Although the data analyzed in these two graphs were secured at different times and by different people, these check better than might have been expected.

The duration of employment curve gives 67 per cent. as of over 1 year and under 5 years' total service, with 10 per cent. of over 5 years' total service. The age-distribution curve gives 70 per cent. as over 25 and under 40 years of age, with 10 per cent. over 40 years of age. The "young" group comes close enough to the proportion of mine-boys claiming to have worked not more than 1 year.

3. General Trend.—All Forms of Tuberculosis.

(*a*) *General Statistics.*

Table 14 covers the period from 1915 to 1930 inclusive and gives without analysis the average Native labour force employed on the Witwatersrand goldfield each year, with the number of cases of tuberculosis detected. Under the heading "Tuberculosis" is included all forms of tuberculosis and simple silicosis.

TABLE 14.

Native Tuberculosis.

Incidence per 1,000 per annum of Tuberculosis, all Forms, and Silicosis, for 1915-1930.*

Average Complement.	Total Number of Cases.	Rate per 1,000 per annum.	Year.
—	—	13·1	1915
—	—	13·9	1916
—	—	12·8	1917
—	—	11·5	1918
—	—	9·6	1919
—	—	10·9	1920
—	—	8·6	1921
154,814	1,587	10·2	1922
170,259	1,396	8·2	1923
171,508	1,595	9·3	1924
168,694	1,550	9·1	1925
176,035	1,778	10·1	1926
180,533	1,596	8·8	1927
193,086	1,617	8·4	1928
193,493	1,445	7·5	1929
194,084	1,401	7·2	1930

It will be seen from Table 14 that, while the prevalence rate has varied from year to year, taking the 16 years as a whole there has been a marked fall, and the latest figures are the lowest figures.

* Figures from 1915 to 1921 are for the Rand Mines Group only. Throughout this period the Rand Mines Group accounted for more than half the Native Reef-complement, and their returns from 1922 to 1930 vary but slightly from the total returns.

(*b*) *Case Mortality.*

For the years 1916 to 1920 the case mortality, worked out on the figures returned by the mines, was 18·7 per cent.,[48] while for the year 1929-30* it was 17·5 per cent. Given our system of repatriation, whereby all cases fit to travel are sent to their homes, whereupon they drop out of statistical knowledge, and knowing from other sources that some 60 per cent. of these cases die within two years, these case-mortality figures have no bearing on the type or severity of disease.

(*c*) *Comparisons with Tuberculosis Incidence Elsewhere and in Other Phthisis-producing Industries.*

Our figures cannot be directly compared with others owing to our peculiar circumstances ; the gold-mining industry is a phthisis-producing industry worked by a migratory population living in semi-enclosed communities with a system of repatriation. As long as one bears this in mind, one can consider other vital statistics bearing on tuberculosis. As there is no general system of tuberculosis notification, one has to make comparison with mortality figures in most cases and to use the approximation commonly accepted by tuberculosis officers of total prevalence being three times the death-rate.

The following table (Table 15) of deaths from tuberculosis per annum in different countries has been collected from data given in the Statistical Survey of the International Union against Tuberculosis, published in 1925 :—

TABLE 15.

Country.	Deaths per 100,000 per annum.
England and Wales	106
Ireland	146
France	206
Italy	146
Belgium	111
Netherlands	104
Switzerland	164
Austria	227
Czechoslovakia	195
Norway	208
Sweden	163
Denmark	95
U.S.A.	98
Canada	84
New Zealand	62
Argentine	145
Japan	213
" Our Mine Natives "	125

* Figures compiled from returns made to this Committee.

While our figure deals only with men between the latest " teens " and the earliest " fifties," the other figures in the Table cover both sexes and all ages.

An interesting comparison lies with the United Fruit Company, operating in various countries round the Caribbean Sea. This concern, like ourselves, employs a large Native labour force and provides a complete medical service with hospitals for its different districts ; moreover, it practises repatriation. For the four years 1926-29 inclusive, its average tuberculosis incidence was 292 per annum for an average complement of 54,819, or a rate of 5·3 per 1,000 per annum. In this case, one is dealing with a Native labour force employed on an open-air occupation and drawn from the neighbourhood. The United Fruit Company sets us an example in the admirable Annual Reports issued by its Medical Department, and it is from these reports that the above data have been taken.

If we consider phthisis-producing industries elsewhere, we learn that in England the tuberculosis mortality is about eightfold that of the general population, while the following brief table (Table 16) dealing with " Dusty Trades " in the U.S.A. is taken from a report of the National Tuberculosis Association published in 1919 :—

TABLE 16.

State.	" Granite Cutters." Deaths per 100,000 per annum.
Upper Mississippi and Great Lakes States ...	676
North-western and Rocky Mountain States ...	763
Pacific Coast and South-western States ...	318
Massachusetts	841
New England States	962
Central Atlantic States	728
Lower Mississippi Valley and South Atlantic States	441
Mines of Butte, Montana	1,207

The above figures deal with a " fixed population " and cannot be directly compared with our migratory population. The fairest comparison is with our " old miners " (meaning Natives known to have over five years' continuous service on the gold mines), who may be regarded as a " fixed population." Our old miners have a *prevalence*-rate of about 3,200 per 100,000, or about four to five fold the general rate for our mines. Even they do not compare too unfavourably with the miners of Butte, Montana, with a death-rate of 1,207 per 1,000 per annum, equivalent to a production rate of 3,621 per 100,000 per annum.

If we attempt to compare the figures for our Natives with other figures for African Natives there is a certain poverty of data.

