

FILE NAME: Trade Publications (TR)

DATE: 1935 June

DOC#: TR030

DOCUMENT DESCRIPTION: Trade Journal Article - Silicosis - The Harmful Dusts Which Cause It

POTTERS' COLOURS ENAMEL AND UNDERGLAZE

For Painting, Printing, Spraying, Lithography, Stencilling and Sponging.

RAW MATERIALS

Ground Flint, Felspar,
Stone, Quartz, Whiting,
Carbonate and Sul-
phate of Barytes,
Bone, Fluorspar,
Prepared Clays,
Modelling Clay,
China Clay,
Ball Clay, Silica
Sand.

GLAZES

Plumbic, Low Solubility,
Leadless. Coloured, Scar-
let, Crimson, Pink, Trans-
parent, Opaque. Matt
and Artistic, Crystalline
and Rutile, Frits.
Stains for Bodies
and Glazes. Special
Slip for Pink Body
Stain.



LIQUID GOLD

Bright and Matt,

SILVER,

PLATINUM,

and LUSTRES.

BRITISH SEGER

AND

STANDARD CONES.

PHOSPHOR BRONZE

AND

SILK LAWN & RIMS.

TOOLS AND UTENSILS.

CHEMICALS

Oxides and Salts of Cobalt, Chrome, Copper, Manganese,
Nickel, Antimony, Tin, Zinc, Uranium, Iron, Titanium,
Rutil and Zirconium.

ALUMINA, Calcined and Hydrate. Chromate of Iron,
Bulldog, &c.

Telephone :
5126 HANLEY.

Telegrams :
WENGERS, STOKE-ON-TRENT.

TRANSACTIONS OF THE CERAMIC SOCIETY

INCLUDING
The Refractory Materials
and
The Building Materials Sections.

Founded in 1900 as "The North Staffordshire Ceramic Society,"
and continued from 1903 to 1916 as
"The English Ceramic Society."



UNIVERSITY OF CALIFORNIA

JUL 24 1935

LIBRARY

CONTENTS:

- XII.—Silicosis: the Harmful Dusts which cause it.—*Dr. W. R. Jones.*
XIII.—The Handling of Earthenware Casting Slip.—*C. D. Grimwade.*

Abstracts.

Authors are alone responsible for the opinions expressed in their papers.

Published by THE CERAMIC SOCIETY,
THE NORTH STAFFORDSHIRE TECHNICAL COLLEGE, STOKE-ON-TRENT
Free to Members*; Price to Non-Members, 45/- per Vol.

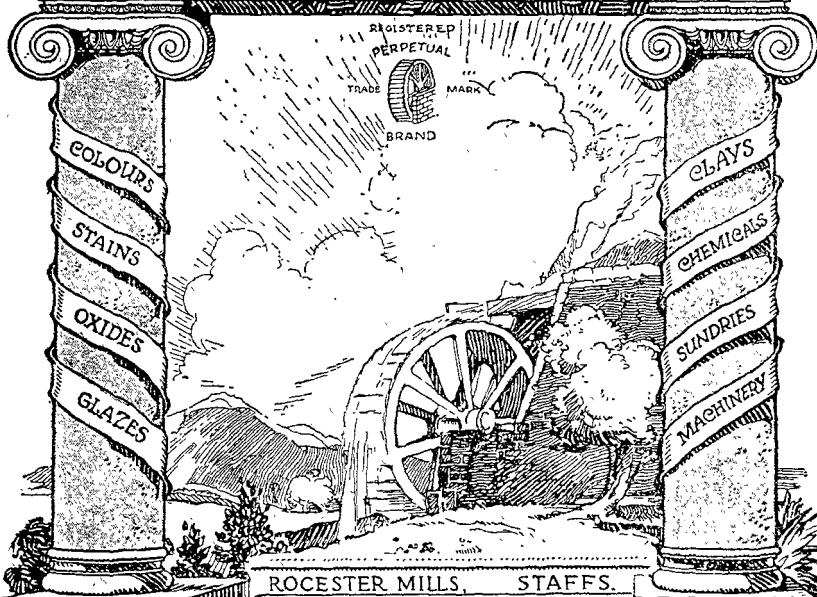
*N.B.—No claims will be allowed for copies of the "Transactions" lost in the post unless such claims are received within 60 days of the date of issue. No claims will be allowed for copies lost as the result of insufficient notice of change of address. (Order of Council, 12th Nov. 1928.)

