colds than the general population?—No. I think they are liable to get a worse attack, though, when they do get it.

368. What would you consider to be the cause of the pleurisy?—That is exactly what has puzzled me. Because, in almost every post-mortem made here for many years, whether on miners or woodcutters, I have invariably found pleuritic adhesions.

369. That is, amongst non-miners as well as amongst miners?—Yes.

370. The labouring classes generally.—Yes; sometimes there were marked adhesions.

371. In the axillae commonly?—In the base wall frequently; and it has been a question with me as to whether the dust in the district, apart from mining, has had the effect of causing this pleurisy, or whether it is due to the big range of temperature which occurs at certain times of the year in this district.

372. Do you find any noticeable deposit either in miners' or non-miners' lungs or bronchial tubes?—No.

373. As to ankylostomiasis?—Some years ago we examined a large number of miners in hospital for ankylostomiasis, but were unable to find any evidence of the disease.

374. Witness: Miners who are affected with pneumonia are extremely bad cases.

375. Do you feel inclined to make any statement as to the prevalence of fibrosis amongst miners?—My impression is that the majority of cases of fibrosis have been contracted as a rule elsewhere, outside Kalgoorlie. I am under the impression also that pleurisy is very prevalent, though I am not satisfied that it is due to silicosis. I should very much like to see a microscopic and meteorological examination into this question. I think such an examination would throw some light on it. I understand such examinations have been conducted in Melbourne. Adherent pleura seems to be prevalent on these fields; and I understand that in other places, in Melbourne for instance, it is also prevalent. If so, it may be due to the climatic conditions in Australia; or to the dust which you get everywhere, as bad in Melbourne as here.

376. Anything else?—I am strongly of opinion that tubercular men should not be allowed to work in mines, both on their own account and on account of other workers. A terrible lot of tubercle has been introduced into this district by the sending up of patients

from the coast and from the other side. I have noticed a marked increase these last few years. I am given to understand that four cases came out from Ireland to go to the sanatorium.

(*The witness retired.*)

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KALGOORLIE, MONDAY, JULY 25TH, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

JAMES OWEN HUDSON, Inspector of Mines, Kalgoorlie, sworn and examined:

377. *By the Royal Commissioner*: Taking a comparison between the condition of things now and what they were in 1904, when the Royal Commission on Ventilation and Sanitation of Mines sat, has any evidence come under your notice that there is an increased prevalence of lung diseases amongst miners?—No. I should say the conditions are considerably improved. That is borne out by records to be obtained from the Department in reference to fumes, accidents due to cyanide, sand filling, and explosives. In 1903-04 the number of men affected by accidents due to fumes was very large; now such accidents are rare.

378. When you say accidents from fumes are comparatively rare now, do you mean cyanide fumes or explosives fumes?—Explosives fumes are very rare.

379. Is it to be assumed from that that the ventilation is much improved?—It is much improved. At the time the previous Commission sat there were virtually only two connections; now the whole of the mines are virtually connected.

380. Right through, one with another?—Yes. At that time they were depending largely on one shaft. The Great Boulder is an instance. At that time they had only one shaft; now they have three. The Ivanhoe at that time was very bad, but that mine is now wonderfully improved, due to having been connected with the Boulder and Horseshoe.

381. Has that made much difference to the temperature change which the men have to undergo in coming up from below to the surface?—Yes; I think you will find in a large number of cases that the bottom levels are, if anything, cooler than the top ones.

382. So that the men have not now to work in such a warm atmosphere as previously?—No.

383. You have been on other fields?—Yes; about three years next February I travelled all round Australia and New Zealand.

384. Are you in a position to say anything at all about the comparative prevalence of lung diseases?—I would not say altogether lung diseases. Speaking of miners' complaint, i.e., silicosis, I think this place is freer. As to lung diseases generally I would not say, because I think a lot of lung disease is due to the differences in temperature which you do not get in other places. For instance, at night the men here lie down on stretchers, sometimes even in the open or under verandahs; and the temperature at night in summer here frequently changes suddenly.

385. In saying that silicosis is not so prevalent here, there are two or three factors probably operating. In the first place the dust may be different, and in the second the population may be a younger one and silicosis has not yet had time to develop. Of those two main factors, which do you think operates here?—In New Zealand you find comparatively young men suffering from silicosis, and they die at an early age; here you do not find it so. I do not notice it so much here. That is more due to the difference in the ore, not being quartzy and the dust being of a finer nature.

386. You are inclined to say from that, that it is the nature of the rock which has to be dealt with?—That; and I believe we have a better ventilation than obtains in metalliferous mines in other places.

387. In your official capacity have you received complaints from men here as to any conditions which might be bettered?—We have at times received small complaints in reference to the change houses not being up to date—probably that there is not sufficient drying arrangement, that hot water is not being provided, or as to want of cleanliness at times. These are immediately dealt with.

388. Those have been in every case details?—Last year we had complaints as to sand-filling affecting one man. I personally investigated that complaint. I had the sand tested and found it was considerably lower than the standard laid down.

389. That is in cyanide contents?—Yes; in cyanide salts. That is the only complaint we have had for some years of that nature. There was also a complaint in reference to the quality of one brand of explosives affecting the men. That was gone into very thoroughly. Mr. Mann, the Chief Inspector of Explosives, came up and made inquiries. Immediately after that the complaints ceased with reference to this explosive.

390. Has any evidence come under your notice of undue prevalence of tuberculosis here amongst miners?—Not an undue prevalence; not more than you would expect to find. I have found more pneumonia amongst the men miners here—some of them are very prone to contract pneumonia.

391. Have you come across any evidence at all, either written or personal, indicating that increase of barometric pressure affects men?—No; I do not find any effect. I go down the mines every day and usually rush round down below for a few hours and come up again. In such circumstances I think I should feel the differences in barometric pressure more than the men working below for eight hours continuously would do; and again the men usually have time to cool off.

392. Have they tried respirators here?—Yes.

393. What was the experience in that respect?—Some of the men thought them very good. One man used them continuously whilst working on a small hand-borer. He considered he was affected with silicosis and wore a respirator continuously for 18 months and had great faith in it. No doubt they could be used to advantage in a great many cases, especially in trucking from stopes; but considerable difficulty has been experienced in getting the men to use them. There would be no difficulty whatever in getting them supplied; if the men wanted them the mines would supply them, and then each man might have his own respirator.

394. What has been the experience here since the publication of this last report with regard to the use of water in machines?—We tried water machines which were a failure—the linotype drill and also the electric drill for boring. In my opinion, the humidity is worse than the dust; the drives become so hot that it is impossible to live in them.

395. The humidity becomes pronounced?—Very pronounced; it is like walking into steam.

396. Did the men complain of that?—Yes; they would not use them. On the Ivanhoe we used a finer spray which gave good results in "rising," a good bit of which class of work was being done in that mine then. Personally, I think respirators more advantageous than sprays for the men.

397. On some of the other fields men have told me they do not find respirators comfortable to wear, as they have to breathe harder in order to take in the same quantity of air?—That must have been a bad type of respirator.

398. You have not found that here?—You always find men who will not use anything. There is that one case of a man who wore one continuously while working in dust; when there was no dust he dropped it—there is no need for a man to keep his respirator on all the time.

399. Anything else?—We made inquiry at one time into the question of deaths of miners from miners' phthisis; and from information supplied we found that it was not miners' phthisis from which a majority had died, but from pneumonia actually.

(*The witness retired.*)

RICHARD GEORGE ARDAGH, Secretary Goldfields District Council of the Australian Labour Federation, sworn and examined:

400. *By the Royal Commissioner*: Have you any system in your association of paying men during the time they are off duty through sickness?—No; that is a matter which is settled by the individual labour organisations themselves.

401. In your position you do not handle any medical certificates?—No.

402. But you do, perhaps, for deaths of your members?—No.

403. You are not like Mr. Glance in that respect?—No. Mr. Glance's organisation sends delegates to our council—all the organisations are affiliated with the council.

404. So that I cannot get from you any statistics as to men suffering from sickness or as to deaths amongst your members?—No; you would get that information better from Mr. Glance or Mr. Dodd, who come more in contact with such matters.

405. Do you know of specific cases of miners suffering from lung diseases in your own district?—I have known of them; in fact of men with whom I have worked in the Eastern States. One or two of them have died here from miners' disease.

406. They came here from Victoria?—From Victoria.

407. Could you fix any estimate of how many?—No; I could not tell you that. A number of members of the miners' union have died whose deaths were attributed to miners' complaint; but you could get that information better from the officers of that union.

408. Are there any other officials here associated with your organisation whom you think I should see?—There are other organisations, such as that of the surface hands, filter press union, and possibly the firemen's union. Those men always work on the surface amongst the dust, especially workers in the mills.

409. The union of surface men is separate, then, from that of the underground men?—Yes.

410. But engine-drivers are affiliated with you?—Yes.

411. Beyond general statements, are you in a position to give me any definite information as to cases of lung disease amongst miners, or of miners who have died from lung disease, or to say whether in your experience lung disease is becoming more, or less, prevalent—in short, what is your idea on the general question?—My idea of the question, as one who has followed mining in Victoria and Queensland and over here in the early days, is that the occupation is certainly not a healthy one. I believe, too, that the contract system has a good deal to do with it.

412. How?—Men working on contract have to quote against each other to obtain work, or else have to accept it at the company's price; and consequently they have to "speed up" day after day to earn a bedrock wage. Sometimes they make a little more, but ofttimes considerably less. And men working at this high pressure have to rush back into dead ends, rises, shafts, and so forth into smoke and dust, so bad that at times the men cannot see a lighted candle an arm's length away.

413. Do the men when on contract sometimes work for two successive shifts; are they allowed to do so?—Only in extreme cases, in which a man might stop on until his mate came to work. Possibly the miners' representatives will tell you all about that. This continual rushing of the work under contract they do not take much notice of for a considerable time; but it gradually wears on them. I believe that the contract system tends to shorten the days of underground miners. Another thing, owing to the frequent changes of shift miners are subject to catch cold, besides the consequent irregularity of the hours for meals and sleep is detrimental.

414. I do not know what you mean by "frequent changes of shift"?—Well, one week a man will go on from 8 till 4; that is the day shift; on the following week he may be on the 4 to 12, or night shift. These changes get the men out of regular habits of eating and sleeping, besides rendering them more liable to catch cold.

415. A man on night shift during summer has, of course, to sleep during the day time?—Yes; and often it is very difficult to get even a couple of hours' rest in the day time in summer.

