

**A statistical investigation into the mortality of the miners in the district of
Lelant / by Richard Q. Couch.**

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*A Statistical Investigation into the Mortality of the Miners
in the district of Lelant.*

BY RICHARD Q. COUCH, Esq., M.R.C.S., &c.

IN the present Paper I propose to examine, statistically, into the causes of the mortality of the Cornish miner, in the district of Lelant, which embraces the parishes of Lelant, Ludgvan, and St. Erth. In my former communication, I selected St. Just for examination, because it formed the extreme western boundary of the district which it would be in my power to examine; and I have now chosen Lelant, because it forms the extreme easterly limit. But these two districts are not so wide apart in their geographical position as they are in their topographical features. Without entering into any minute description of the physical characteristics of St. Just, it may be mentioned, that the whole parish is formed of an elevated *plateau*, untraversed by a single valley of importance, or interrupted by any line of hills. There are, however, many hilly undulations, but the flats are large and uncultivated. The western and northern shores are bold and surrounded by the Atlantic: the climate is uniformly cold in winter, but the cold is not excessive. The cottages are, for the most part, superior to those of the agricultural labourers, though they are not all that could be desired, and some are unfit for human habitation. In the district of Lelant, the physical geography is altogether different: within its boundaries are many high hills and a few deep valleys, and the water-shed of the county passes obliquely through it. On its north-east boundary it is exposed to the north and north-east winds, forming the south-west shore of St. Ives Bay, which is but little more than sand-hills, called *Howans*, entirely divested of vegetation. The valley of the Hayle river passes beyond the church-town to Penberthy in a south-east direction; and at Phillack, a wide arm of the sea runs in a north-east

course, bounded also by barren towans. The southern limit of the district is a portion of the northern shores of Mount's-bay, where the climate is proverbially temperate, even in the depths of winter. About the centre of this district are the uncultivated hills of Trencrom, Trink, and Castle-an-Dinas, shedding their bleak influence over all around. Trink hill rises to an elevation of 652 feet above the level of the sea. The northern side of this hill slopes away into the "rocky downs" and towards the low and swampy flats of Towednack, and is hence quite exposed to the northerly and bleak winds of winter, and to the chilly easterly winds of spring. During the summer, the climate is mild and bracing. To the west, the ground undulates into the moors about Embla and the Lady Downs, where there is no shelter, either by trees or hedges; for all hedges are very low, and trees there are none. Towards the east, the soil is more cultivated; it gradually slopes towards St. Ives, having a hilly ridge from Penbeagle, on the north, to near Trevethow, on the south, lying between it and the sea. About a mile to the south-east of Trink hill rises the hill of Trencrom, which is about 550 feet above the sea-level. This hill is rocky and uncultivated, and, to the east, sweeps down to the wooded domain of Trevethow, the seat of W. B. Praed, Esq., and to the shores of the Hayle estuary. In a south-westerly direction, a few hilly undulations bring you to a deep valley, which, beginning about Embla and the Lady Downs, becomes a valley at Nancledrea, and deepens in a south-east direction, till it becomes a ravine. There is a stream of water which empties itself in the bog to the west of Marazion. About two miles to the south-west of Trink hill, in a straight line, rises the hill of Castle-an-Dinas; its elevation is 735 feet: to the north it slopes into the valley of Nancledrea, forming its southern boundary, and into the bogs and moors bordering the Lady Downs. The name of "Pig Moor," &c., given to the localities in this direction, very accurately describes the country: in the winter, a wet and bleak morass; and in the summer, barren, but refreshing. To the west, the soil becomes more fruitful and more cultivated where it borders on the parishes of Madron and Gulval. To the south, the slopes terminate in the fertile fields of Gulval and Ludgvan, and extend to

the water's edge of Mount's-bay. The line of the hills is the line of the water-shed of the county; more rain falling here than anywhere else in the district. In the winter these hills are frequently covered with snow; while the lower slopes are green and fertile, bearing the crops for the early London markets. St. Erth is low and level; but, from being bounded in a south-east direction by the hills of Godolphin, Tregonning, &c., the line of greatest rain passes through it.

The population of the district divides itself into three classes,—the mining, agricultural, and mechanical. The mining is almost confined to the high lands. All the mines are to the north and east of the valley of Nancledrea, leading to Lower-quarter and Marazion; and the miners are confined almost exclusively to the same district. They live near and in Halsetown, and around the base and sides of the “rocky downs,” Trink hill, and to the north of Castle-an-Dinas and the surrounding moors; a few residing in Ludgvan village, Lower-quarter, in the villages skirting the road to Hayle, and in Lelant: they live, therefore, in localities the most exposed to the inclemency of the weather. The agriculturalists are well situated on the cultivated slopes,—particularly towards the south and east. The mechanics live at and near Hayle, being engaged in the extensive foundries for mine machinery there; and their house-accommodation is good and comfortable. The cottages of the miners are most of them of worthless character, and altogether unfit for human habitation. On the Lady Downs, on Castle-an-Dinas, at the china-clay works, and the “rocky downs,” if they are not in swampy situations, they are as exposed as possible; their only protection being the undulations of the ground. Many of them have only one floor, and only two rooms,—a kitchen and a bedroom. Others have two floors; but the kitchens are small, unfloored by anything but earth; the doors are either so much dilapidated, or are so badly made, that they freely admit every wind that blows; and the rooms are, consequently, cold and comfortless. In the bedroom, or, if there should be two, in the bedrooms, sleep all the family, however numerous. Crowding together of a family is common, and depends altogether on the number of which each family

may be composed: in some cases, where the number of children, both boys and girls, is large, the crowding is by far too great; in some cases not allowing more than 200 cubic feet of air for respiration, and sometimes not more than 100. But this inconvenience is in some measure remedied by the fact that the wooden partitions between the rooms extend only to half the height of the ceiling, thus leaving the upper part free for the circulation of fresh air; and as the staircase very commonly passes up between the two rooms and is unenclosed, the air of the upper rooms is in common with those below. This, while it permits the access of the freshest air the house can supply, renders the sleeping compartments very cold and draughty. They are always open to the bare roof. The windows are extremely small and low, and very commonly incapable of being opened. In the lower and eastern part of Lelant, and in the neighbourhood of the church-town, the miners' cottages are much better. The same may be said of the cottages of the agriculturalists in the mining localities, but as a rule they are better and less crowded, for their children at a very early age go out to service and do not sleep home; but the children of miners, if old enough to work at the mines, always return home to sleep. The only exception to this crowding is when the men work in corps (cores).—In this case, they work alternately through the day and night; and by this plan much mischief is avoided, as all the family are not home at one time except on Saturday and Sunday nights. Some of the men are small agriculturalists, farming their land during the intervals of labour at the mine; but many of them have no occupation except mining, and as eight hours is the extent of their diurnal labour, the remainder of sixteen hours is spent in sleep and busy idleness.

The population of the district, according to the census of 1841 and 1851, is,—

	1841.	1851.
Uny Lelant.....	1999	2290
St. Erth	2447	2457
Ludgvan	3185	3529

making the total population, in 1841, 7631. The census of 1851 shows an increase of 645 in ten years, the population being 8276.

In St. Erth, where the foundries are, the increase has been least, being only one per year; the greatest increase is in Ludgvan. St. Erth is the parish in which there is most agriculture and trade, and Lelant, in which there is most mining.

In order to estimate the proportion of deaths to the population under each year, I shall state the aggregate number of births per annum, so as to enable any one very easily to ascertain so important a point, with something like an approximation to the truth. But it must be remembered that there are several sources of error, such as emigration; and even migration, which is sometimes great, many people leaving one mine for another pass and repass from parish to parish with a ceaseless change. The agriculturalists are more stationary, and the farm labourers are almost always born in the same locality in which they pass the remainder of their lives; the parish is in fact frequently the extent of their wanderings.