COPYRIGHT:—No paper may be reprinted from this Journal without the written permission of the Society and of the author, or authors, of the paper.

Printed in Great Britain by
William Clowes & Sons, Ltd., London and Beccles,
1935.

W. PODMORE & SONS

LTD



COLOURS

STAINS

OXIDES

GLAZES

CLAYS

CHEMICALS

SUNDRIES

MACHINERY

ROCESTER MILLS, STAFFS.

CONSALL MILLS CONSALL

STATION MILLS, CONSALL

MOSTYLEE MILLS, STONE, STAFFS.

WETMORE MILLS, STONE, STAFFS.

CLAY MILLS STRETTON Ath BURTON ON-TRENT

CALEDONIAN MILLS, STOKES-ON-TRENT

MANUFACTURERS
AND MILLERS OF
MATERIALS FOR THE
POTTERY, GLASS
ENAMEL IRON &
BRICK INDUSTRIES

Telegrams
PERPETUAL
STOKES-ON-TRENT

Telephone
2814 HANLEY
3 Wetley Rocks

HEAD OFFICE -

CALEDONIAN WORKS, STOKES-ON-TRENT

XII.—Silicosis: the Harmful Dusts which cause it.

BY DR. W. R. JONES.

During the last three years I have had occasion to visit a number of collieries in the anthracite district of the South Wales Coalfield with the object of collecting, from the former working places of underground employees who had contracted silicosis in the course of their work, samples of rock which could be proved to come under the category of "silica rock" as defined in English law, for the purpose of compensation under the Silicosis Scheme. Previous to October 22nd, 1934, when the Scheme was changed to include "any operation underground in any coalmine," English law in this respect differed from that in certain other countries. In South Africa, for example, an employee who is certified as having contracted silicosis in the gold mines of the Witwatersrand, or in any "Scheduled Mine" (scheduled as a mine which has, or can, give rise to silicosis-producing dust) receives compensation without any legal proceedings whatsoever. In Great Britain, however, this was not the case; an underground workman in a British colliery, even where many cases of silicosis had already been proved to the satisfaction of the Judge to have been contracted in that same colliery, still had to satisfy the Court, unless he had already satisfied the Colliery Company, that he had been working in what the law defines as "silica rock." This was because the law was based on the definition of silicosis as accepted at the final sittings of the International Conference on silicosis in 1930, namely, that silicosis "is a pathological condition of the lungs due to the inhalation of silicon dioxide," and that to produce this pathological condition "silica must reach the lungs in a chemically uncombined state."¹

In a number of silicosis cases in the anthracite collieries, samples of rock which fulfilled this legal definition could be found, but in some (and the number of such cases is increasing), even when post-mortem examination had revealed undoubted silicosis and where the former working-places of the deceased were accessible, it was not possible to find rock of the type included in the Silicosis Scheme; such rock did not occur in the relevant parts of the mines. These cases aroused my interest, for they appeared to make clear the possibility that rocks other than those included

silicates cannot be regarded as a single group showing a uniform effect on the pulmonary tissues and producing the same results of disablement and death of those affected.²³ Dr. Badham, also at the Conference, stated that "he was by no means convinced that the silica was the whole story of their disease. He found confirmation of that view in the fact that where they had, as in Broken Hill, 85 per cent. of silicates, most of them intractable, they found in the lung after death intractable and other silicates. It was, therefore, reasonable to assume that silicates had a considerable effect on the production of fibrous pneumoconiosis."²⁴