416. Do night shift men seem to catch cold more than other men?—According to my experience, yes.

417. What would be the reason for that?—I dare say it is possibly due to their rushing from their homes to the mine, changing and then going out into the open air and waiting there for the cage to go below; and the same thing occurs again in the morning after they come up from below.

418. You have had mining experience in other States, which part?—Gippsland and Walhalla.

419. Long Tunnel?—Yes; Long Tunnel.

420. How does the amount of lung disease—silicosis and other types—here compare with over there?—It would be hard to gauge, because the community here is a larger one. There are thousands of miners here, where there are only a few hundreds at Walhalla.

421. There is in existence a Mines Regulation which says that no person suffering from tuberculosis shall be allowed to work underground; and I understand it has been suggested that should be enforced. How would that be taken by the men themselves?—I do not know. The first thing would be to prove that they were suffering from the complaint.

422. Of course that would be necessary?—Yes; and then some other avenue of employment would have to be found for those men, if a large number was found to be affected through working in mines. One thing I have noticed ever since I was a boy. An underground worker suffering from illness, if he took a sea voyage, usually came back a new man. Of course it is awkward for men to do that here—the expense would be too great for many of the men. It could be arranged by the Government, particularly if we had the line to Esperance; excursions to the coast could then be easily arranged.

423. Do the men here usually show material benefit by taking trips?—Yes. And in the Eastern States I have worked with men who have taken a sea voyage and come back much improved. In fact, I have benefited by it myself.

(*The witness retired.*)

JABEZ EDWARD DODD, M.L.C., Secretary Federated Miners' Union, sworn and examined:

424. *By the Royal Commissioner*: Comparing the condition of things now with what they were in 1904, do you think there is more lung disease amongst miners now than then?—Yes.

425. You think it is increasing?—Yes.

426. Would that be amongst men who have probably contracted it here, or men who came here from elsewhere?—I should say amongst the men here.

427. As well as imported cases; there must be some imported cases here?—Undoubtedly there are.

428. In saying "lung diseases" are increasing, do you mean tuberculosis, i.e., consumption, or dust disease, silicosis as we call it?—I would rather put it this way. I do not know whether you say bronchial disease——

429. That is included, yes?—I should say bronchial diseases and the number of men who are suffering from the conditions under which they work (that is, dust and heat causing ordinary miners' phthisis) are increasing.

430. What do you think, and what do the men think, are the causes which produce their lung diseases—just in outline, I mean?—I should say, first of all the increased depth of the mines and the increasing extent of the workings. In the early days there was not the same extent of workings, the drives were not in so far, and taken as a whole the workings were of no extent compared with to-day. It follows that as a mine becomes developed the greater the drives, stopes, etc. Further than that, I think that the pressure at which a man works is responsible for a certain amount of disease. For instance, in the early days, in the oxidised zone men never worked at the same high pressure as they do to-day.

431. You mean the pressure of work, of course, not the barometric pressure?—The pressure of work, on account of the contract system. The men on day work in the early days had to work in the oxidised zone where the ore is easily got, and then also the mines were then very rich. It follows that as a mine gets deeper it becomes more expensive to work. I think that is a contributing cause. Then, again, the ventilation is not so good.

432. Speaking of the contract system, do the contractors ever work more than one shift on end, in order, say, to get a particular piece of work finished?—You mean does the contractor work more than eight hours in the 24?

433. Yes, continuously?—No; he works only eight hours. The Mines Regulations would not allow a man to work more than eight hours consecutively.

434. You meet most of the men in your official capacity, and you would know those men who are affected; at any rate, those who are badly affected?—Yes.

435. Can you give, from your official records, any statistics? Do you pay a man, or make him any allowance at all, when he is off duty through sickness?—Only in respect of accidents.

436. You keep a record of deaths?—Yes.

437. You get copies from the district registrars of the certificates of deaths of those members who die away from here?—The death certificates are generally forwarded by the registrars to Mr. Glance; his is the general secretary's office.

438. Supposing a man left this State and died in Victoria, would you get a copy of the certificate sent over here?—Yes.

439. Of those men whom you know in this district to be badly affected, have I seen them all?—Yes, I think you have, so far as we can reasonably judge. Of course, our union does not include the whole of the underground miners; there is quite a number not in the union.

440. You know, of course, about the Regulation which says that no man suffering from tuberculosis shall work underground. Supposing it were decided to enforce that —I am taking a suggestion now, put forward by Dr. Ellis, I think—what would be the attitude of the men? —I really could not say. In my opinion, before such a Regulation was enforced some provision should be made for these men. There is nothing in this State provided for such men.

441. Looking at it from the men's point of view, is the air in the mines better now than in 1904 when the other Commission sat?—I should not say so.

442. There has been no improvement since then, you think?—What I say is that as a mine goes down it is more difficult to provide good air. I think it naturally follows that as a mine gets deeper the air becomes worse.

443. Have you anything you would like to bring before the Commission?—I should like to say that a large number of men, when they felt themselves becoming affected, left the mines; they now follow some other employment, or have gone away altogether. Of course, of those men we keep no record whatever. For instance, our president of last year had to go on the land. He was advised that if he remained here he would probably contract the complaint if he had not already contracted it. He is on the land now.

444. I suppose he was so advised by one of the doctors?—Yes; he was told he had better get out of mining. Then again you have examined the men Toms, they are not working; then there is Reynolds, who is working. If I could get records for the last five years I have no doubt I could have quoted quite a number who have given up mining.

445. Those are men badly affected, or beginning to get bad?—Just beginning. They felt they had worked long enough in the mines and had better get out.

446. Can you suggest any way in which I might get on the tracks of those men?—No; we keep no record of men who drop out from time to time.

447. So far as you know, there is no way by which I could get the names of those men?—I do not see how you could trace them; and I dare say a number of them would not like their names made public, either. I think also it would be a good idea if placards were printed and posted in a conspicuous place on mines, similar to the notices as to signals which you see on every plat, detailing what should be done by miners in order to prevent this disease spreading. For instance, some leaflets were issued by the Central Board of Health some time ago on the subject. I think something like that should be done to draw attention to the method and desirability of endeavours to prevent the spread of the disease. It is also remarkable the number of deaths in respect of which pneumonia is given on the certificates as the immediate cause; during the last four years there have been 49 such deaths.

448. That would be amongst members of your society?—Amongst members of the Boulder Branch of the Miners' Union—that is, 49 including phthisis; of those recorded as phthisis there have been something like 14 or 16 in that time.

449. Is there any way in which you can suggest that I can make the work of the Commission more complete? My object is to find out how many men are suffering from lung diseases?—The only thing I can suggest is that you might advertise another sitting here, at which men who have not yet been examined and who think they are suffering from miners' complaint, could be given another opportunity of attending.

450. I have examined on the Boulder Belt something over 1,100 men—that is, underground men. There are only 3,000 underground men, and I have examined over one-third of them. Do you agree that that is a fair sample?—Yes.

*(The witness retired.)*

HENRY GLANCE, General Secretary, Federated Miners' Union, sworn and examined:

451. *By the Royal Commissioner*: Comparing the position now with that in 1904 when you gave evidence before the previous Commission, would you say there is more, or less, lung disease amongst miners?—From my observation as one coming into touch with the men I think there is more. I have more members to keep in view now than I had then. For instance, we issue an annual report. We pay certain amounts in respect of deaths amongst our members, and in this connection I have to deal with not only the Boulder district, but the mining centres between Lake Way on the north and Ravensthorpe on the south. Between those points we have something like 25 branches; and I have, therefore, more opportunity of seeing and knowing the state of affairs in this respect than in the past. In connection with the report we compile a list of fatal accidents and a death roll of members. When compiling the death roll for last year we also included the ages of the men at death. We have met one difficulty. Most of the men at Boulder we know personally, and we found that in the certificates of death of many of them the cause of death was set down as pneumonia; and some of those men I have known myself to have been suffering for months, practically for years, from miners' complaint, and to have been so ill from it as to be unable to work. Of course, pneumonia may have been the immediate cause of death in those cases; still we knew that for years those men could not work.

452. Were such cases entered in your table as pneumonia?—Just as the certificate testifies in each case. Last year the causes of death entered were miners' complaint, phthisis, miners' disease, heat apoplexy, and pneumonia. Miners' diseases are more definite on this occasion than in the past.

453. You mean to say that the number of lung diseases is more noticeable?—More noticeable because the position is more plainly explained in the death certificates.

454. Does the death roll published in your annual report include the deaths of all members of your union? —Our members only.

455. Every member who dies is in that list?—Every man who dies; but he must be a member of the union.

456. Do you include in your membership any non-miners?—No; a man must be engaged in the mining industry to entitle him to membership.

457. In these annual reports do you state the total membership?—Yes; I think that last year, according to the report, the membership was 5,000.

458. And these reports go back how far?—Four years. We have been amalgamated as an organisation for five years.

(Reports put in.)

459. Do you feel in a position to say whether the increase in lung disease is noticeable amongst any particular type of mine-workers?—I am prepared to say that it is more noticeable amongst men working in "rises."

460. What about machines?—They are practically all working machines. In this district it is nearly all machine work; very little hand labour.

461. What about shovellers and truckers?—They are also liable to it, especially shovellers and truckers from chutes and main ore passes. There is an enormous quantity of dust in those places, and there is no way for it to get away. It is the same with the men in the crackers on the surface. The man who is keeping the rill clean is all the time subject to dust; in fact he cannot see.

462. Have you any experience of any other types of surface work, the men on the roasters or on Krupp mills?—Yes; it is the same with the Krupp mills. There is a very fine dust present which can be seen floating in the air around and can be felt in the nostrils. I have worked in them. The raw ore is worse than the roasted ore. There has been a big improvement on the roasters since the last Commission sat; they have installed fans to take away the dust. That is not so bad; but still it is with the raw process that there is the most danger of lung complaints. Only a few of the mines are using roasters; the others have the wet (Diehl) system. The roasters are very dusty and subject men to all the fumes that come from the ore.

463. In so far as dust is concerned, have you had any experience in regard to respirators?—Yes; I have used them and found that they are hard to breathe through, especially when a man is exerting himself.

Besides, it is always hard to breathe when working in dust, and when a man is wearing a respirator it is very uncomfortable. Something seems to be holding the breath back, and it does not take long for the sponge in the respirator to become clogged. It is all very well to walk about with a respirator on and do no manual work—of course, that is, the type of respirator I have seen.

