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July 26, 1954

Dr. Leroy E. Hooker, Director,
Research Laboratory for the Study of Determinants,
7 Church Street,
Harmon Lake, L.I.

Dear Roy:

When you sent The Determinator Journal (published in Beyond the Bay and Page 1267) there are some interesting articles in which you and Ann are both quoted, including one by your friend Dr. James of Lake City State. There are certain statements in these articles that are so contradictory to our recently accepted thought that I am enclosing it to have it referenced then. If you do not get them, let us know and I will send you my copies, provided, of course, you return your right hand and solemnly swear to return them.

Best regards.

Sincerely yours,

A. J. Lemon, M.D.
Assistant Medical Director

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GOVERNMENT EXHIBIT 47

"The man who says 'It can't be done' is liable to be interrupted by someone doing it."

Silicosis and Asbestosis.

A Joint Meeting of the Refractories Association of Great Britain with the Yorkshire Section of the Society of Chemical Industry

The Discussion which followed the reading of the Papers. (Concluded from our May Issue).

DR. P. Hetherman, M.D. (Tuberculosis Officer to the Derbyshire County Council)* said: "I would like to express my thanks to Mr. Rees and Dr. Tideswell for so kindly inviting me to this meeting, to-night, and giving me the privilege of listening to such stimulating papers as those we have just heard.

It is a happy augury to see geologists, petrologists, physicists, chemists, bio-chemists and medical men, meeting to-night to discuss these questions, each contributing his share and co-operating for the advancement of knowledge. Such team work has been long overdue.

I was particularly delighted with Dr. Fownweather's paper, which conclusively showed that the extent of the fibrosis in a silicotic lung bore no relationship to the amount of the silica actually found in the lung because, from *a priori* reasoning, I had always believed that this would be found to be the case: that silica entered the lung, did its nefarious work, and then departed. It had been known for many years that the quartz particles which were found in the lymph nodes in early silicosis disappeared from the silicotic nodules and from the silicotic fibrosis with the passage of time. This was foreshadowed by Belt of Toronto many years ago, and was confirmed by other workers, including Professor Stewart, whose absence from the gathering to-night, everbody regrets.

What is not, perhaps, so generally recognised is that silica is eliminated daily in the urine. Normal urine contains, if I remember rightly, up to 80 milligrammes per litre. It is also eliminated by the bowel, and is capable of entering into organic combination in the bodies of men, animals and plants.

The feathers of birds, for example, depend upon their silica content for their stiffness and elasticity, as do the stems of cereals, bamboos, etc., and the silica content of some old-fashioned plants such as the equaseturns, is very high. In bird's feathers, the silica is supposed to exist according to Professor J. B. S. Haldane, as cholesterol silicate, and, in plants, as silicates of polysaccharides.

As regards Dr. Jones's paper, it is important to remember that silicosis is only one form of pneumonoconiosis, but is an unique form, and is distinguished from all other forms by its basal unit: the silicotic islet or nodule. It should not be confounded with other forms of pneumonoconiosis or fibrosis.

In Derbyshire, silicosis risk occurs in [illegible] industries, viz., the quartzite industry, the millstone grit industry, the chert quarries (he showed a skiagram of silicosis in a chert quarryman, and a specimen of the material) and the pocket silica sand industry. Derbyshire coal miners do not suffer from silicosis although the coal mines are dusted with "shale".

Derbyshire quartzite differs in no material particular from Ganister and Dinas quartzite and I should like to ask Dr. Jones if this material contains sericite. There is no doubt as to the dangerousness of this quartzite dust in producing silicosis [illegible] contains 96% of silica, and only 1.4% of alumina and ferric oxide taken together, so that there is very little room for any combined silica in its structure. It contains a good deal of mica, but this appears to be flaky mica of the muscovite type. In fact, a Derbyshire stonemason can always tell the natural bedding of a piece of millstone grit by the disposition of the flakes of mica.

Chert is pure silica of the micro-fibrous or chalcedonic type, in which the individual fibres are so fine that they are said to be measureable only in one dimension. As regards the pocket silica sands or clays employed in firebrick making, I have always maintained that the silicosis risk in this industry is comparatively slight, but I would not be surprised to hear that the material contained more sericite than any of the other three.