The Premier Diamond Mine presents circumstances in many ways comparable to our own, with the important proviso that theirs is not a phthisis-producing industry. The following figures are due to the

courtesy of Dr. A. Gow. For the ten years 1916-26 the average morbidity per 100,000 was 256, with an average mortality of 176, giving a case-mortality of about 68 per cent. They have not got a repatriation system comparable to that of the gold mines of the Witwatersrand and, from the point of view of case-mortality, are rather comparable with the Union Mental Hospitals and the South African Labour Corps in France.

Professor Lyle Cummins gives the following figures for the South African Labour Corps in France during the War: Prevalence rate, 2,907 per 100,000; deaths per 100,000 were 2,219; case-mortality, about 76 per cent.

By the courtesy of Dr. J. T. Dunstan, we get the following figures for the Union Mental Hospitals: Prevalence, 1,600 per 100,000. Dr. Dunstan stated that nearly all the cases were acute tuberculosis, and that the case-mortality was over 90 per cent.

In his Tuberculosis Survey of the Union, Dr. Peter Allan found no Native location with a morbidity below 600 per 100,000.

The colliery tuberculosis figures for 1926-7 show a prevalence rate of 383 per 100,000 with a case-mortality of 26 per cent.

The mean annual incidence of tuberculosis on Natives admitted to the prisons of the Union, 1919-21, was at the rate of 148 per 100,000. (Incidence on European males for same period, 386 per 100,000.)

The Medical Officer of Health for Cape Town returns non-European mortality from tuberculosis at 430 per 100,000 per annum (1926).

The Medical Officer of Health for Kimberley returns Native mortality from tuberculosis at 213 per 100,000 per annum (1926).

The Tuberculosis Officer for Durban returns the Native death-rate from tuberculosis at 160 per 100,000 for 1925. The actual number of deaths was 45. For the same year 111 cases were notified, or a prevalence rate of 358 per 100,000. (Compare collieries.)

In this context Native Labour Corps and mental hospitals may be regarded as being comparable with phthisis-producing industries. The gold-mining industry does not compare unfavourably with them. If the other figures quoted be considered, one notes that all the populations considered are more or less migratory. If we consider the ratio of phthisis-producing industry tuberculosis to the tuberculosis of the general population among Europeans, the comparison between tuberculosis rates on the Witwatersrand goldfields and among the general Native population is not unfavourable.

4. INCIDENCE RATES ON WITWATERSRAND MINES, 1926-1929.

Data and Primary Statistics.—During the period covered by the investigations of the Tuberculosis Research Committee, monthly returns (hereafter referred to as the standardized monthly returns) have been made by the medical officers of 34 gold mines on the

Witwatersrand, recording the mean Native labour complement employed during each month, and the numbers of discovered cases of (1) pulmonary tuberculosis, (2) pulmonary tuberculosis with silicosis, (3) simple silicosis and (4) other forms of tuberculosis. In this Section these categories will be designated by the corresponding abbreviations—(1) P.T.B., (2) T.B.S., (3) S.S., (4) O.T.B.

The monthly returns have been grouped in years for each of the mines under discussion, and the data here used cover the three completed years July, 1926, to June, 1929.

TABLE 17.

LABOUR COMPLEMENT. 34 GOLD MINES.

	1926-7.	1927-8.	1928-9.
Total Complement	180,461	191,486	193,493
Mean Complement per Mine	5,308	5,632	5,691
Standard Deviation	3,485	3,655	3,652
Coefficient of Variation %	65·7	64·9	64·2
Probable Error	± 7·33	7·21	7·09

The mine complements varied from 1,400 to 17,000, which accounts for the large standard deviation ; but it must be borne in mind that the distinction between a large and a small mine is more administrative than statistical, for the large mine has different shafts and different compounds, and its statistical significance differs from that of a similar aggregate of smaller contiguous mines only in so far as it is subject to a unified control.

It is evident from Table 17 that the period under investigation was one of expanding labour force, and the steadiness of the coefficient of variation shows that there was no appreciable bias in the distribution of the increase amongst the mines.

In Table 18 are given, for each year and in each category, the recorded number of cases and the mean incidence rate per 1,000.

In considering the numerical values here computed for the rates of incidence, it must be borne in mind that they are relative rather than absolute ; for, owing to the very large turnover of the Native labour force—about 100 per cent. per annum—the actual number of individuals at risk during any year is considerably greater than the average complement. Of course, the mean duration of risk per individual is lessened by the rapid turnover, but this need not necessarily compensate for the increased numbers at risk, and a comparison of the rates here given with those deduced from the experience of a more stable population would be of doubtful validity.

TABLE 18.

34 GOLD MINES.

Category.	P.T.B.			T.B.S.			S.S.			O.T.B.		
Year	1926-7.	1927-8.	1928-9.	1926-7.	1927-8.	1928-9.	1926-7.	1927-8.	1928-9.	1926-7.	1927-8.	1928-9.
Total No. of Cases:	761	746	607	381	345	345	198	162	166	235	355	327
Incidence Rate (per 1,000)	4·217	3·896	3·137	2·111	1·802	1·783	1·097	0·846	0·858	1·302	1·854	1·690
Standard Deviation ...	1·270	1·406	1·487	0·891	0·828	0·784	0·972	0·598	0·604	0·785	1·529	1·190
Coefficient of Variation %	30·1	36·1	47·4	42·2	46·0	44·0	88·6	70·6	70·4	60·2	82·4	70·4
Probable Error ± ...	2·65	3·28	4·61	3·97	4·44	4·19	11·48	8·07	8·03	6·39	10·23	8·03
Charlier Coefficient ...	21·5	29·1	41·1	29·8	33·6	30·8	78·4	53·8	54·0	46·7	76·4	62·6
Probable Error ± ...	3·71	4·07	5·32	5·62	6·08	5·99	12·97	10·59	10·47	8·24	11·04	9·03

It is satisfactory to note that in three of the four categories the general rate-trend has been downwards during the period under investigation. A least-square determination of the linear trend during the 40 months July, 1926, to November, 1929, gave for the mean monthly rate of change in the incidence rates per 100,000—(1) P.T.B., —0·315 ; (2) T.B.S., —0·145 ; (3) S.S., —0·086 ; (4) O.T.B., +0·144.