464. Do the men at all complain of noticing any difference when working above or below 1,000ft., when a mine is well ventilated?—In some of the mines they complain; they consider there is not too much air. In the deep levels of the Boulder, say the 21—I was down there recently, and the air was good down so far as I went on the plat. I find now that they are putting in winzes there and getting a better air current. I noticed that in other places recently they had slush lamps on the plat. Several men who work underground have told me that the smoke and fumes coming from these lamps is not very nice.

465. What about the conditions of the change rooms now?—They are now greatly improved.

466. Do you know of the existence of that regulation which says that no man suffering from tuberculosis shall work underground; it is not enforced?—No.

467. I believe it was suggested up here—by Dr. Ellis, I believe—that some such regulation should be enforced. If it were, how would the men take it?—I think it would be difficult to enforce it; because I have known men to go to one doctor who informed them they were suffering from miners' complaint and that they should leave the mines; and another doctor has told them they have bronchitis. Again, I do not know how it is possible to deal with those men who are to be debarred from working. Some provision must be made by the Government for them. Many of the working miners are married men with families; and if the Government says they must not work in mines, what is to be done with them? The Government must make some provision. The trouble is that these men being married have either to work on until they die or knock off and see their wives and families starve. If the Government will make provision for the wives and families when the men are stopped from working on the mines, then I say enforce the regulation strictly. Without some such provision I find it hard to decide. Dr. Ellis put forward some suggestion that the men might be placed on a fruit farm; but anything in that nature would require to be properly started before the enforcement of the regulation. The affected men would not continue working in mines twenty minutes after they knew of their condition were it not for their wives and families.

468. Amongst the men whom you know are so badly affected as to have had to leave off working have I seen and examined a fair proportion?—Yes; but I find that when men learn that they are suffering in that way they go out of the State, to Victoria and elsewhere, and are difficult to trace.

469. I am only speaking for the present of those who are in the district?—Yes; you have seen most of those who are not working.

470. Have I seen all those you know of?—No; it is difficult to get them to come up.

471. You just mentioned about these people going to Victoria. Have you any records?—Of one man. He resided at Broad Arrow. I will write for his Victorian address.

472. Has he gone to Bendigo?—Yes. He worked in the mines here for 12 years; a benefit was arranged here to send him away.

473. In the case of a death occurring in the Eastern States, do you get a record of that?—Yes; provided the member has kept good on our books.

474. Does that happen in most cases?—Yes.

475. Are there any from Victoria?—Yes. Last year I think two from Victoria. But most of those who go away are very neglectful when they get into that state of health, and never think to keep themselves good on the books. If a member, or his people for him, neglects to pay 2s. every three months, his name is struck off the books; and if he dies there is no benefit. Those who keep themselves right we know of; others we do not. Even in Boulder itself they get careless.

476. So that your books would not be a complete record of all who have left the State and died on the other side?—No; only of those who kept themselves good on our books after leaving here.

477. When I decided to take the work in the way I have, *i.e.*, to go round and myself examine the men and keep notes, I arranged with the Chamber of Mines to examine one-third of the men on this field. I have more than done that. I want your opinion, whether you would consider that a fair sample, one in three?—Yes; I think it is a fair sample. I suppose you took night-shift men?

478. One complete shift on each mine?—I think you have given the men every opportunity to come forward.

(*The witness retired.*)

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COLLIE, WEDNESDAY, AUGUST 10TH, 1910.

WILLIAM HENRY RIGBY, District Medical Officer, Collie, sworn and examined:

479. *By the Royal Commissioner*: What has been your experience of lung diseases amongst miners in this place. Chiefly, what I want to know is whether you think lung diseases of any sort, including pneumonia, are at all common here?—No.

480. Is it right to say that they are not more so amongst miners than amongst the general population?—No.

481. Nor pleurisy?—No.

482. What about tuberculosis?—There is hardly any tubercle; I cannot remember a miner having had tuberculosis here. A dozen cases in ten years altogether would be as many as there have been here, if that many. They were not miners. I have seen two cases of fibroid phthisis; and those were old men who had worked in other places.

483. Only two?—Yes; only two.

484. Can you call to mind whether they had been gold miners?—Yes; in both cases they had been gold miners.

485. There have been no other lung diseases you can call to mind, except pneumonia?—Pneumonia is very rare. I cannot recollect any cases of pneumonia amongst miners.

486. That is in how many years?—Ten years.

487. Have you met any evidence that coal dust affects the men at all so far as the lungs are concerned?—No; though the sputum is always discoloured, of course.

488. It seems to me, so far as I can ascertain, that coal miners are not affected with tuberculosis or fibroid phthisis?—There is little or no tuberculosis here.

489. And amongst the men working on coal there is no fibroid?—No. Previously they did appear to suffer from fumes; they were affected sometimes from the knees down when using powder.

490. Have you seen any cases of fumes poisoning?—I had a case some years ago; a man who was in bad air. He was in a uraemic condition. The men here, although always wet through, do not suffer from general colds. In Newcastle and Bulli (N.S.W.) there is a good deal of fibroid phthisis.

491. Were you practising over there?—I was there for some time.

492. You would not like to say off-hand that you have seen a case of pure fibroid phthisis in a coal miner?—I have never yet, at any rate.

493. What about rheumatism?—No. It is remarkable how free the men are here from ordinary colds and other effects that usually follow on exposure. In fact, the general conditions here are pretty good.

(*The witness retired.*)

GEORGE YOUNG, Secretary, Collie River Miners' Union, sworn and examined:

494. *By the Royal Commissioner*: The object of my visit is to find out how much lung disease there is amongst miners, and what conditions there are locally which might predispose to lung disease. In the first place, do you know of any cases at present existing here?—No.

495. Do you know of any that have been here?—Only one.

496. Can you give his name?—Mutinelli. He died in Perth hospital. I may say I do not think the disease was contracted in this district.

497. Would you be prepared to say that the conditions on the Collie fields do not produce, so far as you know, any lung disease, whatever else they might produce?—I am prepared to say that, because I do not think the conditions prevailing in the Collie mines would produce anything of that sort.

498. You do not make payments to your members on account of sickness?—No.

499. So that you have no record of men who may have been off work through sickness?—No.

500. Have you any records whatever which might be of use to me?—I have not any that would be likely to be of use to you. I have none at all so far as that goes.

501. Do you know the coal mining fields in the Old Country or in the East?—Only from hearsay; practical experience I cannot speak from.

502. Do the men here suffer at all unduly from colds?—Colds are prevalent, but I would not say they are connected in any way with the mines, because the weather at certain parts of the year is often extreme.

503. Colds are prevalent amongst the general population as well as amongst the miners?—Yes; it is a general thing.

504. Have the men on this field, during your term of office, made any suggestion that there might be conditions locally producing lung diseases?—Not to my knowledge.

505. The method I have adopted is to go into the mines and get the men. I have done this with two objects: first, to get the men under working conditions, and secondly to personally examine as large a percentage of the men as possible. Is there any way you can suggest that would make the investigation more complete?—I do not think so. I think the examination of men under practical and actual working conditions would be complete. I do not know of any other method which would further your experience. When a man is working in a mine he is subject to the conditions of the mine, and any tests he may then go through would be absolutely practical.

506. Is there anything which you wish yourself to bring under the notice of the Commission. I am not dealing with the ventilation or sanitation of mines?—On the goldfields they have change houses connected with the mines, and I think that such a system would be well adapted to the coalfields also. Speaking personally, I live in Collie, but until lately I was working at the Burn, in wet places. I had to come up out of that mine and make my way home in wet clothes, a distance of four miles. If there were change houses at the pit-head it would, I think, save a deal of trouble and sickness. I have known cases of men having to go home in wet clothes who have complained of colds for many days afterwards; and that sort of thing is calculated to lead to sickness of one sort or another. In my opinion the establishment of change houses would be a preventive of that sort of thing.

507. You think the men would use change houses if provided?—I am satisfied as to that; they are using the conveniences at present available so far as they can. At Collie Burn they have a place in which some of the men change; but it is not all it should be.

508. Would you suggest anything further?—No; only that the men be enabled to make a dry change after coming up from the mine.

509. Apart from change houses are there any other improvements which you can point out as being desirable?—No; that is the vital thing, in my opinion.

(*The witness retired.*)

THOMAS DAVY BRIGGS, Inspector of Mines and Coal Inspector, Collie District, sworn and examined:

510. *By the Royal Commissioner*: How long have you been at Collie?—Since the inception of the field, since 1899.

511. In your official capacity you probably know the men on this field fairly well personally?—Yes.

512. Do you know of any cases of lung disease at present existing on this field?—I do not.

513. Can you recollect any cases that have been here, either locally produced or imported from other fields?—I do not remember one.

514. Have you received from the men any complaints as to the hygienic conditions of the mines?—I have received one complaint during the past three years, on 24th July, 1909; that was of inadequate ventilation on one mine.

515. On investigation, what was the result?—I do not remember. I may state that I have had several prosecutions against managers during the past two years for not complying with the general rule which provides for the ventilation of mines.

516. You have had experience in coal mines in England?—In England, New South Wales, and Victoria.

517. How long in each place?—In England, 11 years; Collie, 12 years; Victoria, 5 years; New South Wales, 7 years. I was for five years away from coal mines, on the goldfields in this State.

518. How does the sanitary condition of the mines at Collie compare with that of the mines in those other places in which you have been?—Very favourably.

519. Are the conditions as good?—Quite as good; better if anything.

520. You have taken a series of temperature observations at the various mines, I suppose?—Yes. I consider it a warm place which registers 70 with the dry bulb thermometer. If it gets above 70 I know the ventilation is deficient, because the air on the intake, whether it be summer or winter, becomes of the same temperature as the strata.

521. Can you supply samples of those readings?—Yes. I also test for air purity.

522. What method do you use, 2oz. bottles and lime water?—Yes.

523. Mr. Young suggested the advisability of change houses being provided on the mines?—I think it would be a good idea.

524. Do the general regulations provide for that?—No. I think it would be a good idea; but at the same time I do not think the men would avail themselves of the facility at first, at any rate not all of them. It would have to be a gradual thing. They could make a start at the Cardiff and the Burn, where the men have to wait for a train. The men do use the change house at present provided; but it is not quite suitable. I doubt, however, if the men would avail themselves of a change house at the Collie Proprietary, which is close to their homes.