I have been taken to task regarding a paper I wrote some years ago on the freedom from silicosis of workers in this industry, because I had not given dust counts, and because I had not stated what changes occurred in the firing of the bricks. Well, Dr. Middleton, who had done the dust counts, is present and could doubtless give us some information about them. He might also say whether continued experience has modified his views as to the risk in these industries.

Firing merely inverted the quartz into tridymite and cristobalite, or left the quartz unchanged. In the potteries, the persons who trimmed the ware after firing were subject to silicosis as well as those who worked with flint before the firing took place.

* In the paper read at our May meeting Medical Officer of Health for Derbyshire [illegible] the name of Dr. P. Hetherman. [illegible] as to Dr. Hetherman's designation and [illegible] the error which occurred. It should have read Tuberculosis Officer to the Derbyshire County Council.

[illegible] would [illegible] group.

In considering whether silica or sericite caused silicosis the pathological and experimental work of Leroy Gardner and Cummings at Saranac in the U.S.A. was of great importance. Their pathological conclusions differed in no way from those of Professor Stewart, and no more need be said about them. But their experimental work has been going on for nearly twenty years and is of wide range and great importance. As long ago as 1920, Gardner showed that he could produce typical silicosis in the lungs of guinea pigs by exposing the animals to "pure quartz dust," while similar exposure to granite dust failed to produce silicosis. I would like to ask Dr. Jones which mineral contained the more sericite,† the "pure quartz" or the granite?

Similarly Gardner and Cummings have compared the action of quartz dust experimentally with that of asbestos dust, dusts of aluminum, alunite, emery and other non-siliceous abrasives, with carborundum dust, and coal dust, and always with the same result: the quartz dust produced silicosis, and the others did not.

As regards the supply of fresh air to workmen by means of masks. I brought home, from Canada, in 1910, a "Bulmer Air Mask." The Bulmer mask consists of a hemisphere of light jaconet, tied loosely on the face. It was fed with air, under slight positive pressure, by a light rubber tube supported from the shoulder by light webbing harness. It was quite unirritating in use, but the drawback seemed to be in the air compressors, which fed the pipes. These had to be lubricated and the lubricating oil volatilised or became polymerised into poisonous hydrocarbons. I have passed on the mask to Dr. Fischer.

As regards the colloidal theory of the action of silica in the lungs, recent acquaintance with the work of the Bragg has somewhat modified my views. Gardner and Cummings have shown that the rapidity of action of quartz dust depended upon the smallness of the particles, and the work of Sir William Bragg on silica and of his son Professor W. Bragg on the structure of silicates goes to show that, provided the particles are small enough, there is no essential difference in the action of silica and silicates as aerosols and as hydrosols. Both might very well act chemically, when freshly made, as well as colloidally, and the aerosol might be the more active of the two. One other thing Professor Bragg's work did show, viz: that clays, micas and talcs, were the most inert, electrochemically, of all the mineral silicates, so that if silicosis was the result of chemical action, clays, micas, and talcs would be the least likely to cause it.

† We would refer our readers to "Studies of Refractory Minerals" (No. 3) on page 228 for a description of Sericite.

Note on "Shale."

The term "shale" is now loosely applied to materials which are often very different in chemical and physical composition. Properly so called "shale," is a compressed carbonaceous clay, occurring near the coal measures, and containing a few quartz particles (not as even the finest clays *les argiles veritables*, do). Such shale is quite incapable of producing silicosis, and has been used for many years in "dusting" the Derbyshire coal mines.

It is well-known that Derbyshire coal miners do not suffer from silicosis. At our sanatorium at Chesterfield, many thousands of coal miners of all ages have been treated for tuberculosis of the lung, during the past twenty years, (although miners in Derbyshire do *not* suffer disproportionately from pulmonary tuberculosis). Radiographs of the chest have been taken in every case, and these radiographs are available for inspection at Chesterfield Sanatorium. *None show silicosis.*

Unfortunately the term "shale" is sometimes applied to a formation consisting of thin beds of very friable gritstone alternating with thin beds of very material containing many quartz particles. Such "shales," incorrectly so called, would, of course, be very dangerous. A typical example is the "Yoredale Shale" (sic) formation of South Derbyshire which consists mostly of layers of soft grit.