The large probable error of the coefficient of variation diminishes the significance of changes in this statistic. In only two of the categories, viz., P.T.B. and O.T.B., is the difference between the maximum and minimum values of this coefficient greater than the standard error of the difference. In the case of pulmonary tuberculosis the increase of variability is undoubtedly significant. While the mean incidence rate has diminished, its dispersion has increased. This is accounted for by the fact that the large mines have lagged behind the average in respect of improvement in this category. In the case of Other Tuberculosis, the increased incidence experienced by the large mines has been in advance of the average. In fact, of the excess of cases recorded in this category in the two later years, practically two-thirds are accounted for by two large mines whose joint complement is nearly 30,000.

Despite the warning already given that a mine is an administrative and not a statistical unit, these facts might tempt one to conclude that the size of a mine is one factor which influences the distribution of incidence rates of P.T.B. and O.T.B. Were such the case, the supposition should receive support from a significant positive correlation between incidence-rate and mine complement. The correlation coefficients are as follows :—

TABLE 19.

34 Gold Mines.

Correlation Coefficients between Incidence Rate and Mine Complement.

	1926-7.	1927-8.	1928-9.
P.T.B.	−0·0195±0·116	+0·167±0·112	+0·163±0·113
T.B.S.	−0·092 ±0·115	+0·115±0·114	+0·221±0·110
S.S.	−0·192 ±0·111	−0·137±0·114	−0·133±0·114
O.T.B.	+0·123 ±0·114	+0·198±0·111	+0·213±0·110

Not only are these coefficients intrinsically small, but, in view of their probable errors, even the largest of them does not reach the threshold of possible significance. The nominal size of a mine, therefore, is not a significant factor in the production of tuberculosis or of silicosis.

5. SEASONAL OSCILLATIONS IN THE TUBERCULOSIS INCIDENCE RATES.

(a) *Data.*—The standardized monthly returns yield the following monthly incidence rates for all gold mines :—

TABLE 20.

MONTHLY INCIDENCE PER 100,000 COMPLEMENT.

Year.	Month.	P.T.B.	T.B.S.	S.S.	O.T.B.
1926	July	26·9	9·9	6·6	4·9
	August	25·2	20·2	6·6	6·0
	September ...	28·7	23·3	6·0	6·5
	October	35·5	27·3	15·8	9·3
	November ...	53·5	32·9	12·8	16·7
	December ...	52·7	32·9	25·0	15·9
1927	January	49·1	14·1	7·9	11·9
	February ...	35·1	11·0	6·6	13·2
	March	29·6	11·9	9·2	12·4
	April	32·0	11·2	7·5	8·5
	May	26·1	8·5	6·4	8·5
	June	26·3	11·8	4·8	9·1
	July	30·9	6·0	2·2	11·4
	August	46·1	13·6	5·4	15·7
	September ...	44·2	14·0	3·8	8·6
	October	41·2	13·4	5·9	14·4
	November ...	45·6	18·0	9·0	14·9
	December ...	42·8	14·8	7·9	18·5
1928	January	30·5	17·9	6·8	27·9
	February ...	27·6	16·9	8·2	20·4
	March	27·7	13·6	11·6	15·1
	April	26·0	14·0	5·0	17·5
	May	20·5	14·5	6·5	11·0
	June	19·2	10·1	7·1	10·1
	July	23·0	18·4	6·7	10·7
	August	25·2	9·8	5·1	10·3
	September ...	27·2	14·4	5·7	12·3
	October	33·0	25·3	16·5	20·1
	November ...	34·3	19·8	9·4	16·7
	December ...	25·9	13·8	4·8	20·7
1929	January ...	35·4	19·6	5·3	16·4
	February ...	29·4	12·9	7·7	16·5
	March	24·9	17·8	6·6	11·7
	April	25·8	12·7	5·6	13·2
	May	17·3	11·2	7·6	13·2
	June	16·6	9·3	6·2	7·8
	July	18·9	12·1	5·2	10·5
	August	31·7	12·7	5·3	17·4
	September ...	37·8	11·0	6·3	17·3
	October	36·3	15·8	7·9	17·3

There were also available similar returns made by Dr. Orenstein for the Rand Mines group, but these differed to some extent inasmuch as they did not separate the tuberculo-silicosis cases from the tuberculosis cases.

(*b*) *Secular Trend.*—Assuming a linear law, which is all that is justified in view of the shortness of the period under investigation, we find for the mean secular trend of each of the four categories :—

P.T.B. ... ... $r_1 = 38{\cdot}1 - 0{\cdot}315t$
T.B.S. ... ... $r_2 = 18{\cdot}4 - 0{\cdot}145t$
S.S. ... ... $r_3 = 9{\cdot}42 - 0{\cdot}086t$
O.T.B. ... ... $r_4 = 10{\cdot}6 + 0{\cdot}144t$

r is the monthly incidence rate per 100,000 and t is the number of months elapsed from June, 1926.