Cases of silicosis occur in a factory in Denmark, where cryolite is being crushed. This mineral, a fluoride of sodium and aluminium (Na_3AlF_6) is imported from Ivigtut, in Greenland, and as it reaches the factory for crushing, it contains only 3 per cent. of free silica.²⁵ Examination by Dr. Sk. V. Gudjonsson, the Chief Medical Officer of the Labour Inspectorate of Denmark, of 78 workers who had been occupied in the factory for more than two years, "revealed various stages of silicosis, up to the second stage, in 40 out of the 78 workers."²⁶ Certain fibrous minerals are associated with the cryolite, but there are reasons why I should not at present refer to those minerals. This provides a clear case of the causation of silicosis by dust that contains not more than 3 per cent. of free silica. If free silica is the only cause of silicosis, it is pertinent to ask why such a small amount of it has given rise to silicosis in more than 50 per cent. of these 78 workers, whereas in this country certain firms, since before the war, have been crushing quartz as pure as they can obtain it (and pure quartz is 100 per cent. free silica) without the incidence of a single case of silicosis. In fact, there had only been one²⁷ fatal case of silicosis in silica-milling notified in this country up to 1930, and the workman had been engaged in the industry for only $3\frac{1}{2}$ years; his previous industrial history, which might have been of significance, is not given.

There are extremely few mines in the world where not less than 3 per cent. or even 10 per cent. of quartz is present in the orebodies and in the adjacent rocks; and there is a very large number of mines that work in quartz, but where no cases of silicosis have occurred in the long history of such mines.

SILICOSIS IN THE POTTERY INDUSTRY.

Literature on this subject lays great stress on the danger of the dust from the flint beds, on which the ware is placed for firing. The reason given for emphasising this danger is that flint is a form of free silica, and that "placers" (those who put the ware on the flint bedding) are more subject to silicosis than other pottery workers. Let us examine the facts. Of the 5 silicotic lungs of pottery workmen submitted to me, two were the lungs of a china-turner and a jigger, workmen whose employment does not take them

near the flint beds. The result of recent investigations concerning 951 workers²⁸ in the pottery factories of Denmark showed that silicosis in one stage or another was found in 361 cases, that is, in about 45 per cent. of the cases examined. It was found, and this is very important, that it was most frequent in turners, workmen who have no cause to go near the flint beds. Except the employees who make plaster of Paris moulds (and they do not contract silicosis), pottery workers handle the "clay body" in some form or another. This clay body, consisting largely of kaolin (china clay) formed from the decomposition of felspar, contains numerous fibres of sericite. Fig. 17 is a photomicrograph, taken between crossed nicols, of a typical "clay body" used in the English potteries; it was supplied through the courtesy of Dr. C. L. Sutherland. It will be noted that fibres of sericite are numerous. These readily become freed into the atmosphere, particularly from the dried clay; and it is, I submit, the fibres of sericite from dried clay handled by the placers that are the chief cause of the incidence of the disease amongst them. In the mineral residues from the five silicotic lungs of potters I investigated, fibres of sericite outnumber, by thousands, any other mineral present in the lungs.

ASBESTOSIS.

Although this paper is not concerned particularly with the minerals which cause asbestosis, there are one or two facts noted during the examination of the mineral residue of parts of the lung of a worker who died of this disease, that appear to be relevant here.

The asbestos fibres in the residue are, for the most part, several times the length of the longest fibres of sericite noted in the residues of silicotic lungs; some of the former are over 40 microns long, that is, 20 times longer than most of the sericite fibres, and it is possible with more lung material that longer fibres would be found.

It would be unusual to find free silica present in asbestos; in fact, its presence would render asbestos unsuitable for most of the industrial uses to which the mineral is applied. Here, then, is a fibrous silicate mineral which causes a disease similar in some respects, at least, to silicosis; in other words, a fibrous silicate mineral, without the presence of quartz or any form of free silica, does produce a deadly pulmonary disease.