Note on the Kolar Conditions.

I am a retired Officer (Major) of the Indian Medical Service, and from 1901 to 1915 (when I went on War Service) I worked in Madras. I am therefore, acquainted with industrial conditions in the South of India.

I noticed, with some music comprehension, the statement that the Indian employees in the Kolar mines "refused to be radiographed"—I think I could suggest an explanation of that refusal.

I would advise those concerned to take any evidence, coming from Indian sources regarding the absence of silicosis amongst Indians employed in the Kolar quartz mines, with some reserve.

Dr. Chas. L. Sutherland, D.P.H. (Chief Medical Officer—Medical Board for Silicosis and Asbestosis—Sheffield): Dr. Sutherland showed two specimens of lungs of South Wales coal miners who had died of silicosis. The first of these was aged 34 and had been employed in tin mines in Cornwall up to the age of 23, and, after that, for about 4 years as a hard ground worker in the anthracite area. The lung of this man showed a very advanced nodular type of silicosis which contrasted very remarkably with the second lung which was shown. This was from a Welsh coal miner from the anthracite district, who was aged 43, and had been employed in coal pits in that area for 23 years. For a year and a half of this,

he was definitely employed as a hard heading worker, i.e., working in sandstone, and for over 21½ years, he was employed as a collier, when he might, or might not have been exposed to silica dust. This lung showed the appearance which has been described as that of silico-anthracosis. It is solid, jet black, and appears to be breaking down in the centre. The specimens illustrated the subject matter of the discussion, since the exposure included granite dust, coal dust, and silica dust.

In conclusion, Dr. Sutherland, thanked the members of The Refractories Association of Great Britain (and the Yorkshire Section of the Society of Chemical Industry) for their kindness in inviting him, through Mr. W. J. Rees, to attend the meeting that evening.

Mr. C. C. Davis (Secretary, The Refractories Industries Compensation Fund Ltd.): I understand that ganister does not contain much (if any) sericite and Dr. Jones' contention is that sericite is the harmful material which sets up silicosis. If this is so, how does he account for the fact that out of 465 cases under the Refractories Industries, 167 of them are ganister miners or getters. There are also 85 cases of crusher men and grinders, and probably it would not be an unfair estimate to attribute at least half of these cases to ganister. Of the 314 other cases, again a proportion of them are people working in ganister. It would, therefore, appear that more than half our cases come from working in material where there is very little sericite.

It seems to me that if Dr. Jones' contention is to be accepted (and a very interesting suggestion it is) that the most careful investigation will have to be made as to the presence, or otherwise, of sericite in ganister. Of course, my records do not show what particular ganister the men have been working in. I do not know enough of the subject to know whether some ganister has much sericite and some a little.

Mr. W. J. Rees, M.Sc., F.I.C. (Head of the Refractories Department of Sheffield University) (Secretary of the Refractories Association), remarked that he was particularly interested in the suggestion put forward by Dr. Jones. There seemed to be more than one cause of the fibrosis typical in the silicotic lung.

If Dr. Jones' suggestions with regard to sericite are established, it would appear likely that there are many other raw materials worked on a large scale which are quite as dangerous, from the point of view of silicosis, as silica rock. Kyanite, Sillimanite and similar classes of material are extensively used in the Refractories Industry.

"It is a subject of great interest and importance, and I should like to read you a communication I have received from Professor W. G. Fearnsides, M.A., F.R.S. (Sheffield University)."

Professor Fearnsides' Communication.

Professor W. G. Fearnsides, M.A. F.R.S. (Sheffield University): I should have come along to listen, if not to speak, at your Silicosis discussion . . . but needs must that I go with my University Field Class to Llanrollen instead.

I have been looking at quite a list of slides of Coal Measure Shales, Grits and Sandstones collected locally and am clear that one would be unwise to certify any one of them free from the kind of secondary mica which has been called sericite, but how much of that mineral is "platy" or bladed in habit and how much is "fibrous" and, therefore, according to Dr. W. R. Jones, particularly dangerous, I am not prepared to say. There is abundant sericite in all our specimens of Loxley Edge Rock, Middle Rock, Crawshaw Edge Flags and Rough Rock, and in Basement Canister, but much less in the good Halifax Hard Bed, Deepcar and Oughtibridge Canister, and, so far as I can see none survives in the silica I have of burnt silica bricks.