525. Would it not be advisable to make the use of a change house, if provided, compulsory?—Yes; it would.

526. On this question, would you suggest any type of change house?—I think what is required is a good, roomy place, with facilities for the men to wash and to place their clothes when on shift.

527. And some apparatus for drying clothes?—Yes. It is easy enough on a mine to warm a room up to a temperature sufficient to dry clothes.

528. Has there ever been a complete analysis of the air on these mines?—I have occasionally sent samples away to Mr. Mann for the purpose.

529. No evidence of the $CO_2$ or other organic gases?—We have never found any carbonic here; I looked for it carefully at the time of the fire. So far I have never been able to detect any trace of fire damp. I have had traces of carbonic oxide—at the time of the fires, of course.

530. What about fumes? Have you ever been called to a case in which a man has been poisoned?—No.

531. Such cases have to be reported to you?—Yes. We had one case in which the men claimed that a man was suffering from bad air. That was nine years ago; but the evidence of his mates went to prove that it was particularly good. The truth is that he died from blood poisoning consequent on Bright's disease. That is the only case I have ever heard as having been suggested by anyone. Occasional cases of carbon dioxide poisoning have occurred.

532. Have you heard of men complaining of coming up from the warm air below producing colds or coughs?—No.

(*The witness retired.*)

WILLIAM DRYSDALE, Manager of the Collie Co-operative Coal Mines, sworn and examined:

533. *By the Royal Commissioner*: How long have you been in Western Australia?—Ten months.

534. And prior to that you were engaged in coal mining in England?—I was for about four months in New South Wales.

535. And before that in England?—In Scotland.

536. For how long?—All my time. Fully 20 years in the mines; 24, I think.

537. The task set me is to report as to the prevalence of lung diseases amongst miners. I should like you to tell me whether there is in Scotland amongst coal miners a noticeable number of lung troubles of any sort, pleurisy, pneumonia, or consumption?—I have known of a few cases of consumption; but I do not know whether these could be traced to show that they were contracted as a result of coal mining.

538. Not a large number?—No.

539. Did the men suffer very much from pleurisy or pneumonia?—No.

540. They did not, on coming up from the mines, find themselves liable to contract colds or coughs?—No; with the exception of men coming up wet into frosty air.

541. Were such cases common enough to be remarked upon?—I would not say that.

542. Do they have a system of change houses at the Scottish collieries?—No.

543. The men simply go home in their working clothes?—Yes.

544. How do the mines here compare with regard to ventilation with the mines you were used to in Scotland?—I think they compare favourably. There are no "gassy" mines here, of course.

545. To sum it up, does the cold climate of Scotland produce inflammation of the lung, pleurisy, or ordinary colds to any great extent?—I do not think so.

546. Which part of Scotland were you working in?—Lanarkshire and Ayrshire.

547. So far as you have been able to judge since coming to Collie, then, there is not any greater prevalence of lung complaints here than in Scotland?—No; there is no trouble of that nature here at all.

548. Not as much as in Scotland?—No.

(*The witness retired.*)

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PERTH, WEDNESDAY, AUGUST 17TH, 1910.

Dr. J. H. L. CUMPSTON, Royal Commissioner.

LIONEL ROBERTSON, Medical Practitioner, Busselton, sworn and examined:

549. *By the Royal Commissioner*: What experience have you had in mining districts, coal or gold?—Coal mining on the south coast of New South Wales and at Lithgow; gold mining at Cambellego and at Cue.

550. Amongst coal miners did you notice any affection of the lungs?—Yes; decidedly.

551. Of what type?—They were all affected with chronic cough. When I say "all affected" I mean there was a large percentage; nearly half the miners on the list would come for treatment for coughs.

552. So far as you recollect, had those men been always coal mining, or had they at some time been gold miners?—Many of them had been on gold, but most of them were purely coal miners. Those who had been gold mining told me they had better health on the gold mines, so long as they did not get "leaded," or cyanided.

553. Was pneumonia or pleurisy at all common?—There were several cases of pleurisy, and there was a great tendency to bronchial asthma amongst coal miners. I attended several cases of pleurisy, not many of pneumonia.

554. Have you formed any idea as to what would be likely to cause the bronchial asthma?—I reckoned it was due to the inhalation of coal dust and the impure air in the mines.

555. Have you had any men from Collie down at Busselton?—No. I believe, though, that the Collie mines are the most sanitary coal mines in Australia.

556. Did you notice whether true tuberculosis was more common amongst coal miners than amongst the general population?—On my experience in those parts there was more true phthisis amongst them, though there was a large amount amongst other people, too. They all had trouble with the bronchial tubes. I noticed amongst those people that if they started with ordinary influenza, an attack which in other men would be all right in a few days had a tendency to develop pleurisy and perhaps pleuritic adhesions afterwards. They all had bad after-breaths. I came to the conclusion that if they got any infection of the chest they stood it infinitely worse than ordinary men. That I remember being much struck with at the time. Ordinary catarrh of the chest with them went on to leave trouble; many of them had the ordinary dry pleurisy; others, pleural effusions. Many of those were people whom I knew before they became ill, and they were then in ordinary health. When I was in gold-mining places I noticed I did not get nearly so many people up with affections of the chest. Probably the climatic conditions affected them.

(*The witness retired.*)

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Signed statements as under were secured in cases in which it was inconvenient to secure sworn evidence:—

HENRY COLBRAN, examined at Lawlers, April 29th, 1910.

I am Inspector of Mines for the East Murchison Goldfields.

I do not know of any cases of lung diseases amongst miners in my district. This district includes all the mines from Diorite to Wiluna and Darlot to Sandstone.

I have received no complaints from any of the men, or from the secretaries of the unions, as to the ventilation or the prevalence of dust in any of the mines in my district.

I have been in this district three years next July.

I have never heard the subject of respirators discussed by the men.

McLeod, underground manager at the Black Range mine at Sandstone, was affected with lung disease. To the best of my knowledge he was so affected when he arrived in Western Australia.

James Warman, foreman underground manager at Sons of Gwalia mine at Leonora, was affected with lung disease during my time of residence in that district.

The above two are the only cases that have come under my notice in this State.

H. COLBRAN.

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ROBERT MERRICK, examined at Lawlers, April 29th, 1910.

I am secretary of the Workers and Engine-drivers' Union at Lawlers.

I have been at Lawlers four years.

I know every man in the mines well, including the foreigners.

The only case of lung disease I know of is a man named Russell, working at the Vivien Gold Mine, who, I think, is suffering from this complaint.

I have not heard the subject of respirators discussed.

I have heard no complaints from the men working on the mines at Lawlers as to the lack of ventilation or the prevalence of dust in the mines at Lawlers.

R. MERRICK.

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Dr. ARTHUR CROOKE, examined at Lawers, April 30th, 1910.

I am a medical practitioner practising at Lawlers, and am medical officer to the Mines Medical Fund in the Lawlers district.

I have not at present under treatment any cases of chronic lung disease amongst miners, and have not had since the case of an Italian from the Waroonga mine, who consulted me about eight months ago. This Italian was suffering from true tuberculosis and, acting on my advice, he, so far as I know, returned to his native country.

ARTHUR CROOKE.

# INDEX TO WITNESSES.



By Authority: Fred. Wm. Simpson, Government Printer, Perth.

Plate 1.—Showing exposure of chest by miners. This photograph was taken immediately after the men came out of the pit.

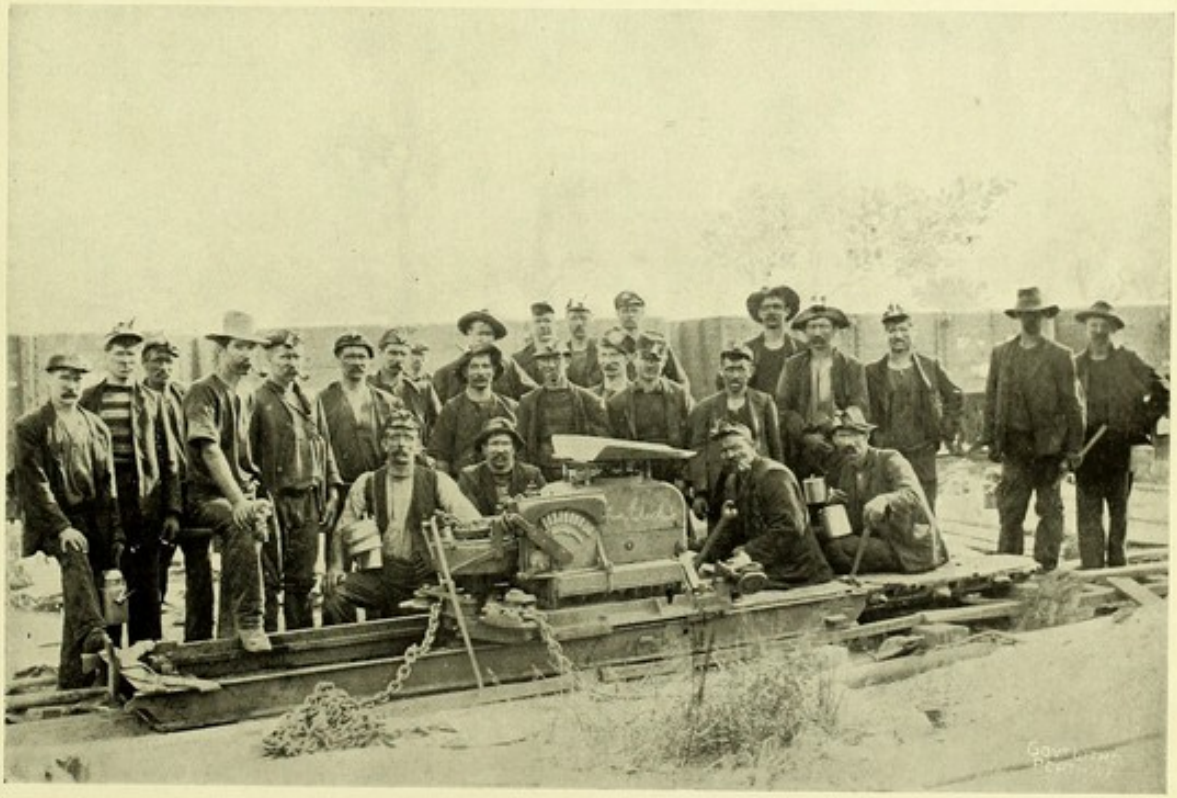

Plate 1.—(Second section).

Plate 2.—Portion of lung from post-mortem examination No. 1, illustrating the mottling under the pleura due to street dust.