Except in the case of " Other Tuberculosis," there has been a mean decrease per month of approximately 1 per cent. of the mean monthly rate. In the exceptional case the secular trend has been upwards to the same extent.

Dr. Orenstein's data for T.B. give for the secular trend :—

T.B. (Rand Mines) ... $r = 64{\cdot}0 - 0{\cdot}305\ t.$

The mean monthly decrease has here practically the same absolute value as that deduced for P.T.B. from the standard returns, but the mean value is much higher. This higher mean value is due probably to the inclusion of T.B.S. cases in the T.B. classification.

In the collieries experience the monthly P.T.B. rate has shown a slight upward tendency, the line of best fit being—

P.T.B. (collieries) ... $r = 23{\cdot}51 + 0{\cdot}074t.$

(*c*) *Fluctuations.*—The mean deviations from the secular trend of the monthly rates are given in the following Table :—

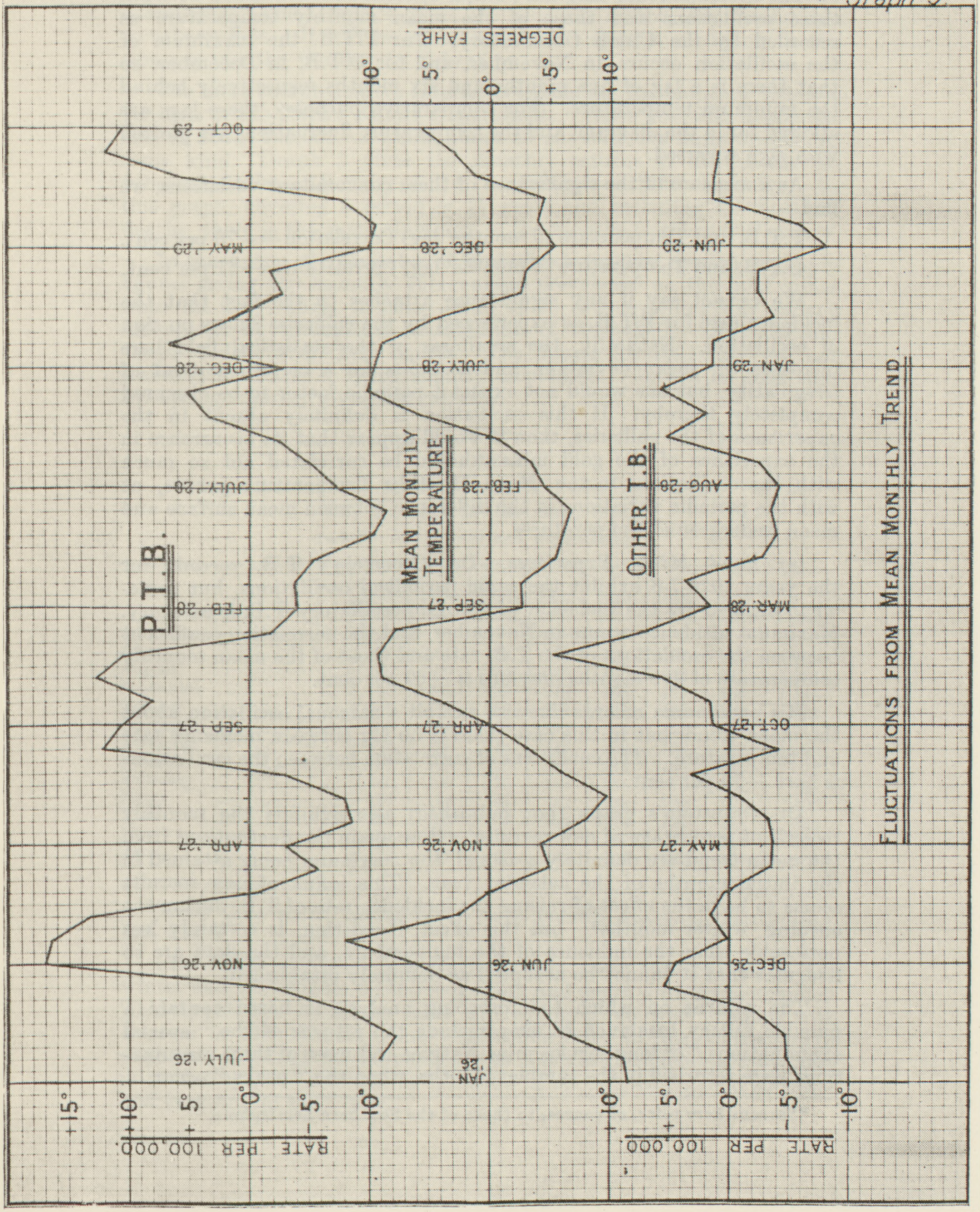
TABLE 21.

Category.	Mean Rate.	Mean Deviation.	M.D./M.R.
P.T.B.	31·6	7·4	0·23
T.B.S.	15·4	4·3	0·28
S.S.	7·65	2·5	0·33
O.T.B.	13·5	3·5	0·26
T.B. (Rand Mines)	52·5	14·3	0·27
P.T.B. (Collieries)	25·0	13·6	0·54

The large value of the ratio in the case of the collieries may be due to the smallness of the field of observation ; it may also be due in part to a less systematic medical supervision.

(*d*) *Periodicity.*—There is a marked difference between the character of the deviations from the mean trend in the case of P.T.B. and O.T.B. on the one hand and T.B.S. and S.S. on the other. In the silicosis groups the deviations are irregular and more or less random, while in the categories P.T.B. and O.T.B. there is a very definite seasonal oscillation which is strongly marked in the case of P.T.B.