Dr. R. L. Middleton of the Home Office, having been invited by the Chairman to speak, remarked that one or two points had been raised in the papers on which he would make a brief comment.

We are indebted, he said, to Dr. Jones for bringing to bear on this important problem of silicosis, the science of geology; this had been done previously in South Africa to a limited extent, as well as in other countries.

Medical men who have studied the disease realise the diversity of its nature and the difficulty there may be in deciding exactly the points at which it merges into other pulmonary diseases. We have realised that the type of silicosis found amongst sandblasters and flint crushers, for example, differs from the type of the disease met with amongst potters and the coal miners of South Wales. It appears to be not inconsistent with the theory put forward by Dr. Jones to maintain that free silica has a fundamental action on the lung tissue and that other substances have a modifying effect on that action. It is conceivable that two kinds of dust may act separately in the same lung at one and the same time.

Dr. Hefferman has referred to the occurrence of silicosis amongst the workers in the pocket clays. Atmospheric dust samples showed that when dried and subjected to mechanical treatment in the processes of manufacture, enough fine dust was given off to account for the occurrence of silicosis, though the period of time the workers had been engaged in the process has to be considered.

Mr. Rees' remarks and the observations of Professor Fearnsides are of particular interest and extremely important, and I hope occasion will be found to publish them.

The subject of silicosis has been one of vital importance to Sheffield, which may be regarded as the cradle of silicosis in this country. In the middle of last century the then Medical Officer of Health referred to the mortality amongst steel fork grinders, who rarely reached the age of 40.

"Great works are performed, not by strength, but by perseverance."

I feel that there is still much information to be gathered together on this subject and I would particularly stress the importance of keeping an open mind until we are in a position to review all the facts.

Dr. C. G. Addingley (British Belting and Asbestos Ltd., Scandinavia Works, Cleckheaton, Yorks.): I remember some time ago reading the different results obtained by Dr. Fowweather, who found that the ash of the lung was entirely silica, and by Dr. Tideswell, who found that the silica constituted about 50% of the ash, may, perhaps, be explained by the difference in the nature of the dust inhaled. In Dr. Fowweather's case, it was asbestos. Ordinary white asbestos is essentially hydrated magnesium silicate; if this decomposes, the silica will remain largely insoluble, but the magnesium hydroxide, or any other magnesium compound likely to be formed, will be readily soluble and would presumably disappear fairly rapidly from the lung. Hence, on analysis, only silica would be found.

On the other hand, in the cases examined by Dr. Tideswell, the inhaled dust contained principally compounds of silica with alumina. Any decomposition taking place would leave both the silica and the aluminium hydroxide insoluble. Hence, on analysis, the percentage silica found would be similar to that in the dust inhaled.

In the decomposition of asbestos, a result frequently obtained is the destruction of all or almost all the metallic oxides, leaving a residue of fairly pure silica. This silica retains the characteristic fibrous structure of asbestos, an appearance which may lead to the erroneous conclusion that the asbestos is unattacked. It is possible, therefore, in the examination of lung residues, that what appears to be unchanged asbestos, may partly, or entirely be silica in fibrous form. This, at any rate, would appear to have occurred in the case described by Dr. Fowweather.

Dr. Addingley asked Dr. Fowweather what type of silica or silicate was used by Prof. Kettle in the experiments on inter-tracheal injection of guinea-pigs, and if Dr. Tideswell could say whether there was any correlation between the degree of fibrosis of the lung and the amount of colloidal (readily soluble) silica in the lungs he examined? Such a correlation, would be valuable evidence on the chemical theory of the cause of silicosis.

In a recent lecture (J. Davidson Pratt and G. S. W. Marlow, "Legal Pitfalls of the Chemical Engineer," Joint Meeting of the S.C.I., and the Institution of Chemical Engineers, London, January 8th, 1934) mention was made of a new, and fairly comfortable, type of gas mask or respirator which was being tested. Was this the same as that mentioned by Dr. Jones?