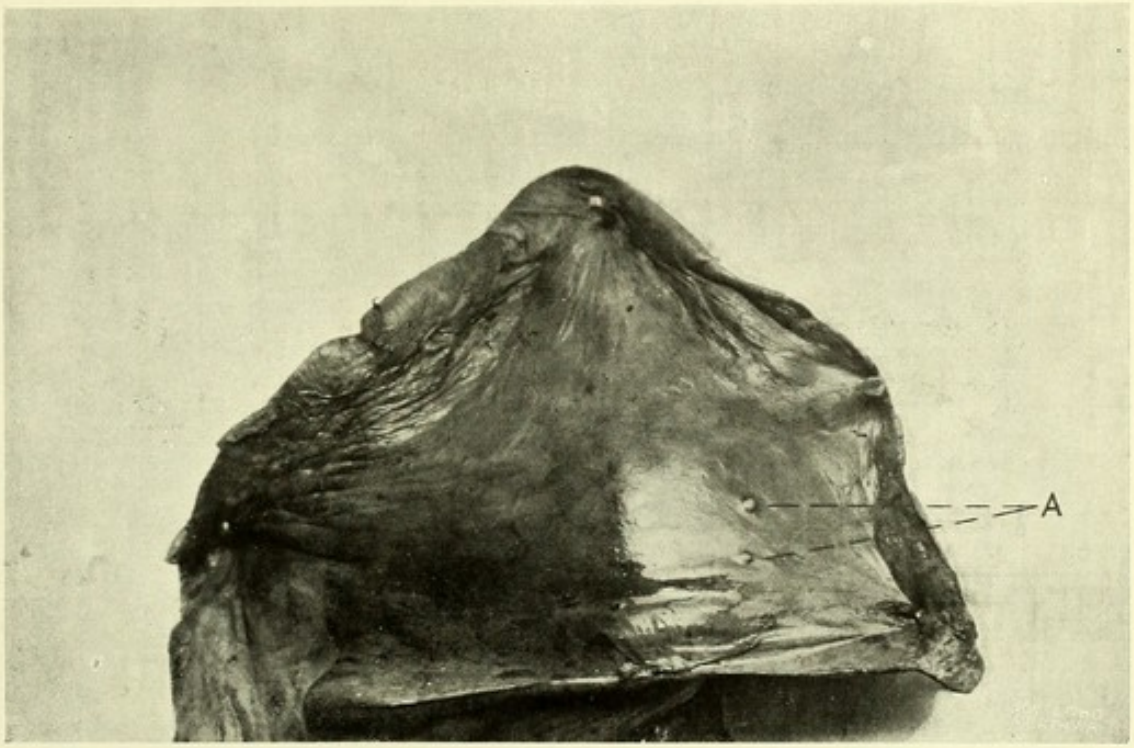


Plate 3.—Portion of lung from post-mortem examination No. 1, showing two tubercular nodules (marked A). As this is part of the same lung as is illustrated in Plate 2, the difference between the effects produced on the lungs by the tubercle bacillus and by the dust is quite obvious.

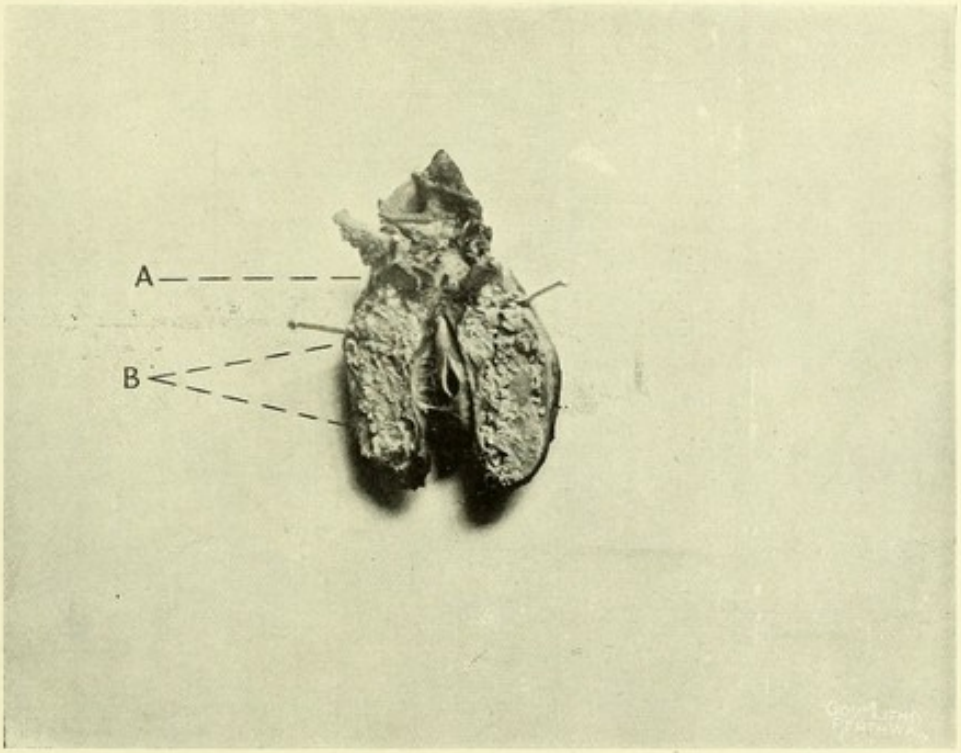


Plate 4.—Bronchial glands from post-mortem examination No. 2. At the top (A) is a small gland pigmented with dust; below (B) is a tubercular gland.

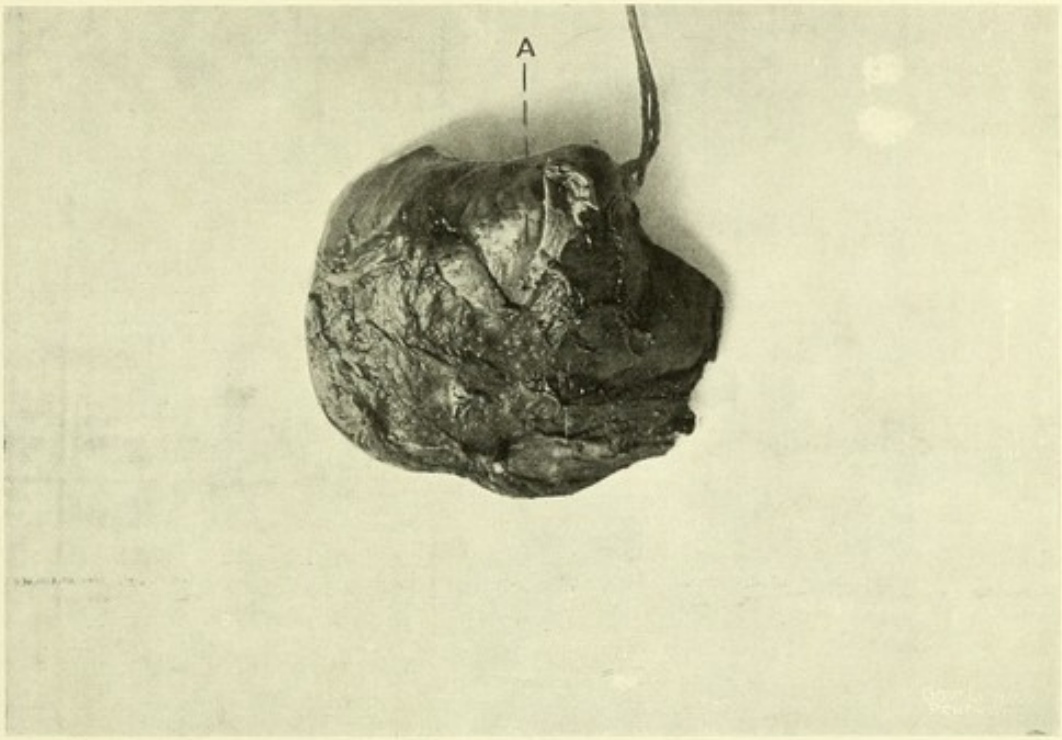


Plate 5.—Apex of lung from post-mortem examination No. 2, showing pleuritic adhesions. At the point marked A the newly organised tissue has been peeled back, showing the thickened visceral pleura and the mottling due to dust.

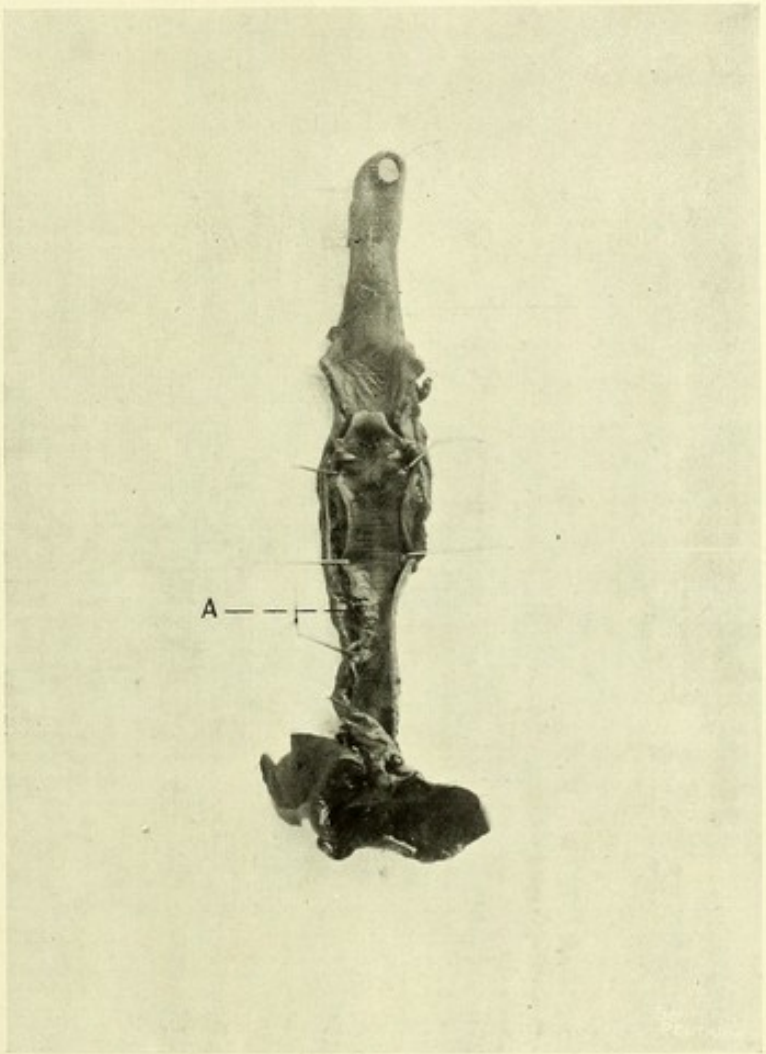


Plate 6.—Trachea and lungs from rabbit in Experiment 2. Trachea congested. At point A is a collection of coagulated blood and mucus. The congestion of the lungs is indicated by their dark colour.