Graph 3.


P.T.B.
Mean Monthly Temperature
Other T.B.
Fluctuations from Mean Monthly Trend.
Degrees Fahr.
Rate per 100,000
Rate per 100,000

The accompanying diagram (Graph 3) exhibits the relation between these oscillations and those of the mean monthly temperature as recorded by the Union Observatory. For P.T.B. the maximum of the oscillation occurs in November, and for O.T.B. in December, so that there is a lag of five months and six months respectively behind the minimum temperature. For comparative purposes, these lags are allowed for in the diagram, and the temperature fluctuations are plotted with sign reversed.

As a measure of the significance of these concomitant variations, we find—

P.T.B. and Temperature (5 months' lag) Correlation = – 76 per cent.

O.T.B. and Temperature (6 months' lag) Correlation = –67 per cent.

We cannot say if any significance attaches to the fact that the incidence rate for P.T.B. as experienced by the collieries shows no sign of oscillation. Naturally, the smallness of the statistical field here increases the mean deviation, and accounts for a certain amount of irregularity, but one would not expect a periodic factor to be obscured completely thereby. If this oscillation is definitely absent in the experience of the collieries, then it would appear that its occurrence in the experience of the gold mines should be correlated not so much with the oscillations in the Mean Monthly Temperature *per se*, as with the periodic variations in the difference between mean surface and mean underground temperatures.

(*e*) *Rand Mines Experience.*—Dr. Orenstein's T.B. records for the years 1926-7-8 exhibit the same periodical oscillations, but somewhat masked by the inclusion of the non-oscillatory T.B.S. category. Maximum incidence occurs in November, and the correlation coefficient between the oscillations of the T.B. rate and those of the mean monthly temperature of five months previous is —60 per cent.

His pneumonia records likewise exhibit a seasonal oscillation about the mean trend, but in this case there is no lag between incidence rate and temperature. The coefficient of correlation between the oscillations is here —70 per cent.

Dr. Orenstein's graph (not published) also exhibits the monthly records of percentage of new recruits. Here again the fluctuations from the mean trend are definitely seasonal, the maximum being attained in the initial months of the calendar year. This influx of new recruits seems to have the effect of raising the incidence rate of T.B. during the ensuing winter months*; but this effect, if existing, is certainly less noticeable than the influence of the temperature, and the data are so irregular that it cannot be accepted as definitely established.

The returns on which the foregoing analysis is based contain a possible fallacy inasmuch as they include the returns of the " special examinations " of long-service mine Natives and most of these examinations were returned in the summer months, when the " peaks " occur.

*Seasons here refer, of course, to those of the Southern hemisphere.

(*f*) *Death Rates.*—Deaths, however, are not affected by the special examinations and Graph 4 gives the monthly returns for deaths due to tuberculosis. It will be seen that deaths show a clumping in the summer months October to February.

The most comprehensive returns available are the Monthly Sickness Returns of the Native Affairs Department. These deal with a population of about 250,000, of whom about 80 per cent. are mine-workers of some kind. Graph 5 gives the monthly returns of deaths due to tuberculosis from January, 1914, to December, 1930, inclusive. In this graph, covering a period of 17 years and including nearly 9,000 deaths, there is the same clumping in the months October to January.

In conclusion, the Chamber of Mines has been good enough to supply figures giving the monthly tuberculosis prevalence on the gold mines from 1st July, 1919, to 30th June, 1926, thus avoiding any fallacy introduced by the special examination of 1926-1930. Table 22 and Graph 6 deal with these figures. The figures for 1921-1922 are not included in Graph 6, being slightly incomplete. It will be seen that the spring-summer clumping remains.

TABLE 22.

GOLD MINES.

MONTHLY RETURNS FOR TUBERCULOSIS (ALL FORMS) AND MINERS' PHTHISIS.