Mr. R. W. Oakes (Yorkshire Amalgamated Products Ltd.): Relative to the question of water spraying in the shops and, in view of Dr. Jones' remarks regarding respirators, I should like to ask him whether he thinks that if fans were introduced in the upper part of the workshop and the air changed ten times quicker, the risk of silicosis in such surroundings would be ten times less?

Mr. Frank S. Russell, F.C.S. (Past President of The Refractories Association and The National Association of Clayworks Managers) (Chairman, General Refractories Ltd.), said: May I take this opportunity, on behalf of the industrialists operating in silica for the production of refractories, of saying how deeply grateful we all are to those scientific men who have given such deep study to this horrible disease, and how anxious we all are to find a means of effectively reducing its incidence amongst our workers. I do feel that considerable credit is due to Dr. Jones and his colleagues for the great work they have been, and are, engaged upon.

Dr. Jones seems to be a pioneer in a new direction, and I do sincerely hope that he may be able to continue his valuable research work on the same lines, to ultimate success.

Further, we are still more grateful for the suggestions as to the way in which we can reduce the liability of our workmen to the disease.

Dr. Jones has suggested that we might supply employees direct with clean surface air, in the case of mines; and for factories, with clean air from outside the factories, say, from a supply tank.

I am just wondering how the spent air was exhaled. No doubt Dr. Jones will be able to enlighten us on that point.

In conclusion, may I just repeat how exceedingly grateful we all are for the privilege of hearing this matter so carefully examined and discussed.

Dr. Fowweather in replying to the various questions raised, said that he did not know whether cases of silicosis or asbestosis had ever been found in rats or in dogs associated with mines or asbestos factories.

With regard to the statement made to Mr. Russ, that asbestosis did not occur amongst the workmen in the asbestos mines in Canada, Dr. Fowweather felt that, without definite knowledge as to the precise conditions obtaining in the mining side of the industry, as compared with the manufacturing side, and without knowing anything as to the conditions relating to examination and certification of illness arising amongst workers in the mines, the question could not usefully be discussed.

Referring to Dr. Middleton's comments on the case of asbestosis, in which the whole of the ignition ash could be accounted for as silica (SiO_2), Dr. Fowweather agreed that it was usual to find a number of fibres in lungs which were the seat of asbestosis, and thought that his own case was rare, in the completeness with which the asbestos had been decomposed: one would expect that the more recently inhaled fibres would be relatively unchanged, though

"It is one thing to decipher problems, quite another to know to deal with it."

earlier date might be much altered. Nevertheless, the finding of some unchanged asbestos fibres was not proof that decomposition did not occur, and he, personally, could find no other explanation of the figures in this case than the one he had already referred. The so-called "asbestosis nodules" found in cases of asbestosis, were spindle-shaped bodies, in which one often found remnants of a fibre, running through a larger mass of hyaline material. It was not known what the hyaline material consists of, but he thought that it might prove to be silica gel, resulting from decomposition of the asbestos. Moreover, Dr. Addingley had informed us that the asbestos fibre could lose its metallic oxides and still retain its fibrous structure; this also showed that the persistence of fibres did not show that decomposition did not take place.

In Professor Kettle's experiments, Kaolin was the material used for injection.

Appreciation was also expressed by another gentleman present at the meeting who expressed the hope that it would be possible to obtain a verbatim report of the papers (and the discussion) given that evening.

Dr. W. E. Gregg, in replying to the discussion, stated that in the type of microscope used by geologists for the examination of minerals, the light was polarised and the optical system arranged specially to bring into prominence the presence of doubly-refracting minerals like quartz and sericite, whilst at the same time rendering the rest of the microscope field quite dark. By this arrangement, with the nicol prisms in crossed position, quartz and sericite, for example, were seen clearly in varying degrees of brightness against the dark background. Biological microscopes, on the other hand, of the type used by pathologists, were not equipped with a polariser and analyser, and were, therefore, quite unsuitable for detecting the presence of such doubly-refracting minerals in lung sections.

It was true, as Dr Tidswell had stated, that the fibrous form and the higher birefringence of sericite, helped to bring that mineral clearer to the view than the particles of quartz. The fact, however, that they were brought into prominence, and were so numerous, was indisputable proof of their presence in silicotic lungs. Moreover, against the dark background, with a good substage focussing condenser, high magnification, a suitable source of light, using a "sensitive red" plate, particles of quartz of one micron in diameter (one twenty-five thousandth of an inch) could be brought to view. The findings in this way, under the petrological microscope had received complete confirmation from the chemical analyses of the mineral residues obtained from these silicotic lungs.