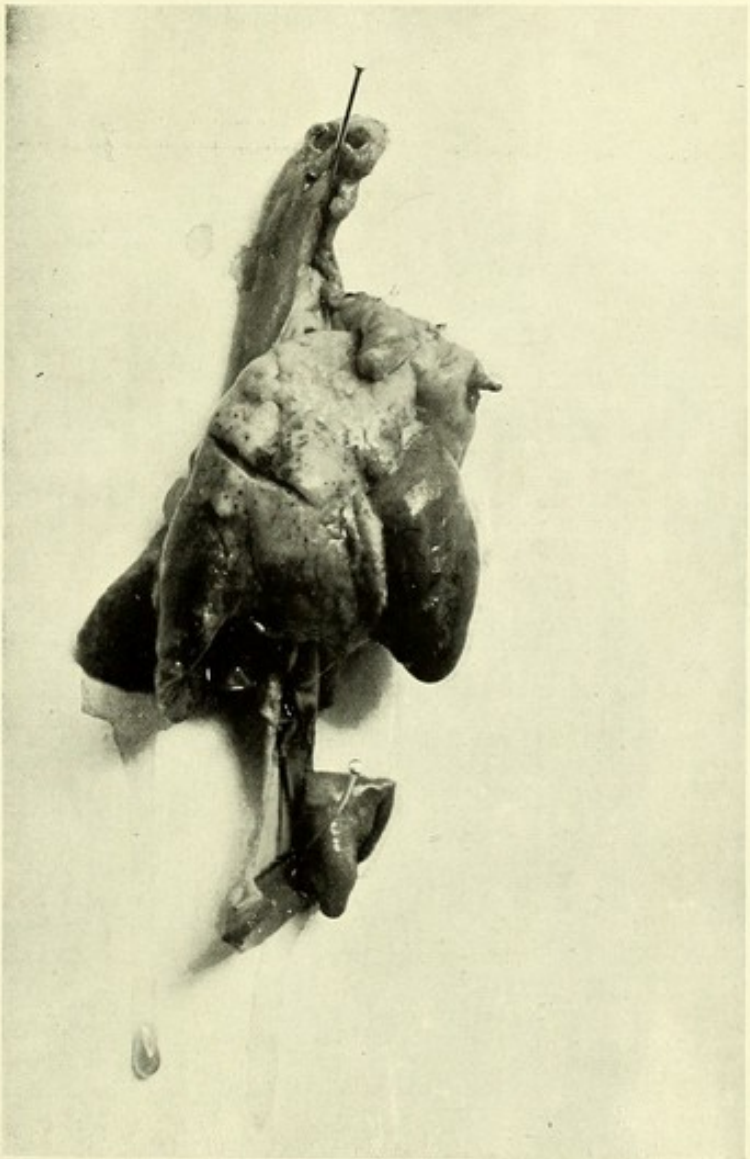

Plate 7.—Lungs from rabbit in Experiment 4. The pigmented nodules caused by the collections of dust under the pleura are plainly visible.

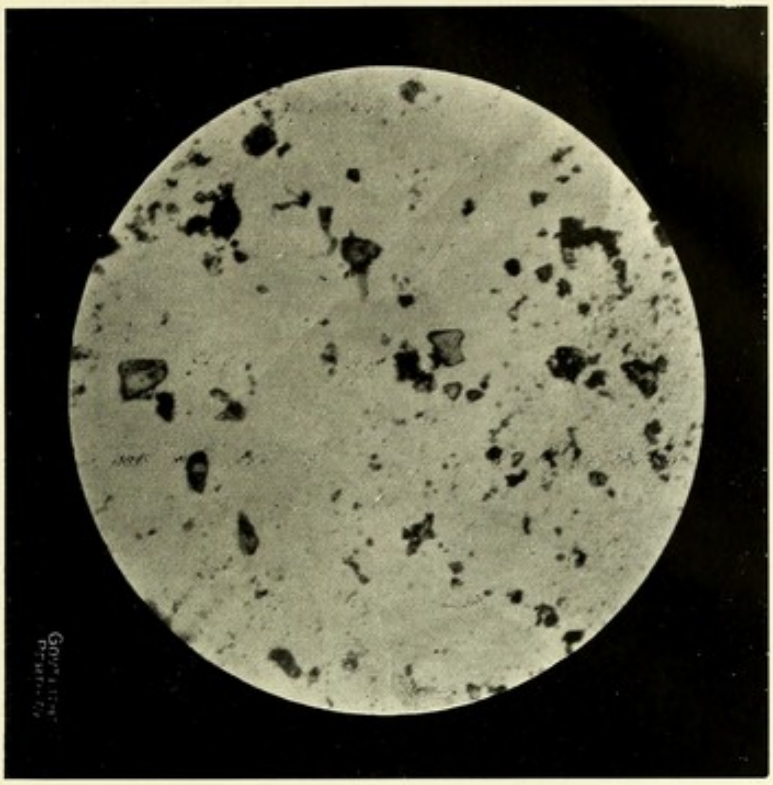

Figure 1.

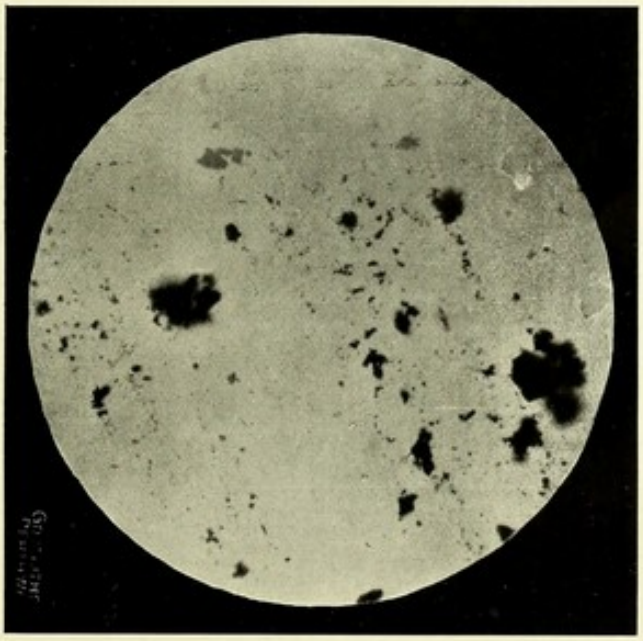

Figure 2.

Plate 8.—Figure 1 shows the dust used in the experiments described in the Report magnified to a low degree. The dust is mineral dust which has passed through a mesh of 100 to the inch. The sharp irritating edges and angles of the particles are clearly shown.

Figure 2 shows finely powdered coal dust—the edges and angles characteristic of the mineral dust are not seen in this coal dust.

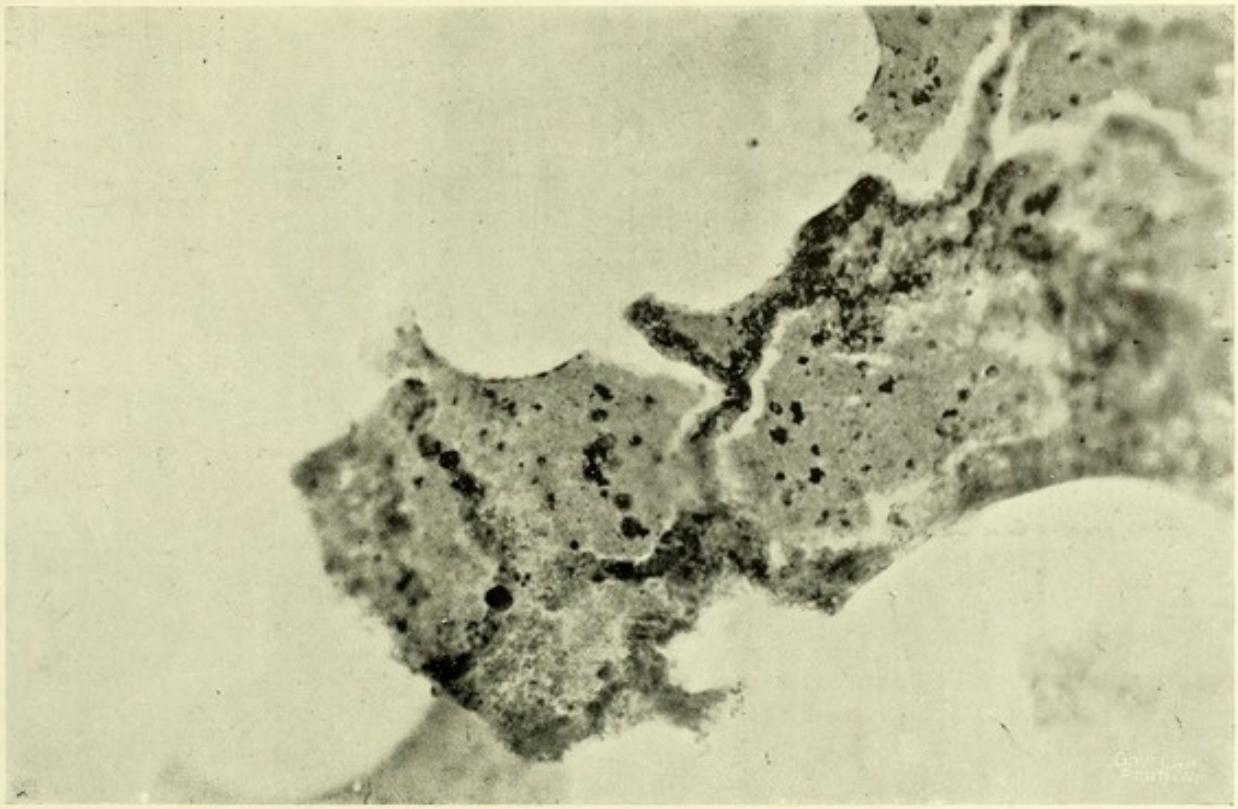

Plate 9.—The plate shows two alveoli from the lung of the rabbit in Experiment 4. The abolition of the alveolar cavities is well marked, and the dust can be seen in small collections, which, under higher magnification, are seen to be leucocytes packed with mineral particles. The fact that the alveolar walls are darker than usual is due to the large number of leucocytes (many of them containing mineral particles). The section is seen under low magnification (Objective 2/3; Ocular No. 2).