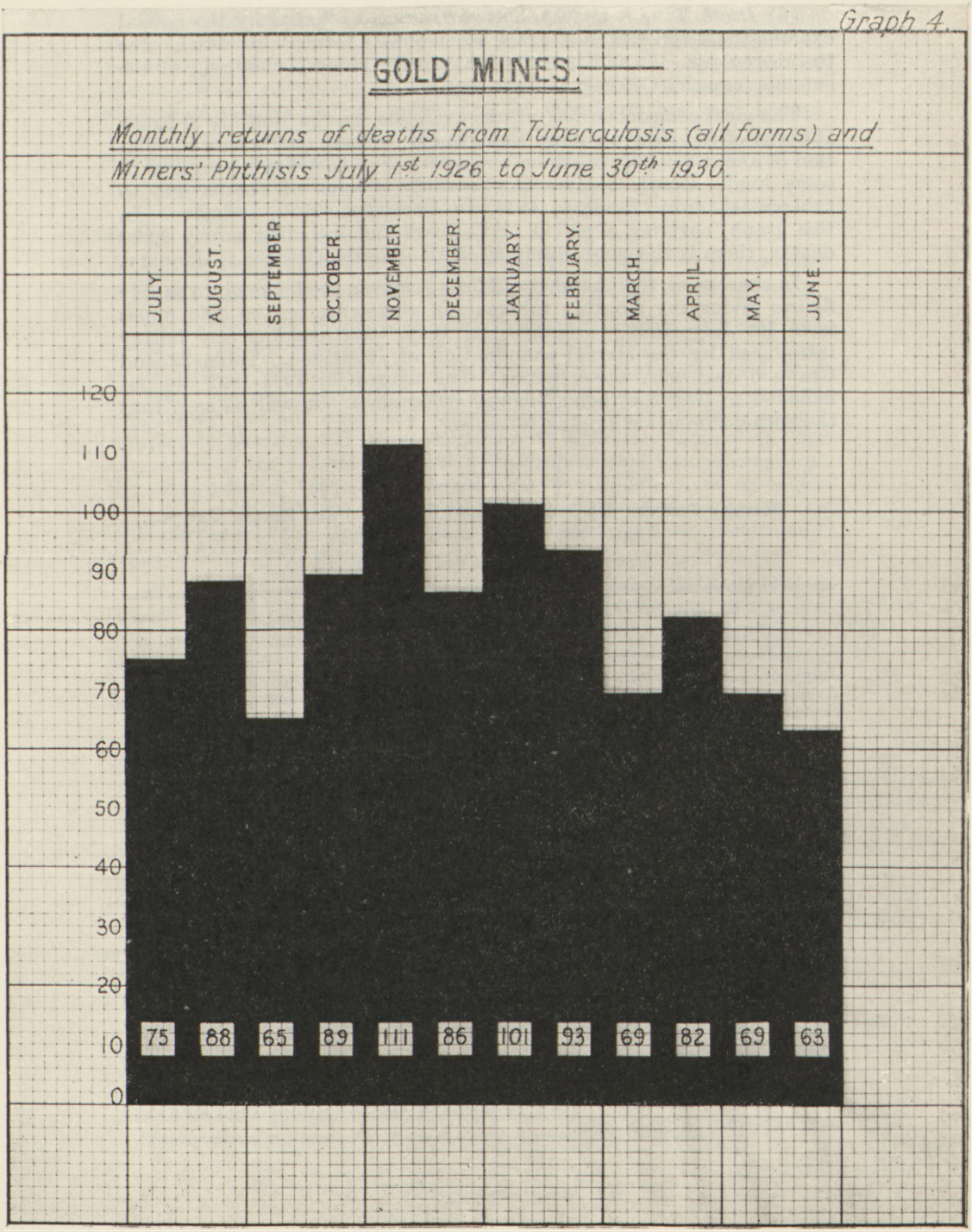
July 1st, 1919, to June 30th, 1926.

Includes both Deaths and Repatriations.

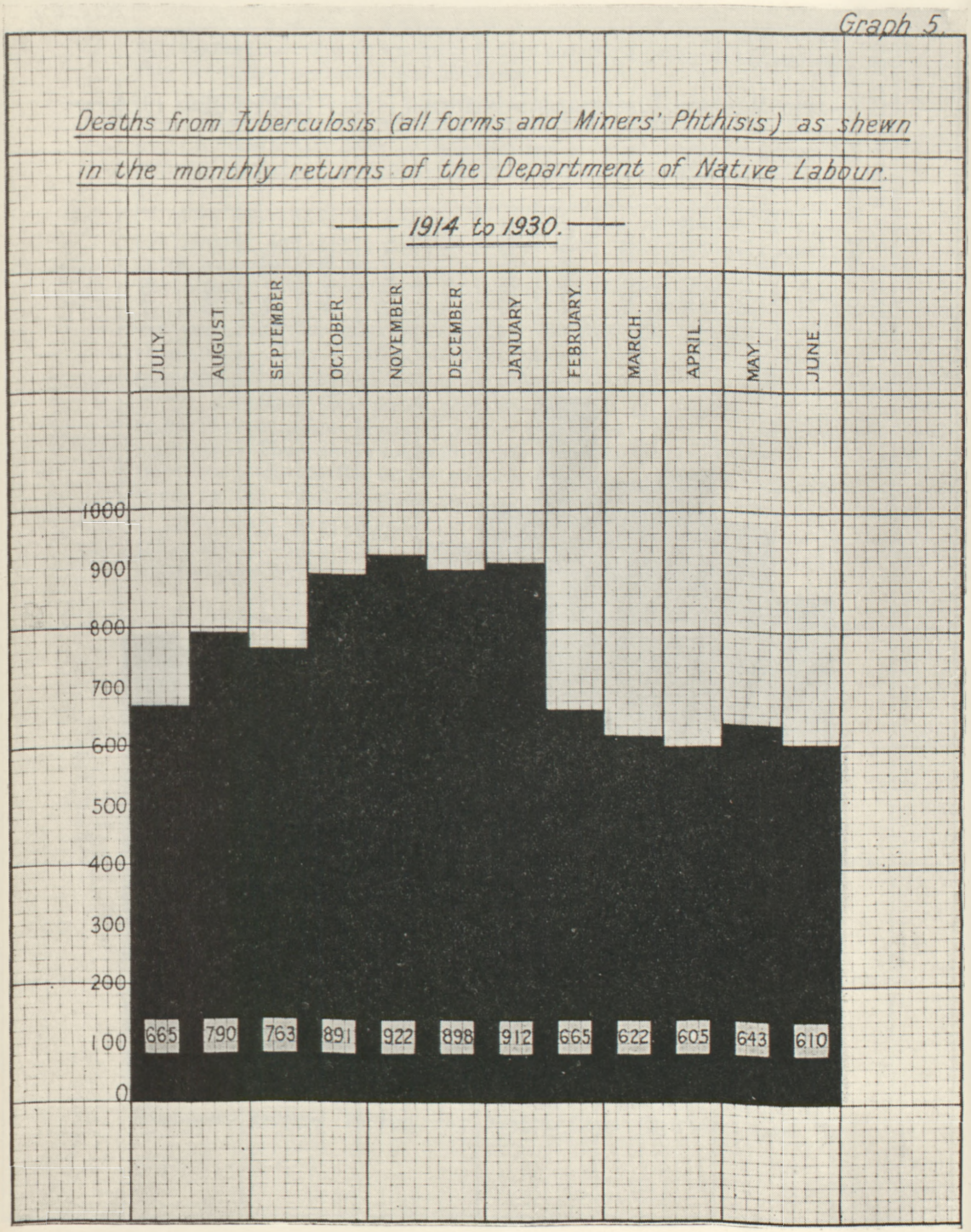
Month.	1919-1920.	1920-1921.	1921-1922.	1922-1923.	1923-1924.	1924-1925.	1925-1926.	Totals.
July	123	161	64	139	154	165	114	920
August	160	199	94	205	165	123	118	1,064
September	145	205	83	212	166	175	159	1,145
October	146	171	88	228	191	153	152	1,129
November	226	184	136	192	224	186	167	1,315
December	176	198	118	148	160	180	142	1,122
January	163	106	128	157	216	160	141	1,071
February	140	106	77	143	184	77	124	841
March	177	114	97	122	138	120	127	805
April	133	98	105	134	120	131	111	832
May	148	90	112	127	177	94	115	853
June	162	69	122	134	166	125	130	908