DUST IN UNDERGROUND ATMOSPHERE : CHANGES IN THE RELATIVE AMOUNTS OF MINERALS PRESENT AT DIFFERENT PERIODS AFTER DRILLING AND BLASTING.

Medical specialists on silicosis have asked if I could suggest a reason why, in silicotic lungs, fibres of sericite should predominate so greatly *in number* over the particles of quartz, especially when the rock which has given rise to the dangerous dust contains a

Witwatersrand gold miners investigated in South Africa in co-operation with the medical specialists at the Medical Bureau and the Institution of Medical Research, Johannesburg, consist of minute acicular fibres of sericite. This mineral is a hydrated silicate of aluminium and potassium, and is sometimes called "secondary white mica." It is abundantly present in all the rocks and materials which gave rise to the inhaled dust which had caused silicosis in all these cases. It is present in these rocks in minute fibres of the size and form they are found in the dust obtained from the silicotic lungs, and also as seen in sections of silicotic lungs when these sections are examined under transmitted polarised light.

(2) Silica in the uncombined state, as quartz, is also present in these residues as relatively coarse and fine grains. Numerically, however, the fibres of sericite predominate very greatly over the particles of quartz.

(3) One relatively large grain of quartz, measuring $10 \times 8 \times 5$ microns, such as is found in the residues, is equal in volume to 800 fibres of sericite measuring $2 \times 0.5 \times 0.5$ microns, and contributes as much silica in the chemical analysis of a residue as would 1,600 fibres of sericite. This would appear to be out of all proportion to the silicotic effect of one such quartz grain in the bronchi and bronchioles, compared with the effect in the alveoli of hundreds of fibres of sericite.

(4) At the International Congress on Silicosis, held in Johannesburg in August, 1930, the definition accepted at the final sittings was that silicosis is a "pathological condition of the lungs due to the inhalation of silicon dioxide," and that to produce this pathological condition "silica must react in the lungs in a chemically uncombined state." It is submitted here that silica in the uncombined state is not the chief cause of silicosis in the cases here described. This appears to be conclusively established by mineralogical and chemical evidence from the lung residues, by the examination under the petrological microscope of sections of silicotic lungs, and from the following facts: (a) The amount of quartz and the size and form of the quartz grains in the sandstones occurring in the underground working-places in the Scottish coalfields and in the South Wales coalfield, are alike. The latter rocks give rise to dust that has caused hundreds of cases of silicosis, whereas only four or five cases of silicosis have been produced in the Scottish coalfields. (b) The gold-bearing quartz conglomerate of South Africa gives rise to dust that has caused thousands of cases of silicosis; the gold-bearing quartz rock of the Kolar goldfield, India, contains more quartz than the South African rock and yet produces dust that has caused no case of that disease. (c) At the Lonely Mine in S. Rhodesia a gold-bearing quartz vein, about 4 ft. wide, has been worked for over 23 years to a vertical depth of 4,000 ft. Drilling is done dry, there is no water-spraying, and ventilation conditions are particularly difficult. No cases of silicosis have

occurred in the history of the mine. The absence of silicosis in many other mines working in quartz could be cited. (d) Out of 78 workers engaged in a Danish factory in crushing cryolite, 40 contracted silicosis. The cryolite, as it reached the factory, contained only 3 per cent. of silica in the uncombined state. (e) Certain factories in this country have been crushing uncombined silica, in the form of quartz, for over 20 years, and have never had a case of silicosis amongst their employees. (f) No quartz-bearing rocks hitherto investigated by me are known to have given rise to silicosis-producing dust except those which also contain fibrous aggregates of sericite or fibrous silicate minerals, loosely held together and easily freed into the atmosphere when the rock is drilled and blasted. (g) Rocks which contain a relatively small percentage of quartz (well below the minimum amount in the rock types named in the Silicosis Schemes under English law) but which do contain fibrous silicate minerals such as sericite and sillimanite, as for example at Broken Hill Mines, New South Wales, produce dust that has caused a large number of silicosis cases. (h) Rocks which do not come under the category of "silica rocks," as defined in the Silicosis Scheme under English law, are known in some of the anthracite collieries of South Wales to have given rise to dust that has caused a number of silicosis cases.