The number of men engaged in mining operations within the district embraced in this Paper amount to about 1,000. But this must not be taken as even an approximation to the number *living* in the district; for adjoining are the parishes of Towednack, Zennor, and St. Ives, all of which send forth men to work in the mines of Lelant, &c. The tables of mortality have reference solely to the deaths occurring within a certain boundary; but the miners resident there may be and probably are much less than the number here indicated, which has reference to such as *work* within the district. In examining the statistics of St. Ives, this subject will be further examined and explained, and the proportionate per centage of deaths to population ascertained.

1837.

The number of deaths in the district for the period of six months, from June to December, is forty-eight, and of these, nine were miners, or 18·75 per cent.

Of these 9 miners,—

	5,	or 55·55	per cent. died of consumption,
	2,	„ 22·22	„ pneumonia,
	1,	„ 11·11	„ paralysis,
c	1,	„ 11·11	„ dropsy.

From this it appears that 77·77 per cent. of the deaths among miners were caused by diseases of the chest, and 22·22 per cent. by all other diseases.

There are no accidents recorded; one or two have been entered, but have been again erased.

The age of the youngest miner recorded is 26, and he died of consumption; the oldest, 70, and he died from age and paralysis. The average age of the miner is 48 years and 8 months.

1838.

The number of deaths during the year has been one hundred and twenty-nine; and of these, twenty-six were miners, or 20·15 per cent.

Of the 26 miners,—

11,	or 42·30	per cent,	died of consumption,
3·84	„		died of pneumonia,
3·84	„		died of asthma,
7·64	„		died of enteritis,
11·53	„		were killed,
15·38	„		died from old age.

Beside these, 1 died of diseased heart; 1 of disease of the brain; 1 of cancer in the neck; and 1 suddenly, at 48.

Diseases of the chest again cause 50·00 per cent. of the deaths, and the remainder arise from all other causes, including accidents.

The earliest age at which death occurs is 17, of which there are 3; 1 was killed; 1 died of diseased heart; and 1 of enteritis. The oldest died at 86 years of age. The average age is 48 years and 10 months.

1839.

The number of deaths for the year is one hundred and eighteen, and of these, seven were miners.

Of the 7 miners,—

5,	or 71·42	per cent.	died of consumption,
1,	„ 14·28	„	died of fever,
1,			suicide from insanity.

No accident is recorded ; and the registrar seems to have thought that it was no part of duty to record death from such causes.

Thoracic diseases are still the most extensively fatal of affections. The youngest miner died at the age of 26, of consumption ; the oldest, also of consumption, at 59. The average age is 39 years and 5 months.

1840.

The number of deaths for the year is one hundred and twenty-two, and of these, sixteen were miners.

Of the 16 miners,—

9,	or 56·25	per cent.	died of consumption,
2,	„ 12·5	„	died of pneumonia,
2,	„ 12·5	„	were killed,
3			were not recorded.

During this year, the mortality from thoracic diseases among miners was 68·75 per cent. ; 12·50 per cent. from accident. The age of the youngest miner recorded was 20, and he was killed in the mine ; the oldest was 72, and he sank from age and consumption. The average age for the year is 47 years and 6 months.

1841.

The deaths for the year have been one hundred and seventeen, and of these, fifteen were miners.

Of the 15 miners,—

11,	or 73·33	per cent.	died of consumption,
1,	„ 6·66	„	died of rheumatism,
1,	„ 6·66	„	died of cystitis,
1,	„ 6·66	„	was killed,
1,	„ 6·66	„	died from old age.

Disease of the chest again predominates over all other causes of death. The youngest miner died of consumption at 20 years of age ; the oldest, from age, at 79. The average age for the year is 50 years and 7 months. Population in 1841, 7631.

During the past five years, the greatest mortality has arisen from thoracic affections, and more especially from consumption. The

relative per centages have varied very much when compared with the general population ; but when the comparison has been confined to the class of miners, there is a very great uniformity of result through every year. During each year, many children are carried off by "debility," and generally under one year old. Croup is common, and several die of it every year. Measles, scarlet fever, and small pox linger about, carrying off several yearly ; and whooping cough is always to be found in the district, especially in the secluded valleys, and on the sides of the hills.

Though deaths from fever are not very numerous, yet continued and typhoid fevers, with petechial eruptions, are very common : but the deaths are rare, as it is easy to procure fresh air. If the cottages had more comforts below stairs, and less people were crowded into the sleeping apartments, a few domestic arrangements would have the effect of reducing the fever cases very considerably. In the lower parts of the district, near Ludgvan, Lower-quarter, and where there are better cottages, and the bedrooms are ceiled off from the roof, fevers are more rare.

A Table, showing the comparative frequency of thoracic diseases in miners, and in the non-mining population, above five years of age.

Disease.	1837.	1838.	1839.	1840.	1841.	Average.	
Miners :—							
Consumption ..	55.55	42.30	71.42	56.25	73.33	59.67	} 68.15
Pneumonia ...	22.22	7.68	.....	12.50	.....	8.48	
Males, not miners, above 5 years of age:—							
Consumption ..	50.00	23.33	33.33	52.62	21.73	36.20	} 38.69
Pneumonia ...	.....	3.33	4.76	.....	4.34	2.48	
Females, above 5 years of age:—							
Consumption ..	10.00	10.51	24.13	33.33	33.33	22.26	} 31.72
Pneumonia ...	20.00	7.40	6.89	10.00	3.03	9.46	

The amount of thoracic diseases, and especially of tuberculous disease, in miners, is very great when compared with the whole

of the non-mining population; but diseases of an inflammatory description are not numerous, except in particular years. In 1837, pneumonia very greatly prevailed, and it carried off 22·22 per cent. of miners and 20 per cent. of the female population. The next year in fatality was 1840, when 12·50 per cent. of the miners died of pneumonia and 10 per cent. of females died of the same disease, and in the average of five years, more females than miners died of it. It should be remarked, however, that many of the miners who died from pneumonia, as an immediate cause, were yet suffering from phthisis in different stages of development. The increase and decrease of the number of deaths from pulmonary affections in miners is generally accompanied by a similar increase and decrease among the general population; and the years of increase, I find on inquiry, have been years of great variations of temperature and other climatic changes, injurious to health. But, however much circumstances may vary, and one year may be more fatal than another, it is evident the general result bears the same unfavourable evidence of the great mortality of the miner over every other class.

During the last 5 years, deaths from thoracic affections among miners have been more than double those occurring among females during the same period, with an addition also of 5 years to increase the results, and among the male population it is also nearly double under the same circumstances: the average deaths among miners from chest diseases being 68·15 per cent.; among other males, 38·69 per cent.; and among females, 31·72 per cent.

The accidents are less in number than those occurring in St. Just. In 1837, which is but a partial record, no accident is entered. In 1838 there were two accidents and one sudden death; the accidents occurred at the ages of 17 and 19. In 1839 there were no accidents, excepting that one man committed suicide, from insanity, at the age of 33. In 1840 there were two accidents, at the ages of 20 and 25; and in 1841 one man died of locked jaw, from an injury received in his hand, at the age of 54. So that the same observation as was made in reference to St. Just may also be made here,—that most of the accidents occur to the young.

The thoracic diseases among the non-mining males are thus arranged :—

In 1840, out of five agricultural labourers and five farmers, two of each died of consumption; while of three trades (masons, carpenters, and blacksmiths), thoracic diseases were more common, and a *gentleman* died of gout.