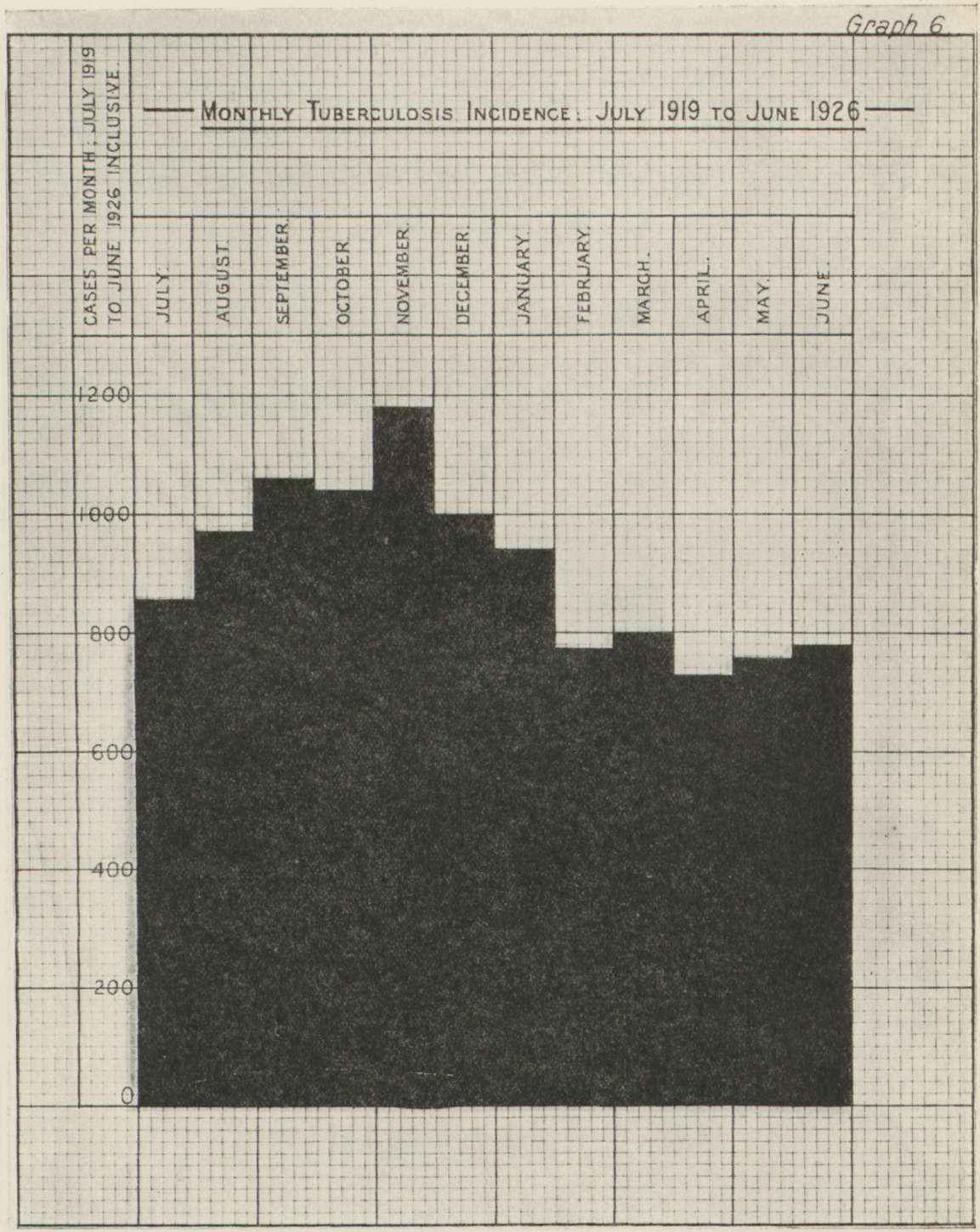
There does seem, therefore, to be a definite seasonal distribution, but why ?

One might say that the Natives start their tuberculosis in the winter and that it goes on to recognition and death during the summer. This hypothesis would be more interesting if we were dealing with Natives in their kraals. One would then refer to food shortage and exposure, but fully 80 per cent. of the Natives considered are working mine Natives, and there is no question of special winter food shortage and exposure in their case.