Plate 10.—Leucocytes containing particles of dust. High magnification. Objective 1/12; Ocular No. 2.

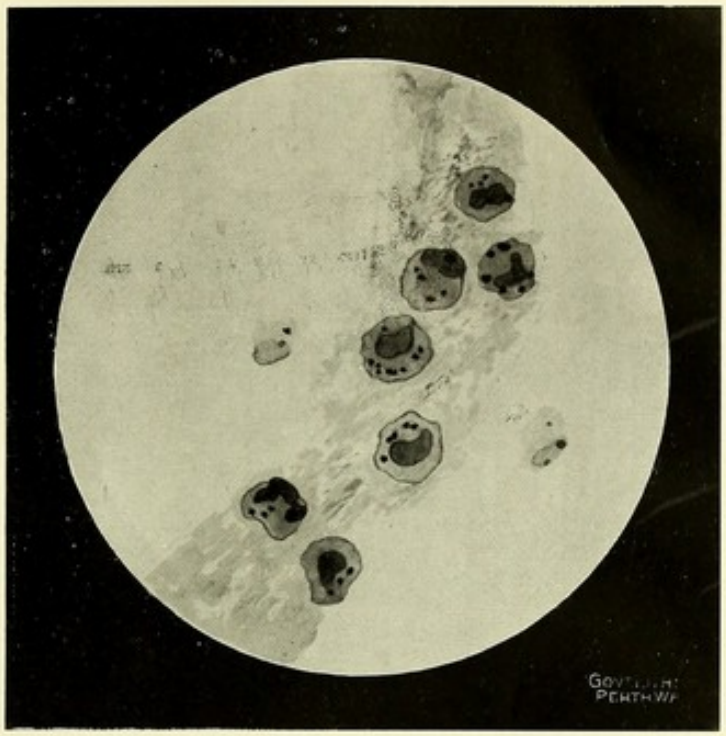

Plate 11.—This is a purely diagrammatic representation of leucocytes in which are enclosed mineral particles.

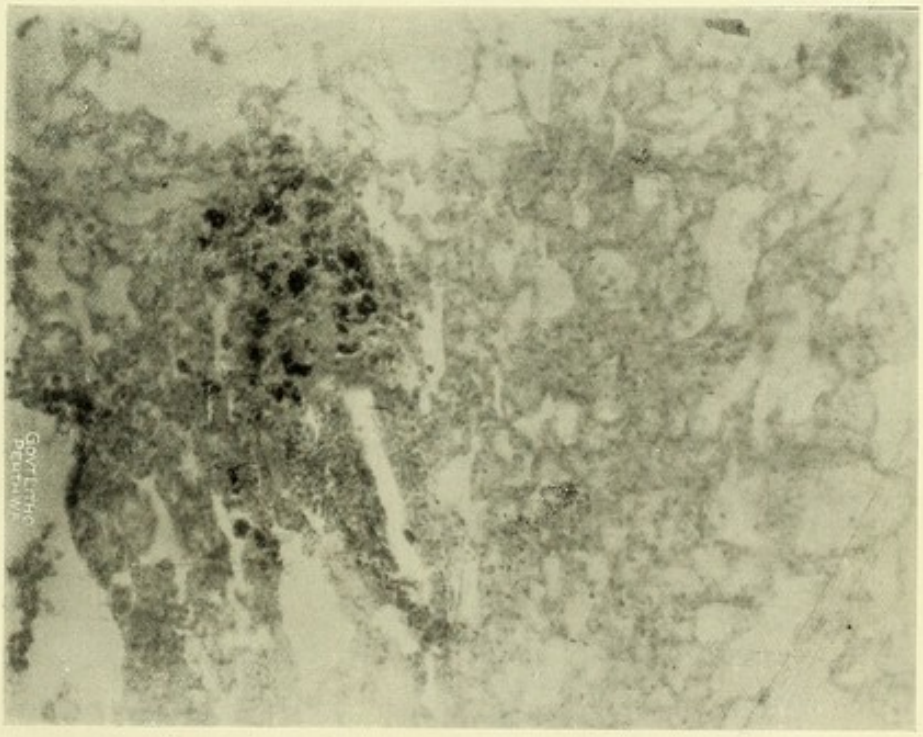

Plate 12.—Section of lung from mouse from Fingall Mine—very low magnification. The dust is well seen collected around the main bronchus, and also on the left of the picture a sub-pleural collection can be seen. The distinction between the consolidated area of lung tissue around the bronchus and the free air spaces further away is very marked.

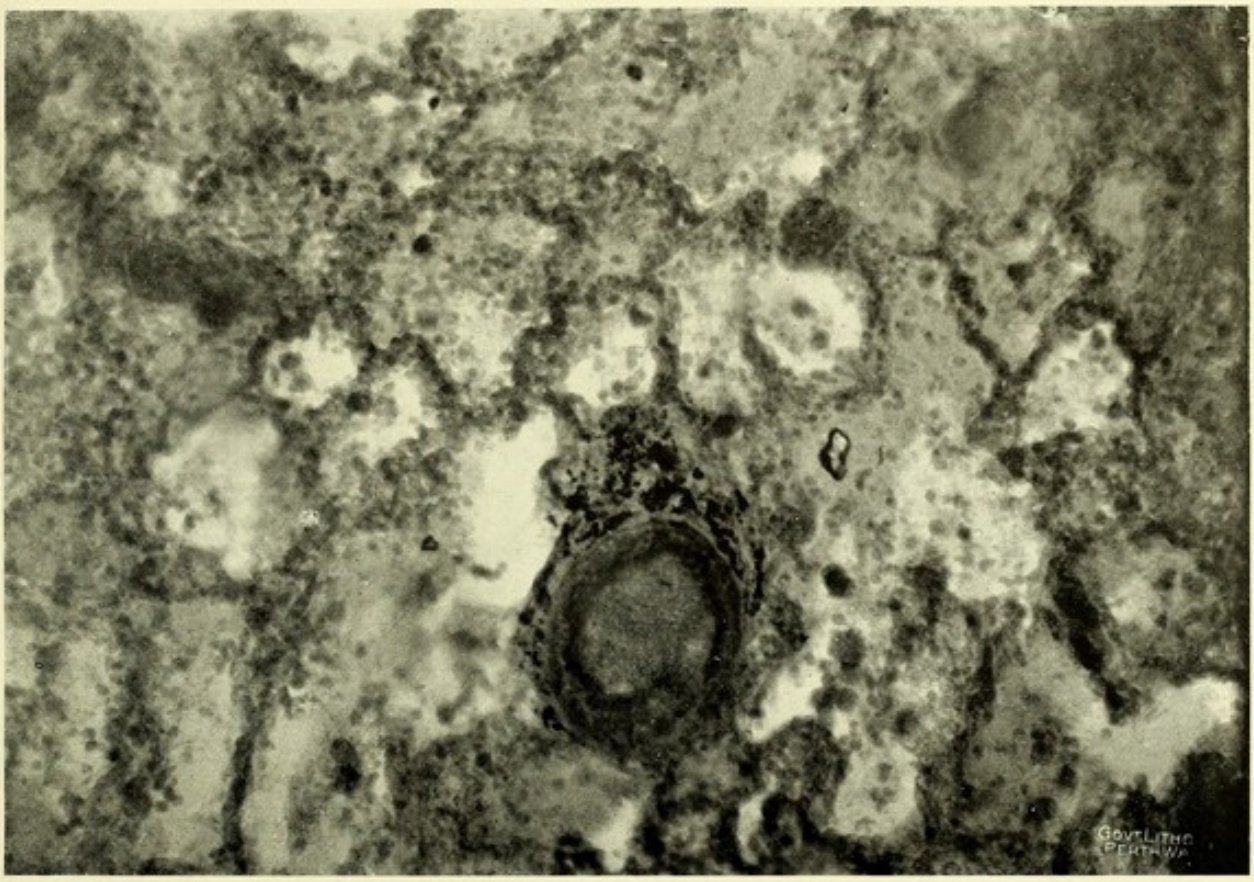


Plate 13.—In this plate one of the small bronchioles is seen, the lumen of the bronchiole is almost obliterated by exudate, and the dust is seen to be deposited around the bronchiole. Many of the alveoli in the neighbourhood are filled with exudate in which the presence of large numbers of leucocytes is indicated by the more darkly stained spots. The changes depicted in this plate have not yet progressed to the stage at which constriction of the lumen of the bronchiole has commenced. The section is seen under low magnification. (Objective 2/3; Ocular No. 2.)