Dr. Hollaender had referred to the fact that Dr. Lanza Gardner had found that the experimental exposure of animals to the fine dust of granite, had failed to produce silicotic effects in the lung, whereas exposure to quartz dust had done so. The speaker had the greatest admiration for the extremely valuable experimental work of Dr. Gardner, with whose publications he was familiar, but would point out that the results of these experiments did not alter the fact that granite dust did produce silicosis in the human lung, as evidenced by the notable incidence of the disease among the tin-miners of Cornwall and the granite workers of Aberdeen and certain other places. That very evening, Dr. Hollaender had shown them the lung of a Cornish tin-miner and had described it as being a very advanced nodular type of silicosis. If experimental proof were necessary in support of the speaker's conclusion that minerals other than those composed of free silica could produce dangerous dust, he would draw attention to the recent work of the well-known pathologist, Professor E. H. Kettle of St. Bartholomew's Hospital, who, to quote his own words, "had had greater success in certain types of experiments with kaolin in producing experimental lesions than he had had with pure quartz or other forms of free silica." The important significance of this effect in the lung, of kaolin, lies in the fact that it is composed not of free silica, but of silicate minerals; that it contains numerous fibres of sericite, and that the amount of free silica in this kaolin was less than 3 per cent.

He would suggest to pathologists that in their future experiment with mineral dust, it would be helpful to them to obtain precise information from a geologist about the mineral composition of the parent rock, and of its dust. The dust of one granite could be very different from that of other granites; there were many types of granites, and these varied greatly in their mineral composition. For example, the granites worked in the tin-mines of Cornwall were characterised by the sericitisation of their felspars, hundreds of minute fibres of sericite had been formed by the alteration of even one crystal of felspar. Granites from certain other districts contained no sericite; the felspar in them was unchanged. There was a further important point which required stressing in view of experimental work on dust inhalation. The dust produced by powdering a sericitic rock in a percussion mortar was of the same composition as the rock itself, whereas *the finest dust released into the atmosphere*, when that rock was drilled, blasted, or otherwise broken, contained a far higher relative percentage of minerals like sericite, which were already present in the rock, before it was broken, as minute fibres loosely held together in the matrix and readily freed into the air when the rock was broken. This had been proved by examination of mine dust under the petrological microscope, and confirmed by chemical analysis. This sorting of the dust by the suspension of the finer particles in the atmosphere, and the settling of the coarser quartz particles, is prevented when a rock

"Those business men have a result from their resolution or from their movement."

is powdered in a percussion mortar; and it was his considered opinion that the anomalous results obtained experimentally, were in many cases due to the fact that the dust from powdered rock, administered to animals, was physically and mineralogically so unlike the fine dust inhaled by those employed in exploiting that rock, that certain far-reaching deductions from such experiments were misleading.

(At this stage of the discussion, the Chairman, Mr. Blain and certain members of the Yorkshire Section of the Society of Chemical Industry, had to leave to catch their train for London. Mr. Alan Lomax (representing Mr. Wm. Lomax, J.P., President of The Refractories Association), thereupon proposed a vote of thanks to the Chairman for the able way he had conducted the meeting that evening, and to the various speakers, which was seconded by Mr. Frank S. Russell, F.C.S.).

Two or three questions had been put to him that evening, continued Dr. Jones, about the incidence of silicosis among the gannister workers in the neighbourhood of Sheffield and elsewhere. He had not so far been supplied with the silicotic lung of a gannister worker, and would avoid theorizing as to the nature of the dust such a lung would contain, as he would await the opportunity of investigating this question. He had now, however, been underground in one of the Ought-ibridge Silica Firebrick Company's gannister mines, through the courtesy of the management, and had taken samples of the rocks. The gannister bed in that mine averaged approximately 18 inches in thickness. All the rock-drilling, however, was confined to the sandstone underlying the gannister. Mr. Taylor the Mine Manager, informed him that they never drilled in the gannister bed itself. Microscope sections of this sandstone showed the presence of numerous fibres of sericite between the quartz grains.