In 1841, labourers and farmers died of consumption, &c., in a less proportion than miners; yet carpenters and other trades indicating in-door employment were more liable to chest affections than others. From the examination of the past five years, the ages at which mortality prevails, from tubercular disease, divide themselves into two groups: among the non-mining males the first period extends from 14 to 30, and the second from 44 to 64. In the first period, both the miners and male population generally that die are less in number than during the second period, and the point of greatest force of mortality is from 25 to 30. The second period, which is the most intense, has its greatest force from 53 to 64.

Among females, two periods of mortality are also observed, but the periods of greatest fatality are reversed; the greatest being from the age of 14 to 23, the period of the development of puberty and womanly charms.

1842.

The number of deaths for the year is one hundred and sixty, and of these, twelve are miners.

Of the 12 miners,—

33·33	per cent.	died of consumption,
16·66	„	died of pneumonia,
16·66	„	were killed.

Of the remainder, 1 died from dropsy, 1 from enteritis, 1 from age, and 1 from the effects of inflammation of the hand, arising from injury. The oldest miner died at 75, from age; the youngest, at 23, from consumption; and the average age for the year is 45 years and 5 months. From this it appears that 50 per cent. of the miners died of thoracic diseases, and 33·33 per cent. died from all other causes except accidents.

1843.

The number of deaths for the year is one hundred and thirty-three; of these, fourteen are miners.

Of the 14 miners,—

50·00 per cent. died of consumption,

7·14 „ died of pneumonia,

14·28 „ were killed.

Of the remainder, 1 died of scarlet fever, 1 of brain fever, 1 suddenly, and the causes of death in the rest are not recorded. The age of the oldest miner is 70, and the cause of his death is not recorded; the youngest died at the age of 17, of brain fever. The average age for the year is 37 years and 6 months. From this it appears that 57·14 per cent. died of diseases of the chest, and 21·42 died from all other causes except accidents.

1844.

The number of deaths for the year is two hundred and thirteen, and of these, sixteen are miners.

Of the 16 miners,—

75·00 per cent. died of consumption,

6·25 „ „ from accident.

Of the remainder, 2 died of fever, and the causes of death for the rest are not recorded. The oldest died at the age of 75, of consumption; the youngest, at 16, of fever. The average age of the miner for the year is 45 years and 1 month. During this year, measles and scarlet fever prevailed as epidemics. Of the males below 5 years of age, 23 died of measles, and 10 of whooping cough; and of the females below 5 years of age, 26 died of measles, and 11 of whooping cough.

1845.

The number of deaths for the year is one hundred and nine, and of these, fourteen are miners.

Of the 14 miners,—

50·00 per cent. died of consumption,

7·14 „ „ pneumonia,

7·14 „ „ asthma;

and 2 died of fever, 1 of dropsy, 1 from age, and 1 is unrecorded. The oldest miner died at the age of 79, of fever; the youngest, at 21, of pneumonia. The average age for the year is 52 years and 10 months. During the year, 64·28 per cent. of miners died of thoracic diseases, while 28·56 per cent. died from all other recorded causes. No accident.

1846.

The number of deaths for the year is one hundred and twenty-seven, and of these, sixteen are miners.

Of the 16 miners,—

31·25 per cent. died of consumption,
 12·50 „ died of pneumonia,
 6·25 „ died of pleurisy,
 6·25 „ died of hydro-thorax,
 12·50 „ were killed.

Of the remainder, 2 died of cancer of the tongue, 1 of ulcerated leg, 1 of nephritis, and 1 is unrecorded. The oldest miner died at the age of 75, of ulcerated leg; the youngest was killed, at the age of 15. The average age is 43 years and 4 months. 56·25 per cent. dying of thoracic diseases, and 24·90 per cent. from all other causes.

In a review of the past five years, the same results appear; an amount of pulmonary disease occurs which more than equals all other causes together, and is much greater than what occurs in all the non-mining population.

Pulmonary Diseases among Miners.

Disease.	1842	1843	1844	1845	1846	Average.
Consumption ..	33·33	50·00	75·00	50·00	31·12	
Pneumonia	16·66	7·14	....	7·14	12·50	
Pleurisy .....	....	....	....	....	6·25	
Hydro-thorax ..	....	....	....	....	6·25	
Per cent. ..	50·00	57·14	75·00	57·14	56·12	59·08

Pulmonary Diseases among Males, not Miners, and Females, above five years of age.

Disease.	1842	1843	1844	1845	1846	Average.
Males :—						
Consumption ..	17.14	26.92	21.87	35.29	23.33	
Pneumonia ....	....	7.69	3.12	11.76	3.33	
Pleurisy .....	....	3.84	....	....	....
Asthma .....	....	....	....	....	3.33	
Per cent. ..	17.14	38.45	24.99	47.05	29.99	31.52
Females :—						
Consumption ..	18.75	22.33	45.71	34.21	27.50	
Asthma .....	....	....	....	2.63	....
Pneumonia ....	....	...	....	....	2.50	
Pleurisy .....	....	....	....	....	2.50	
Per cent. ..	18.75	22.33	45.71	36.84	32.50	31.22

The year of greatest mortality from thoracic diseases among miners was 1844, when it reached 75 per cent.; and the same year was the one of greatest mortality among females from the same cause. But 1845 was the year of greatest mortality among the non-mining males: in examining the returns very carefully, however, the increase of deaths began in the winter of 1844, and in 1845 during the spring and summer was at its highest, hence it probably arose from the inclemency of the previous year, which had been so fatal to the other two classes. The spring and summer of 1844 were remarkably dry and cold; and thoracic diseases, especially pneumonia, were very prevailing, but not fatally so. After the dry and cold spring of 1844, however, all diseases had an aggravated character, and miners as well as the general population suffered severely. But whenever the general public suffer from affections of the pulmonary organs, the miners are sure to suffer in an increased proportion.

The accidents are not numerous. In 1842, there were two, and

both were killed by rocks falling on them, aged 34 and 48. In 1843, two also were killed, but one only in the mine, aged 25, and he fell through the shaft; the other was drowned. In 1844, one, aged 17, was killed by falling. In 1845, there was no fatal accident. In 1846, there were two accidents: one, aged 15, fell in the shaft; the other, aged 54, was killed by a stone falling on him.

Among the other population, pulmonary affections are more common among carpenters than either blacksmiths or masons. Pneumonia is more common in the young and among smiths and masons: a greater age is attained by the farm labourer, farmer, and sailor than by the other classes. Consumptive diseases, among all the non-mining males, have their greatest amount of mortality, in the early period of life, from 13 to 26 years of age, its greatest intensity being from 17 to 21; a second period ranges from 40 to 67 years of age; at 40, consumption occurs only occasionally, and but rarely up to the age of 47; but from 50 to 57 years of age deaths are very numerous; after this they again rapidly decline; a few, however, occur to the age of 62, after which, to 67 years of age, they are again very numerous.

Among the females, consumption, according to the record of the last five years, begins to creep on at 11 years of age, and occurs occasionally till the age of 20, when it is at its greatest rate of mortality, after this it again declines till about 28 years of age; at the age of 36 it again commences, and, with much equality continues to 43 or 44 years of age, when it again decreases, but shows itself up to 65 or 66 years of age, and, in isolated cases, up to 77 years of age,—more sinking in a short space in the early period of life than in old age—two or three years in early life having more victims than any similar period in after-life.

1847.

The number of deaths for the year is one hundred and twenty-five, and of these, twenty-one are miners.

Of the 21 miners,—

47·61 per cent. died of consumption,

9·52 „ „ pneumonia,

4·76 „ „ asthma.