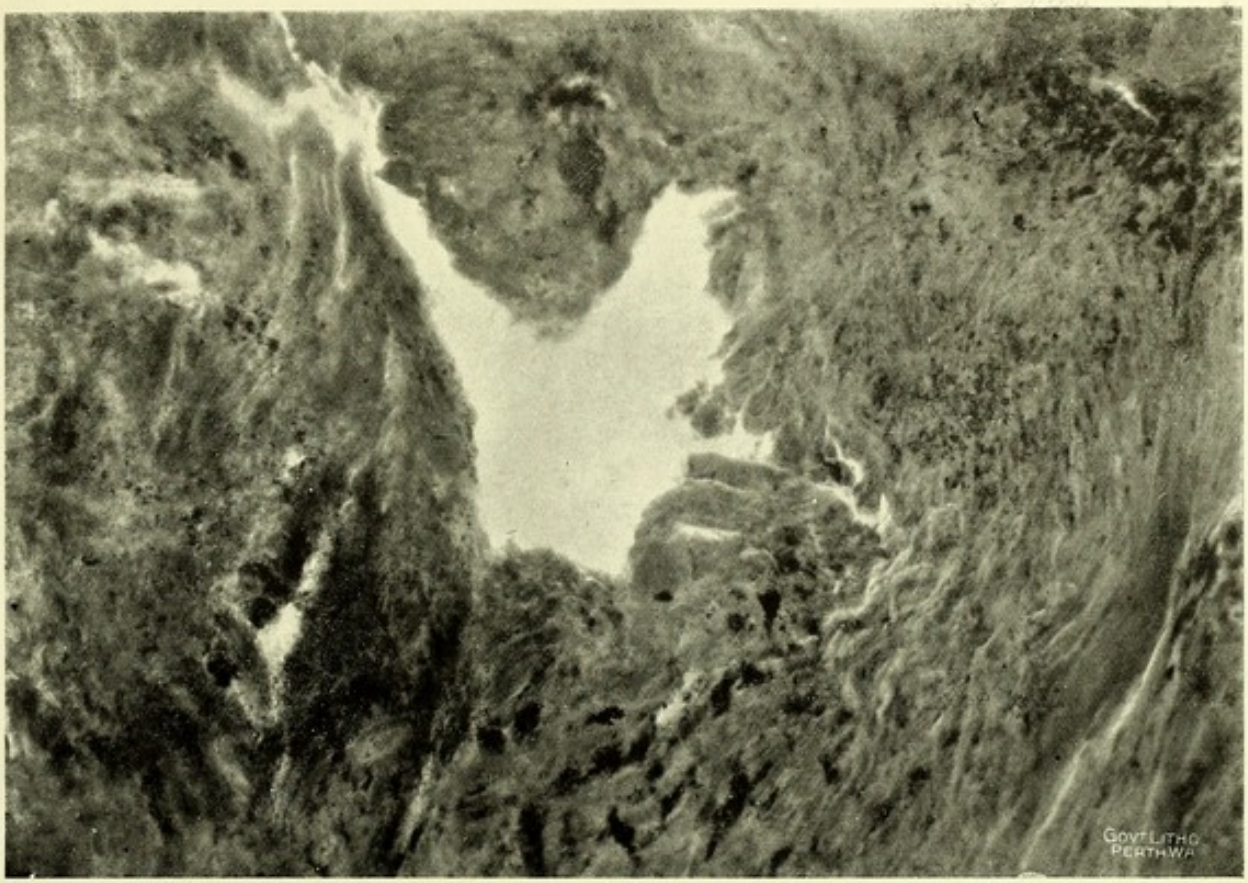


Plate 14.—This plate shows the changes present in a case of advanced fibrosis. The lumen of the bronchiole is markedly constricted and its outline distorted. The whole of the normal lung tissue has been replaced by firmly organised fibrous tissue, and the mineral particles are seen scattered throughout the fibrous tissue. The section is seen under low magnification. (Objective 2/3; Ocular No. 4.)

Plate 15.—The plate shows deposition of coal dust in the lung tissue. As in the previous illustrations, the coal dust is deposited around a bronchiole, but the lumen of the bronchiole is clear and its outline unaffected; the alveoli are not noticeably affected. The contrast between this and the preceding plate is striking. The section is seen under low magnification. (Objective 2/3; Ocular No. 2.)

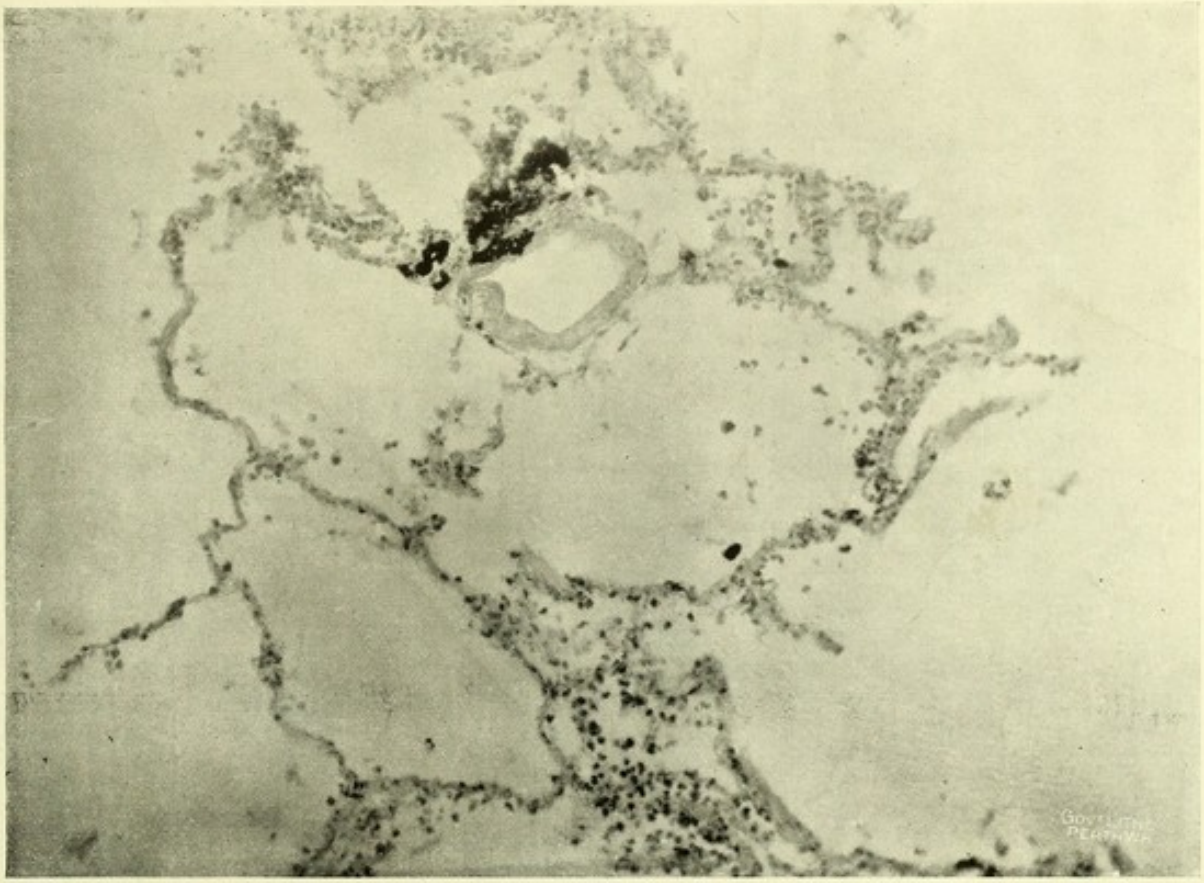

Plate 16.—The plate shows the appearances seen in the section of the lungs from post-mortem No. 1. The dust is deposited around a bronchiole, but this bronchiole has remained unaffected except for the development of a small amount of fibrous tissue around the dust. The alveoli have become dilated, but are otherwise unaffected. The section is seen under low magnification. (Objective 2/3; Ocular No. 2.)

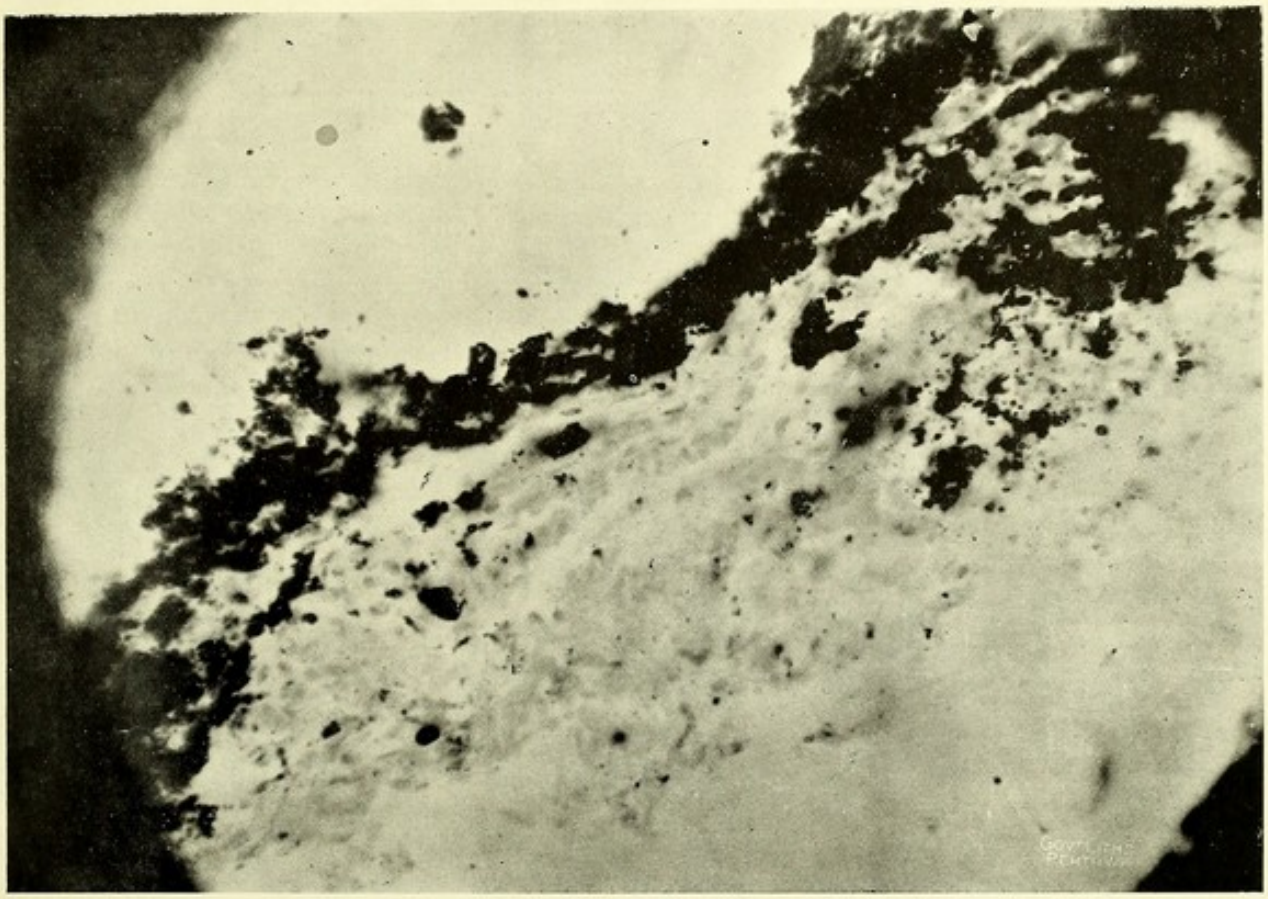

Plate 17.—This plate shows a higher magnification of a collection of dust under the pleura in the lungs from post-mortem No. 1. The development of a small amount of fibrous tissue around the collection of dust is well shown. (Objective 1/6; Ocular No. 4.)