Regarding the question of exhalation of air with the investigating apparatus to which he referred, Dr. Jones remarked that there would be no difficulty in this direction, as all the exhaled air would pass through a little valve, which was very easy to operate. No oil is in contact with the air at all.

In reply to Dr. Addingley's questions, Dr. Jones remarked that the respirator described by J. Davidson Pratt and G. S. W. Mavrogordato was not the same as that he referred to.

Time did not permit him to deal with all the points raised that evening, but after he had read the printed discussion he would gladly answer in writing any unanswered questions addressed to him.

He wished, in conclusion, to add that he had been greatly impressed by the valuable papers given that evening by Dr. Pearce-Duncan and Dr. Tideswell. He gathered that their important work had support to some, at least, of the speaker's conclusions. He would await their publications with great interest. He thanked the Council for their invitation to address them, and said the pleasure of the visit to Sheffield was greatly increased by the fact that it was Dr. Sutherland of Sheffield, who supplied him with the first batch of silicotic lungs for his investigations.

Dr. Tideswell, replying, stated that the investigation of soluble silica in the lung specimens was made with the possibility in mind that some relationship might be disclosed between the proportion of readily soluble silica in the lung and the extent of the silicotic condition. The specimens on which the most recent and most reliable estimations had been made were too few in number and too similar, being chosen for their high silica content, to justify an expression of opinion on this point.

With regard to the nature of the contaminating material, he would ask Dr. Jones whether examination of lungs and lung residues under the petrological microscope would not tend to make unduly prominent the sericitic and other fibrous material as compared with other siliceous material which might be present in greater amount.

On the question of prevention of dust diseases, whilst the ideal solution lay in preventing the dust at source, Dr. Tideswell thought that something might be done to minimise the centrifugal raising of dust into the air. Dust in the air of coal mine roadways, apart from its possible danger, formed a very real nuisance. Recent work carried out in the Safety in Mines Research Board laboratories had suggested that the use of aqueous solutions of special wetting agents now available might solve the difficult problem of wetting fine stone and even coal dusts, and so of laying the dust, for example, that on the floor of a mine roadway.

In conclusion Mr. W. J. Rees expressed the gratitude of all who were present to those gentlemen who had given the papers that evening and to those who had contributed to the discussion which had proved to be both interesting and valuable.

"It is important" he added "that the chemists and the geologists should co-operate with the medical man in regard to this dangerous and difficult disease."

"The Laying of Dust on Mine Roadways." F. V. Tideswell and R. V. Wheeler. Read before Mid. Inst. Min. Eng., March 2nd, 1934.

"History gives the time when the heart is young."

"Everything has another side to it, like the moon."—G. K. Chesterton

Studies of Refractory Minerals.

No. 20.—Sericite.

The interest which has been taken in our report of the recent Discussion on the subject of "Silicosis and Asbestosis" (which began in our May issue and is completed this month) prompts us to include, on this occasion, in our Studies of Refractory Minerals, that which is referred to as Sericite. It would appear, from what Dr. Jones tells us, that Silicosis is not due to free silica, but to this mineral Sericite in particular, and to any other form of fibrous finely divided mineral in general.

We should perhaps, not define Sericite as a "Refractory Mineral" in the ordinary sense of the term, nevertheless, we feel we are justified in this slight deviation on this particular occasion.

Sericite is very closely related to mica; a talc-like hydrous (containing water, chemically combined) mica. It is often defined as an aggregated form of Muscovite. It seems to have been formed as the result of the action of pneumatolytic acids on the particular rock. Pneumatolysis, a term which means decomposition, due to the escape of earth-bound [illegible] in a small measure, for the formation of China Clay, in particular, but when the acidity is of a low order, Sericite is formed instead of Kaolinite.

Briefly, we should say that it is metamorphism which is responsible for the development of sericitisation.

J.E.R.

Prosperity went out suddenly like a lamp, but it is coming back slowly like the dawn of a new day.—W.H.R.—J.C.

The Ceramic Society.

[illegible]

REFRACTORY MATERIALS SECTION.

[illegible]

"One couldn't a poached egg like faith."—Robert Lynd.