Of the remainder, 2 were killed, aged 18 and 37, 1 died of palsy, 1 of dropsy, 1 of fever, 1 of diseased stomach, 1 from age, and 1 is not recorded. The oldest died from age, at 81; the youngest was killed at the age of 18. The average age is 43 years and 7 months.

A great number of children, both male and female, died of "debility," 2 died of croup and whooping cough. Of the miners, 61·89 per cent. died of thoracic diseases; while of other males from 5 years old, 20·82 per cent. only died of the same affections; and among the females, 35·87 per cent.; and of miners only, 23·80 per cent. died from all other causes except accident.

1848.

The number of deaths for the year is one hundred and thirty-one, and of these, thirteen are miners.

Of the 13 miners,—

69·23 per cent. died of consumption.

Of the remainder, 2 died of dysentery, 1 from age, and 1 died suddenly. The oldest miner died from age, at 81; the youngest, at the age of 24, of consumption. The average age for the year is 53 years and 7 months. During the year, whooping cough was prevalent as an epidemic. And while 69·23 per cent. of miners died of consumption, 35·00 per cent. only of the other males, and 24·48 of the females, sank from the same cause.

1849.

The number of deaths for the year is one hundred and fifteen, and of these, seventeen are miners.

Of the 17 miners,—

58·82 per cent. died of consumption,

5·88 „ „ hydro-thorax.

Of the remainder, 2 were killed, 2 died of dropsy, 1 of nephritis, and 1 died suddenly. The oldest miner died suddenly at 77 years of age; and the two youngest were killed by a fall, at the age of 21. The average age for the year is 46 years and 11 months. Whooping cough and measles were mildly prevailing as epidemics, but

7 girls and 7 boys died of them.—A remarkably healthy year. Deaths were not numerous; the chief mortality being from debility among children, and consumption, palsy, and old age among the general population.

1850.

The number of deaths for the year is one hundred and forty, and of these, fourteen are miners.

Of the 14 miners,—

42·85 per cent. died of consumption,

14·28 „ „ pneumonia;

and of the remainder, 2 died from age, 2 of palsy, 1 of diseased brain, 1 of dropsy, and 1 was killed. The oldest died from age, at 78; and the youngest, at the age of 20, of diseased brain. The average age for the year is 44 years and 9 months. This was a very healthy year.

1851.

The number of deaths for the year is two hundred and sixteen, and of these, twenty-one are miners.

Of the 21 miners,—

38·09 per cent. died of consumption,

9·52 „ „ asthma and laryngitis.

Of the remainder, 1 died of nephritis, 2 of dropsy, one of diarrhœa, 2 of small pox, and 5 were killed. The oldest miner died at the age of 77, of consumption; and the youngest, at the age of 16, of the same affection. The average age for the year is 38 years and 9 months.

Small pox prevailed as an epidemic and carried off 21 males and 18 females under 5 years of age, and many died above this age of the same disease. Measles has almost disappeared. The small pox did not commence till June, and did not arrive at its maximum of virulence till July and August, after which it gradually declined.

Small pox, with measles and scarlet fever, when they occur together in the same district, do not appear to be severe. When they follow in succession to each other, this is not generally the case, each appears to run its course, and is mild or severe according

to climatic changes and local influences; but as one decreases in power, another increases in virulence, and becomes more and more fatal. During the past year, small pox superceded all other diseases, and has been very fatal. The population in 1851 was 8,276.

Pulmonary affections are again the most generally destructive of all diseases among miners during the past five years:—

A Table of Mortality from Thoracic Diseases in Miners, in Males not Miners, and Females, above five years of age.

Disease.	1847.	1848.	1849.	1850.	1851.	Average.
Miners:—						
Thoracic disease	61·89	69·23	64·70	57·13	47·61	60·11
Males, not miners:—						
Thoracic disease	20·82	35·00	19·04	28·00	18·41	24·23
Females:—						
Thoracic disease	35·87	24·48	16·85	40·67	22·00	27·97

The greatest mortality among the miners from pulmonary diseases was in 1848, which was also the year of greatest mortality among the non-mining population; but the year of greatest mortality among the females was in 1850, when it was almost at its minimum among the miners. The mortality among any class of this population, such as agriculturalists and artisans, have been far less than among miners, and, as a large portion of the population of the district belong to these two classes, some estimate may be formed of the relative healthiness of each. The wages of a farm labourer is considerably less than that of the miner, and their family and household expenses are equal, yet the miner is the most unhealthy, and the agriculturalist the most healthy, of our industrial classes. This will be a subject for further examination.

The number of accidents is much less than what occurs in St. Just. In 1847, 2 were killed at the ages of 17 and 37; in 1848, there were no accidents; in 1849, 2, at the age of 21; in 1850, 1, aged 24; in 1851, there were 5, but 3 of these were drowned at sea, 1, aged 28, was killed by an explosion, the other, aged 22, met his death by falling into a shaft. These ages still indicate that accidental deaths are most common among the young.

It must be evident from these investigations, that this peculiar occupation will produce disease, and especially consumption. The great preponderance of consumption among miners over all other diseases, and the great excess of it in miners over other portions of the population, very strongly point it out. But a sad confirmation is clearly established in the recent returns on the health of our soldiers, that peculiar occupations produce peculiar diseases.

A soldier is a man arrived at manhood, and, at that period, he is selected with especial reference to good health. A soldier, to pass inspection, must be firmly and robustly formed, and healthy in every organ. He therefore enters on his duties not only in good health, but with every probability of its continuance; and yet, in a few years, this strong man withers and decays. This is not the result of accident, but long continued predisposing causes,—it can be accounted for in no other way. It has been found, for instance, that in proportion to the night-accommodation and occupation during the day is the prevalence of the disease.

Taking the number of deaths per ten thousand per annum of the soldiers' ages, we find,—

In the Household Cavalry	110	die of consumption,
Dragoon Guards and Dragoons....	133	„
Infantry of the Line	187	„
Foot Guards	204	„
While 24 of our largest towns give...	119	„
Manchester, crowded and ill-ventilated	124	„
The London Fire Brigade, who are constantly up at night watching, and constantly wet and exposed. }	70	„
The Metropolitan Police	76	„

The Foot Guards here suffer a mortality from consumption very nearly three times as great as the Fire Brigade; showing that night work and exposure do not of themselves cause all this mortality. Fully to understand these particulars, it would be necessary to enlarge beyond the bounds commonly laid down for your Report; but bad and insufficient bedroom accommodation and deficient occupation seem to be among the chief causes.

These facts cry aloud for remedy, and a remedy could easily be obtained; but bad as these facts are, they do not equal the mortality of the Cornish miners. The difference of the rates of mortality in the different regiments is according to the barrack-accommodation of the men. Where the sleeping apartments have been enlarged and the number of men occupying them reduced, the number of consumptive cases have also been reduced; but where no alteration has been made, the greatest number of deaths still continue to occur.

1852.

There died during the year one hundred and seventy-seven persons, and of these, twenty-one are miners.

Of the 21 miners,—

61·90 per cent. died of consumption,

9·52 „ were killed;

and of the remainder, 2 died from age, 2 of brain fever, and 2 died suddenly. The oldest died at 75, from old age; the two youngest died at the age of 17, one of whom was killed, and one sank from consumption. The average age for the year is 49 years and 2 months.

Small pox prevailed as an epidemic, and among the male children below 5 years of age, 10 died, and among the females, 5 died; but the greatest mortality among children arose from “debility,”—16 males and 21 females dying from this cause alone; being 43·24 per cent. of males and 55·26 per cent. of females under 5 years of age. Population in 1851, 8,276. Deaths, 177; births, 313.

1853.

There died during the year one hundred and eighty-three persons, and of these, twenty-three are miners.

Of the 23 miners,—

56·62 per cent. died of consumption,

17·39 „ were killed.