Graph 4.
GOLD MINES.
Monthly returns of deaths from Tuberculosis (all forms) and Miners' Phthisis July 1st 1926 to June 30th 1930.
JULY.
AUGUST.
SEPTEMBER.
OCTOBER.
NOVEMBER.
DECEMBER.
JANUARY.
FEBRUARY.
MARCH.
APRIL.
MAY.
JUNE.
120
110
100
90
80
70
60
50
40
30
20
10
0
75
88
65
89
111
86
101
93
69
82
69
63

Graph 5.


Deaths from Tuberculosis (all forms and Miners' Phthisis) as shewn in the monthly returns of the Department of Native Labour.
1914 to 1930.
JULY.
AUGUST.
SEPTEMBER.
OCTOBER.
NOVEMBER.
DECEMBER.
JANUARY.
FEBRUARY.
MARCH.
APRIL.
MAY.
JUNE.
1000
900
800
700
600
500
400
300
200
100
0
665
790
763
891
922
898
912
665
622
605
643
610


Graph 6.
Monthly Tuberculosis Incidence: July 1919 to June 1926.
Cases per month: July 1919 to June 1926 inclusive
1200
1000
800
600
400
200
0
July.
August.
September.
October.
November.
December.
January.
February.
March.
April.
May.
June.

Another hypothesis which seems worth considering, not as an explanation covering all the facts but as playing a part, is the relationship between tuberculosis and influenza.

Various mine medical officers are of opinion that tuberculosis is frequently " lit up " by influenza ; cases regarded as influenza passing on to definite tuberculosis, or cases that had been in hospital for influenza and discharged developed a definite tuberculosis comparatively soon afterwards.[48]

With the object of tracing, if possible, any connexion between tuberculosis and any preceding disease such as influenza, a special entry was provided for in the post-mortem record form used by the Pathological Sub-Committee in collecting pathological data (see Appendix 7, p. 411). It must be admitted that this line of enquiry did not elicit any definite connexion between tuberculosis and an antecedent influenza attack but some more recently-acquired information may not be without bearing on this point.

Dr. Ordman[55] has shown that the seasonal distribution of pneumonia on the mines shows a winter peak and a spring peak in its incidence. The winter peak is predominantly due to pure pneumococcal infections, whereas the spring peak is due to a variety of organisms, being, in fact, what is commonly termed influenzal pneumonia.

It is tempting to suggest that this spring influenza sets light to the tuberculosis, which burns on to death or recognition in the ensuing summer months.

6. FACTORS INFLUENCING INCIDENCE ON INDIVIDUAL MINES.

(*a*) *Working Conditions.*—From the values of the Charlier " coefficient of disturbancy "[56] given in Table 18, it is evident that the distribution of incidence rates forms, in all four categories, a hypernormal series, and that the variations in the rates for the different mines are not of the nature of random fluctuations. The problem then is to endeavour to disentangle some of the more important factors operative in causing these discrepant experiences. Such possible influences might be classified as (*a*) *permanent*, and (*b*) *transient*. Permanent factors are those which change but little from year to year ; they are inherent in the mine itself and may be summarized under housing and working conditions. Transient factors, on the other hand, are in a state of flux, and depend upon the constitution of the mine complement at any given time. The rapid turnover of the labour force may cause considerable variations from year to year in any individual mine, in the age and tribal constitution of its complement, as well as in the ratio of new recruits to experienced Natives.

A complete discussion of these factors is not possible, as the requisite data are not available. No general system of identification is in force whereby the previous mining history of a Native may be established, nor is the age or tribal constitution of the general population accurately known. In fact, few Natives know their own ages. In

recording a case medical officers, by personal enquiry, ascertain the tribe and an approximate previous history; and they estimate the age. But in the absence of corresponding data for the total complement no reliable inferences may be drawn.

If what have been called permanent factors were the more important influences which determine an incidence rate, then one would expect significant correlation between the experience of individual mines in successive years. Correlation coefficients have therefore been computed for the returns for successive years in all four categories.

TABLE 23.

34 Gold Mines.

Correlation between Experience in Successive Years.

	1926-7 and 1927-8.	1927-8 and 1928-9.
P.T.B.	+0·288±·106	+0·380±·099
T.B.S.	+0·461±·091	+0·736±·053
S.S.	+0·686±·061	+0·636±·069
O.T.B.	+0·427+·095	+0·522+·084

When, as in the present instance, different causative agencies are operative, simple correlation coefficients must be treated with reserve. Nevertheless, it is suggestive that simple silicosis should show the steadiest influence of working conditions, and that the production of the two silicosis categories should, on the whole, be most influenced by mine-to-mine variation of these conditions. On the other hand, the low value and the bare significance of the correlation coefficients for pulmonary tuberculosis lead one to the conclusion that in this case working conditions are of general effect only, and do not constitute a paramount factor in the variation of incidence experienced by the different mines.

Note.—Since the completion of the foregoing statistical analysis a fourth year of observation has terminated, viz., July, 1929, to June, 1930. 2 of the 34 gold mines dealt with in the preceding paragraphs closed down and therefore disappear from the records. The total mean annual complement of the remaining 32 was 193,843.

The mean incidence rate for pulmonary tuberculosis was 3·307 per 1,000, showing a slight increase on the 1928-9 rate.

The improvement in the two silicosis categories was maintained, for the additional year's experience yielded incidence rates of 1·357 per 1,000 for T.B.S. and 0·614 per 1,000 for S.S.

In these three categories correlation of the experience of 1929-30 with that of the previous year reveals the same general features as those of Table 23. The correlation coefficients are (1) P.T.B., 0.468±·090; (2) T.B.S., 0·704±·058; (3) S.S., 0.609±·073.