Of the remainder, 2 died of brain fever, 1 of dropsy, 1 of dyspepsia, and 1 of extensive ulceration of the thigh. The oldest died at 84,

from old age; and the youngest was killed at the age of 18. The average age for the year is 40 years and 5 months.

Of the accidental deaths, one can hardly be said properly to belong to that class,—having committed suicide at the age of 25. Population in 1851, 8,276. Deaths, 183; births, 296.

1854.

The annual number of deaths is one hundred and sixty-six, and of these twenty-eight are miners.

Of the 28 miners,—

50.00	per cent.	died of consumption,
7.14	„	died of pneumonia,
3.57	„	died of bronchitis,
3.57	„	died of pleurisy,
14.28	„	were killed.

Of the remainder, 1 died of diarrhœa, 1 of dropsy, 1 of fever, 2 from age, and 1 died suddenly. The oldest miner died from age, at 88; and there are 2 others at the ages of 83 and 82, 1 dying from diarrhœa, and the other of consumption; the youngest died at the age of 23, of consumption. The average age for the year is 51 years and 2 months.

During the year, scarlet fever and measles prevailed as epidemics; but not to any alarming extent. Deaths, 166; births, 294.

1855.

The annual number of deaths is one hundred and forty-nine, and of these, twenty-three are miners.

Of the 23 miners,—

43.47	per cent.	died of consumption,
8.69	„	died of pneumonia,
4.34	„	died of inflammation of the windpipe,
13.04	„	were killed.

Of the remainder, 3 died of fever, 1 from age, 1 of dyspepsia, and 2 died suddenly. The oldest died from age, at 86; and the youngest, of pneumonia, at 18 years of age. The average age for the year is 44 years and 4 months.

This year was free from epidemics, except that an occasional case of scarlet fever occurred; but colds and fevers were common, although not of a very fatal character.

Deaths, 149; births, 231.

1856.

The annual number of deaths is one hundred and eighty-two, and of these, twenty are miners.

Of the 20 miners,—

55·00	per cent.	died of consumption,
5·00	„	died of inflammation of the windpipe,
5·00	„	died of bronchitis,
10·00	„	were killed.

Of the remainder, 1 died of lumbar abscess, 1 of apoplexy, 2 from age, and 1 of cancer of the penis. The oldest miner died at 77, from age; the youngest, of consumption, at the age of 20. The average age for the year is 53 years and 10 months.

One of the accidental deaths was from drowning, at St. Ives. Scarlet fever prevailed as an epidemic, and many died of it, both male and female; 13 males and 8 females died of it below 5 years of age. Deaths, 182; births, 276.

1857.

The number of deaths for the year is one hundred and forty-four, and of these, twenty-one are miners.

Of the 21 miners,—

42·85	per cent.	died of consumption,
9·52	„	died of pneumonia,
4·76	„	were killed.

Of the remainder, 3 died of brain fever, 1 of lumbar abscess, 1 of dropsy, 1 of enteritis, 1 of cancer, 1 of stricture of œsophagus, and 1 died suddenly. The oldest miner died at the age of 77, suddenly; the youngest, at the age of 12, of enteritis. The average age for the year is 41 years.

The greatest mortality among children as usual arises from

debility and from whooping cough. Deaths, 144; births, 104:—this year has only a partial return of births.

The six years, terminating in 1857, are uniform in their teachings with the records from 1837, both in Lelant and St. Just; and from this uniformity, I fear we may anticipate the same result in an examination of the only remaining district to be examined. The mortality from thoracic diseases is always more than that arising from all other diseases combined, and in most cases is nearly double that found in the general population living in the same district.

A Table showing the frequency of Thoracic diseases among Miners, and among the general population.

Disease.	1852.	1853.	1854.	1855.	1856.	1857.
Miners:—						
Consumption...	61.90	56.62	50.00	43.47	55.00	42.85
Pneumonia			7.14	8.69		9.52
Bronchitis			3.57		5.00	
Males, not miners, above 5 years of age:—						
Consumption...	30.55	18.18	25.00	22.58	15.15	6.66
Pneumonia	2.77	9.09		3.22		
Females, above 5 years of age:—						
Consumption...	25.00	38.77	33.33	26.53	29.52	13.15
Pneumonia	4.59	2.04	5.12	8.16	4.54	5.26
Asthma			2.56			

The agriculturalists living in the same district have about 26.66 per cent., and the same with agricultural labourers dying of consumption, showing a great amount of mortality against the miner; and this must arise from the peculiarity of his occupation, or circumstances attending his habits. There can be no doubt but that the good health of the agriculturalists and sailors arises from their outdoor occupation. No confinement in the bedrooms, even of the miner, can equal the closeness of the sleeping-places of sailors, where the air for respiration does not amount to one-fourth of what

is required for health. Nor can exposure to the weather alone account for the result, for however wet the miner may get in his wanderings to and from the mine, yet it can never equal the wettings or drenchings of the sailor at sea. The diet of the miner, sailor, and agriculturalist are equally monotonous or uniform; but the occupations of the latter two are in the open air,—the work is regular, and there is no spare time to hang on hands. The miners are therefore on equal terms with the others, except that after a crowding at home, their daily work is in as bad, or I would rather say worse, air than what they have left in their rooms at home.

The position of the miner is a peculiar one, differing from all others, and being worse than all others in what is generally thought to be injurious to health. Having to work underground, and most commonly at some miles' distance from his home, during the winter portion of the year, he goes to his work long before daylight, and does not arrive again to the surface till the daylight is on the wane towards evening; and thus, with the exception of the Saturday afternoon and the Sunday, he has for months together but little enjoyment of the light of the sun.

In my next communication, these points may be enlarged on so as to render intelligible the frightful mortality among miners.

The proportionate rate of mortality in children below five years of age is not so great as in St. Just; but this ought not to be expected in so mixed a population where cultivated farms and a farming population exist, and where there are many engaged in the manufactories of mining machinery; but if the deaths among children of miners be taken alone, it will be found that the rate of early mortality is much worse than what occurs in St. Just. The causes assigned, are "debility," "wasting," "marasmus;" and such names are fully justified by what I have myself seen in the district.

Some of the miners in the low-land districts have families of well-grown boys and girls; but every family lose some, and many can save only one or two out of a family of six or eight children. Among the population of the upper district, 65·04 per cent. of the males die below five years of age, and about 62·00 of the females

below the same tender age; among the agriculturalists, about 35·00 per cent. of the males, and 33·40 per cent of females, die at the same age, but combining the two together, we are then rather in excess of the county, although not so much so as to excite alarm. But the deaths among the miners' children below five years of age are very numerous, and this does not arise from want of maternal care, for the mothers are equally careful of their offspring as the wives of farm labourers, although the number dying in the two classes is much against the miner: this probably arises from the health of the parents, the debilitated state of the father falling on the children.

Mortality among Children.

As this district embraces an agricultural and a manufacturing, as well as a mining, population, the results of a statistical examination into the mortality of children might reasonably be expected to differ in some measure from what was observed in St. Just. If each of these classes be taken separately, the most favourable will be found to be the agricultural, and the least so the mining. But the general mortality among the children, exclusive of the offspring of the miners, is above the average of the kingdom, and this might be expected, from the character of the district. There are several high hills and long extended moors and swamps, with but little protection from hedges, and none from cultivation or woods, except near and around Trevethow: the exposure is therefore great, and the house-accommodation is bad; and for children and their ailments the parents but rarely seek for medical advice.

In the following Table the deaths of childhood are ascertained in reference to the mortality of the district, including all classes; but in the second column the mining population is excluded altogether, and the deaths of children are estimated in reference to the general deaths of all classes, excepting those who are in any way connected with miners. From this it will be observed what an influence the mortality of the offspring of miners has on the general estimates. I have also confined the relative mortality

to the male children alone, as it was intended only to show the difference between the two, without entering on the subject by a more extended examination. The children are evidently much affected by the constitutional peculiarities of the parents, and are less able to resist the inclemency of the weather than the children of other parents. But, in addition to this greater liability to disease, it must be remembered that most of the miners live on the northern side of the high hills and on the swampy moors, while the agriculturalists live in more sheltered and cultivated situations.

A Table of the Mortality per cent. in childhood, at and below five years of age.

Year	Males		Females	Year	Males		Females
	General population with miners	Population without miners	General population		General population with miners	Population without miners	General population
1840	60.00	45.45	42.82	1849	52.27	37.70	45.45
1841	47.72	35.59	39.93	1850	50.00	39.39	37.83
1842	42.62	35.63	40.84	1851	61.85	50.84	48.97
1843	55.17	44.44	49.18	1852	47.84	37.23	42.68
1844	68.31	50.42	60.95	1853	70.51	49.54	39.02
1845	52.68	38.46	33.33	1854	61.11	44.00	38.46
1846	38.77	28.78	31.34	1855	46.55	33.33	29.94
1847	50.00	38.02	27.27	1856	57.66	46.73	45.78
1848	57.44	45.00	33.33	1857	70.90	57.31	46.64

Age.

The age of the miner, if estimated from the returns of the registrar and from the returns of the workers actually engaged in the mines, will present precisely the same differences as were observed in examining the returns from St. Just. In the records the age varies from year to year; but the average age of the last twenty-one years is 47 years and 3 months. But the returns from the mines, in which all are included who are at present engaged in mining operations, whether at the surface or below,

exclusive of carpenters and smiths, give the average age 30 years and 4 months. This conclusion is obtained from returns received from Wheal Reeth, Reeth Consols, Providence, Wheal Kitty, Wheal Margaret, Wheal Mary, and several other smaller mines. The difference between these two sources of information is about 17 years. The returns from the mines must be taken as the average of a *working* miner's life; the returns from the registrar, as the average period of death; and thus giving at the age of 47 years and 4 months a period of seventeen years of unproductive life, either from disease or accident. This is an early limit to active life for any class of men, and indicates the absence of much that renders life happy. The duration of the active life is, therefore, about eighteen years; but this period is much interrupted by sickness and accident, which, while they impair the constitutional strength, yet allow of a subsequent return to work, &c. From my private notes of attendance on the mines I find this interruption is far more frequent than with any other class of operatives in the neighbourhood. Many miners work for years with thoracic disease, while other operatives at the same age are healthy and strong. Occasionally I meet with a working man considerably above the average age who seems to be in the enjoyment of good health. To ascertain the cause of such longevity, I took twelve men, from 68 to 76 years of age, precisely in the order in which they were met at the mines, without any attempt at selection. Two of the oldest had not worked underground for nearly twenty years, as they felt so great a difficulty in breathing, that they could bear it no longer: one of these attended on the drying house, and the other did a little work at the surface and went errands. One man, aged 72, had worked underground from his 12th till his 18th year; he then worked at the surface; in a few years he again went underground; and has, up to the present time till the last nine years, changed every few years. Some worked at the surface in consequence of injuries received many years before; others are engine-men; but all, except the two youngest, attributed their longevity to their occasionally giving up the underground work. And some, who had always worked below the surface, were shaft-men, where

the air was good and had direct communication with the atmosphere above. Such changes are therefore beneficial; and when a miner shows any sign, either of diseased chest or unexplained lassitude, which is the sure forerunner of disease, a month or two months' work at the surface would be of great benefit.

The black expectoration of Miners.

One of the most common circumstances brought under notice in the investigation into the diseases of miners is the jet-black expectoration. It has been noticed by many writers, and very elaborately by Dr. William Thomson. In his Gentleman's Paper, published in the Transactions of the Medico Chirurgical Society, a summary is given of most of what was previously known, and his own views are very clearly laid down. But, notwithstanding this, it is very evident that he has arrived at no definite conclusion derivable from personal investigation; and it may, perhaps, be doubtful whether any more satisfactory results could be obtained from such contradictory evidence as was submitted to him.

Some view the blackness as purely of extraneous origin, the sputa and lungs being infiltrated with carbonaceous matter from without; while others think it is generated in the lungs themselves, or in or by the bronchial glands. From these contradictory views being entertained by persons of equal position in our profession, it has been thought right to investigate the matter specially for these Papers. Among the Cornish miners, therefore, in no instance has recourse been had to the opinions of others, except as suggesting modes of examination, and as indicating the chief points on which further information is required. This seemed to be the most desirable plan to pursue. A mere summary of the opinions of others can be obtained in the Papers alluded to above; while original investigation can be obtained only by persons favourably situated in the mining districts. For these reasons nothing will be recorded but what has been personally observed.

In speaking generally of the expectoration, it may be remarked that it varies from a mere steel-gray tinge to that of a "coal blackness," but that it is most commonly of the deepest colour. The

miners themselves do not consider it as indicative of any disease, and will, therefore, rarely refer to it, except in answer to some inquiry on the subject; and after a careful examination of twelve hundred men and boys, under almost every possible variety of circumstances, at all seasons of the year, in health and in disease, I am inclined to think their conclusion is a right one. Diseases of the chest, and those of the most serious character too, are very common among miners, and are constantly associated with this black sputa, but not necessarily so; for while it occurs in cases of confirmed phthisis, it is equally constant in those who are free from all disease. It frequently happens, also, that men who are incapacitated by serious thoracic disease from working underground lose every trace of blackness by remaining at the surface for a few days; while the able-bodied and healthy continue subject to it so long as they follow their usual occupation. Neither is it confined to any age,—it is as common in the youngest boy as in the oldest man placed in similar circumstances; but the quantity expectorated is much greater in old age. The women and girls employed during the day, either in sorting or dressing the ores, are quite free from it, and so also are the boys engaged about the stamps. It is, in fact, very rare indeed in any person engaged during the day at the surface working; but it occurs slightly in those engaged through the night. Those most liable to it, who work above, are the engine-men and fire-men; and those having it the least are the men landing the mineral at the shaft's mouth: this is done by candle-light. The engine and fire men have it most strongly marked the morning after the fire-places and flues are cleaned out. It is difficult to institute experiments on such men as miners: they are shrewd and very suspicious of any interference with their daily routine. Even questions are answered with caution, except to such persons as they well know. It is always best and easiest to act indirectly on the men by means of the agents or captains. An occasional experiment is sometimes necessary to elucidate a doubtful point not likely to be cleared up by the ordinary course of events; yet they fortunately need not be much employed, as every one having the care of mines must have frequent opportunities for accurate and extensive information.

The period at which boys most commonly commence their underground occupation extends from 9 to about 15 years of age, and about 11 or 12 years may be considered as the average. It sometimes extends to 19, and even 23 or 24 years of age; but these are generally the sons of persons engaged in agriculture; to such, mining is more than usually fatal. The sons of miners are trained early, first at the surface, and then afterwards they are gradually introduced into all the most laborious occupations below. The sons of agriculturalists, when they turn miners and plunge at once into all the difficulties and dangers of a very hazardous employment, suffer very severely. In endeavouring clearly to point out the character of the black expectoration as exemplified among the Cornish miners, it will be best, perhaps, to offer first a few facts illustrative of it in its most simple form, and then to advance to the more complicated and irregular cases. John James, aged 28, a fine healthy-looking miner, went first to underground employment at 11 years of age; he is the son of a miner; and from his 8th year had been engaged in the surface workings during the day. He always enjoyed good health till two years since, when he became subject to a tightness of his breath from working in bad air in the G—— mine; he changed to another soon after, and has been quite well ever since. The first mine he worked in was Wheal Reeth, and his occupation was to wheel the pieces of ore taken from the lode to the shaft before getting them removed to the surface. At this time, he worked 110 fathoms from the surface and about 50 fathoms from the shaft. He continued this occupation for four years, and was constantly going to and from the shaft. Being thus occupied, it was not necessary that he should be with the men while they were engaged in blasting the rocks: he, therefore, generally waited till all the powder-smoke had disappeared before he returned, as he could not see his way in or out till then. At this time he had no black expectoration; but it was much grayer than before he went underground. He did not suffer from any shortness of breath or headache, he enjoyed, in fact, good health; and the only inconvenience he suffered was on first going down, when for a few minutes, he felt as if he wanted room to breathe; but it soon passed

away. At 16 years of age he removed to another mine and commenced working as a regular miner. He now remained in the galleries during all explosions and amidst all the powder-smoke like the other men. It frequently happened that the candles would not burn at all, and constantly they were obliged to be put horizontally, so as to allow the tallow to run into the flame. The boy did not observe anything particular the first day; but on the second, he found his expectoration "as black as ink." In this state it has continued ever since. There is not much expectoration under ground, or in coming up; but when at the surface, there is a great inclination to cough, "from the fresh air going down his throat." The blackness does not last long, it generally disappears before arrival home; but sometimes when much powder has been used, or the "air is very bad," it comes up for some hours, and sometimes till the next morning; but generally it disappears in about a half-an-hour. It lasts longer in the summer than in the winter; for during the hot months there is very much less cough on "coming to grass;" it is only after a walk and during the changing of the clothes that it is felt at all. This case is selected from many others as illustrative of the general progress of this black appearance, uncomplicated with disease; and it may be taken as an example of the mode in which it always makes its first appearance. In this case, however, it did not occur till the sixteenth year. To ascertain how early it would appear, I requested a captain to place a boy, who was about to commence his underground work, and who, from his general healthy constitution, I thought likely to be able to resist any deleterious influences longer than many others, with some men who were working at the 60-fm. level in a very close place. James B——, aged 11, a short, robust intelligent lad, had been engaged at the stamps for two years, and was very healthy up to the time of his going underground. His chest was sound, respiration natural, and his expectoration uncoloured. He first worked at 60 fathoms from the surface, and from 20 to 60 fathoms from the shaft. It was a close and very badly ventilated place. During the first day he did but very little work; complaining of headache and vertigo, and his expectoration became very dark. He was then

removed to the surface again for a week, when all his former good health returned; but on again rejoining his companions below, he became much worse: he had an epileptic fit, but from which he recovered as soon as he was brought to fresh air. After this he was removed to a better aired place; but he has always black expectoration. He has constantly, for the last two years, complained of pains about the chest, with difficulty of respiration, and within the last six months has had repeated attacks of hemorrhage from the lungs. He is now 14 years of age and works at the surface; his black expectoration has entirely disappeared; but he has still tuberculous disease of the upper portions of both lungs, for which he is under treatment. The captain then selected other boys to go underground; but in consequence of the ill effects on B——, it was arranged that no one should go below in any ill-ventilated place for more than a day of eight hours during a week. Under this arrangement the boys kept in very good health; but the dark expectoration was observed in every case immediately on their return to the surface, and it disappeared during the whole of the intervening period.

The early history of the appearance of dark sputa is much alike in all cases, the chief variation being the period of its commencement; but even this arises more from the character of the employment, good or bad ventilation, &c., rather than from any individual peculiarity of constitution. All persons placed under the same circumstances give the same result, one having it, perhaps, darker or blacker than another. Attention to the employment is necessary to arrive at any satisfactory conclusion. On one occasion, I examined four men in succession who differed from any I had before examined; three had worked underground varying from twelve to twenty-eight years without any black discolouration of the sputa; but on further enquiry it was found that they had always been liable to a steel-gray expectoration, and that they had all been shaft-men and had generally worked at no great depths. The shaft having direct communication with the air above, I subsequently found, invariably gave less discolouration than any other part of the mine; and that the colour increased according to the depth, badness of the candles, and frequency of explosions. This fact is illustrated by the case of James,

and may be still further shown by one of the cases alluded to above.

F. Winnan, aged 44, became a miner engaged in underground work at the age of 12, and his chief employment for three years and half was wheeling the ores to the shaft. After this he was engaged in sinking shafts for twenty-eight years. During the whole of this period he had good health, suffering from nothing but colds, much as other men; and he states that he never had any expectoration so dark as the men had, engaged in the galleries: it was generally of a blackish-gray, but varied very much, and disappeared always on arriving at the surface. About four years since, or in the twenty-ninth year of his being a miner, he first went into the galleries to work; but it affected his breathing very much: he felt as if almost suffocated, and his expectoration in two or three days became perfectly black. In about six months from this time he had a severe attack of pneumonia, from which he very slowly recovered; during his illness the sputa regained its natural colour. He has now returned to his occupation; his expectoration is very profuse and as black as it can possibly be. Below, he has but little cough; but on arriving at the fresh air, he feels it very irritating, sometimes producing fits of sneezing as well as coughing. The black sputa will sometimes, when there has been much blasting, continue for hours after the arrival at the surface, and even till the next morning.

J. R——, another miner, aged 53, worked in a shaft for ten years with only slightly discoloured sputa; but within three days after working in a gallery, the dark expectoration appeared, and has continued ever since.

D. S—— worked thirty-three years in a shaft with only occasional discolouration; but within one week after working on a lode, it became "as black as my hat;" and many other apparently exceptional cases might be cited, which may be similarly explained.

On several occasions I have tested the observation on myself.— Once I went about 90 fathoms below the surface, and about 100 fathoms from the shaft. At first, I felt great difficulty of breathing, with tightness about the forehead; but this soon disappeared, and I could get on almost as well as the men employed. The

candles were burning dimly, and lying on their sides as the only mode in which they could at all be kept lighted. A large smouldering smoke was passing up just in front of the men. In the course of about an hour, three explosions were made, and although we were placed out of danger, yet the smoke was very great in all parts, and it was a long time before the men could return to their work. There being no draught, the smoke hung like a cloud through the level. I went from one part to another and remained below about six hours. On coming to the surface, I felt the air very sharp, and I might almost have drawn an outline of all the bronchial tubes, with their divisions and subdivisions, from the sensations which I felt, till it passed off towards the circumference as a generally diffused aura of chilliness. A teasing cough soon followed, and the expectoration was black with a sooty blackness; and this continued for half-an-hour, and then it continued with occasional patches and lines of blackness for several hours. I have on several occasions since made the same experiment and with the same result.

Cases similar to those narrated form the great bulk of what will be found among the Cornish miners; but there are some in which the blackness is much less intense and more quickly disappears, and there are few of the very opposite character, being not only most intense, both as to the blackness and quantity of the expectoration, but also as to the time required for its disappearance. All mines are not equally well ventilated, and consequently all are not equally well lit, and the accompaniments of heat and powder-smoke vary in equal proportions. Those mines that have the greatest number of shafts, by which the atmospheric air can be drawn down, are by far the most healthy. The candles, under such circumstances, burn best; the galleries are more rapidly cleared of offensive smoke; and the black expectoration is much less intense.

Having, on one occasion, been invited by a manager to visit one of his mines while the men were all assembled at their "pay," I was much surprised to find the men almost all healthy, and the expectoration, comparatively speaking, but slightly discoloured. This and other mines similarly arranged I have subsequently

visited several times ; and I think I may assert that the absence of much of what may be considered incidental to mining as injurious to health arises from the number of shafts, and consequently the well aired condition of the mine. The health of the miner would be considerably improved, and the working of the mine would be far more energetically carried on, if more attention could be paid to ventilation and similar other matters. There are mines, such as Botallack and Levant, which stretch far out under the sea : these could not, of course, be so worked ; but even these, by winzes, valved shafts, and artificial means, could be better aired ; and by so doing would be considerably improved. Some mines, on the other hand, are more than usually ill-ventilated, and these are more than commonly unhealthy. Miners are never very florid or robust ; but to see the men from such mines arriving at the surface after eight hours' work, is a most sickening sight : thin, haggard, with arms apparently very much lengthened and hanging almost uselessly by their sides, they seem like men worn out rather than tired. The following case is taken from such a mine :—Samuel H——, aged 37, a thin, cadaverous-looking man, had been a miner since he was 16 years of age. He has worked in many mines, and at different depths ; is neither a drinker nor a wrestler. He worked thirteen years before he had any disease of the chest, and had previously worked in tolerably healthy mines ; but he had always the black expectoration on coming from his work. He preferred shallow mines. On going to work in the mine, he went to the 200-fm. level, and about 100 fathoms from the shaft, in a hot, close spot, where there was no fresh air, and the candles would not always burn, even when placed upon their sides. Though so deep, he could feel the effect of the wind at the surface ; and when it blew from the south-west, he could hardly breathe ; and he believed a coal or a wood fire would have been extinguished. His breath always was tight ; he lost weight rapidly ; and his black expectoration, after three or four weeks, never ceased except when he laid up for a few days ; eventually it became constant. His cough was troublesome at times, and his voice, husky. This gave place to a wheezing sound, “as if the clacker of his throat leaked.” He coughed up bright

blood, and had pains about his chest. At this time I saw him. He had chronic bronchitis, with profuse expectoration of black sputa, and general derangement of his health. His black expectoration continued for eighteen months after he had discontinued his underground work. Employed at the surface, he recovered his usual colour; and although he also increased in weight, yet he never regained his former size or health.

William M——, another man from the same mine, was even more severely affected than H——; and symptoms of phthisis set rapidly in. He left; and having partially regained his strength, entered another mine, and to have better air, he worked nearer the surface; he took cold, had an attack of pneumonia, and died. During the eleven months he remained at home, he never lost the black sputa, and he died in that state. I had a post-mortem examination: both lungs were irregularly pervaded with black carbonaceous patches. The upper third of the right lung was one mass of tuberculous deposits, with small and irregular cavities. The left lung was equally tuberculated at its apex; but not so much disorganized as the right. The bronchial tubes were lined with a muco-purulent secretion, much of which was very black; the fluid of the cavities was also black. The smaller tubes were not only black, but a portion of the intra-tubular structure was also black. As the tubes decreased in size, and became numerous as they got smaller, in some places the dark matter went deeper into the substance of the lungs than in others; it had a very mottled or striped appearance, according to the section made. The walls of the cavities, like the tubes, were lined and permeated with the black secretions. A portion was hepatized and easily broken down. There were old adhesions between the pluræ. In post-mortem examinations of men who have died immediately after leaving their work, or who have been killed while underground, the black expectoration has, as it were, been found *in situ*. The slighter cases have shown that the secretions alone have been tinged, and the mucous before the muco-purulent. This is observed in ordinary cases of bronchitis. It has been my misfortune two or three times to have rather severe attacks of bronchitis; and on these occasions

I have had the candles used by miners to burn on a table near the bed. After the first burst of the cough, and when the expectoration had remained for a time undisturbed, I always found it tinged with the gray discolouration of miners. Since then I have observed it in many patients, that just as the cough is getting a little chronic, the thinner portions of the sputa are constantly of a grayish colour in the evenings and early in the mornings; and this is greatly increased if there has been a fire near. It rarely happens that the purulent matter is tinged except at its surface. The first part affected with discolouration is the mucous membrane of the bronchial tubes, just below and around the bifurcations; after this, the most frequent parts are the smaller tubes, and finally the cells. After the mucous membrane has become affected, it gradually extends to the substance both of the tubes and parenchyma of the lungs themselves. This is the result of numerous examinations after death. It seems to be a needless task to give the result of the examination of every individual case. I have classified those I have examined according to the symptoms observed during life, and the result seems to be just what has been stated.

It has been remarked by a few observers, in the cases of some men who have been subject to this form of expectoration, that it arises from a peculiar thoracic cause, from the fact that it has been observed in men who have taken to the sea after having been engaged in mining occupations. I have seen the same, and I have examined the companions of such men, who have been sailors ever since their boyhood, and the same appearance has been common to all while on board. The cooking-place on deck, or the fore-castle below, are just such places as might be expected to give rise to it. These men I have afterwards seen ashore, and then they have been as free from it as other people.

Cases of extensive discolouration of the lungs in Cornish miners are very rare. I have never seen but two cases, and only one of these could be at all considered as approaching to what I have heard of the blackness in the lungs of the colliers, both of Wales and of the north, forming a true melanoses of the lungs.

From all that I have witnessed in mines in general, and from

twelve hundred cases that I have particularly examined, I am convinced that the whole of the discolouration arises from external causes; and the chief of these are the breathing of smoke of the powder in blasting rocks, candle-smoke greatly increased from air deficient of oxygen, and smoke from fires; or, in a few words, carbon in minute division from any source will produce it.

I have found black sputa in engine-drivers on railways as well as in their assistants, in smiths, and in other persons who work under similar circumstances. Symons, a man who had been engaged on a railway ever since he was a boy, consulted me once in a great fright that he had been "spitting up stuff as black as his hat." He had before always been engaged with the luggage train till four months since, when he went into the fitting shop and worked as a smith. After remaining there for some weeks, he discovered that his expectoration was dark; he became frightened, and left, as he fancied he was "undermining his constitution." There being no place vacant for him for a short time, he became attached to the engine, and the blackness continued. A few days' holiday has, however, dispelled all his evil forebodings, and he is now quite well.

I have seen black expectoration in boys, in young men, in old men, and in persons of all ages working under similar circumstances. It is more profuse in men than in boys; and it is a constantly observed fact, that the expectoration of men working in deep mines, and far removed from the shaft, is more profuse than boys, and far more so than in persons of the same age in ordinary occupations. Miners have very commonly profuse expectoration without much disease. A mucous membrane in a state of health pours out a certain amount of secretion which seems necessary to health; but if that membrane be lessened in tone, or relaxed in texture, a larger amount of secretion or exudation than is natural immediately follows. So long as the membrane continues in this flaccid state, so long will this chronic exudation continue. Miners are particularly liable to this chronic relaxation of the bronchial tubes, and hence a profuse secretion follows, and the black ex-

pectoration is abundant. But in all the cases I have examined, save one, the black expectoration seemed to be derived from extraneous sources.

Conclusions.

The most probable conclusion to be derived from the foregoing remarks is, that the matter producing this blackness of the expectoration is derived from without, and from carbonaceous matter of the powder and candles.

In the first place, because—

1st. It is not found in any of the men or boys engaged at the surface in the open air during the day.

2nd. It is found in all men who are exposed to smoke or dust.

3rd. That its intensity is in direct proportion to the exposure of the men to smoke, and to their removal from good air.

4th. That it appears and disappears just as the men are exposed to the smoke and dust or removed from it.

5th. That the first part affected is the bronchial secretion and not the tubes, or that part which is exposed to the air.

6th. That the first structural part affected is the mucous membrane, and subsequently other parts toward the parenchyma.

7th. That its microscopic appearance is that of carbon derived from smoke.