(5) Asbestosis is a fatal disease caused by the fibrous mineral asbestos, which contains no silica in the uncombined form.

(6) The finer the dust in the underground atmosphere of the Witwatersrand gold mines of South Africa, either from blasting or drilling operations, the greater is the ratio of sericite fibres to quartz particles. This is true also of any rock containing quartz and sericite.

(7) The method of examining konimeter dust-spots by opaque illumination, as practised until recently in South Africa, gives results that are not only unreliable but also misleading; it is now being replaced by examination of the dust-spots under transmitted polarised light.

(8) The suggestion in the year 1928 that "powdered shale" be spread in mines to prevent the incidence of silicosis was based on the then supposed absence of silicosis in British collieries. Since 1928, however, when the Silicosis Scheme first came into operation, hundreds of cases of silicosis have been contracted in the anthracite collieries of South Wales; these collieries are notable as being amongst the driest and dustiest mines in this country, and much of the dust is from shale.

(9) It has been shown that preventive methods, such as wet-drilling and water-spraying, have not been successful in depositing the finest and most dangerous dust and in preventing the incidence of silicosis. It is suggested that the solution of the problem of prevention in the South African gold mines will be found along entirely different lines, namely, by using an apparatus (not a

clay. Now if this is so, I should expect the same thing to be true of ball clays and Cornish stone, as all are derived from decomposed granite.

Another question I should like to ask is whether it is wise to do as we have been recommended, that is, to try to substitute for flint such materials as talc, steatite, etc. It seems to me their molecules are very similar to asbestos and would penetrate the lungs in a similar manner.

One last question: sillimanite is being recommended for saggars, etc. Is there not a similar objection to this material?

Mr. V. HACKNEY:—Does Dr. Jones consider that the dust of any fired ceramic body, say brick dust, is likely to contain sericite, and thus be harmful?

Dr. A. MEIKLEJOHN:—I have listened with very great interest and pleasure to Dr. Jones's very lucid exposition of his researches and to the conclusions to which he felt inevitably impelled. So convincingly has Dr. Jones pleaded his case that I felt swept off my feet and almost inclined to say simply, "I agree," and then sit down.

Personally, we have been very interested in this work since its inception and have followed closely Dr. Jones's lectures and contributions in the scientific press. The original material for these researches was taken by us for demonstration at the Annual Meeting of the British Medical Association in London in July, 1932. Since then, through official channels and by the co-operation of local manufacturers, we have supplied further lung tissues and materials for analysis. The problem is so vitally important to us in this area that we are still prepared to obtain material to enable Dr. Jones to continue his researches and we hope that the results of his analyses shall be made available to us.

Originally it was believed that all sorts of dust could give rise to fibrosis of the lungs. It was due to the classic work of Professor E. L. Collis, culminating in his observations on the flint knappers at Brandon, in Suffolk, that free silica as the sole causative factor in the production of serious lung disease gained widespread acceptance. All was apparently well until the bombshell of asbestosis exploded. Here we had presented to us a serious and often fatal fibrosis of the lungs in which the dust was not free silica but combined silica, viz. a silicate. May I just say here that clinically, pathologically, and radiographically silicosis and asbestosis are not identical but are readily distinguished by experienced medical observers. The next phase, historically, was Dr. Jones's work on sericite. Now let us be quite clear and just as to the position taken up by Dr. Jones. Unequivocally he claims sericite as a cause of silicosis, but at the same time he admits that in some instances free silica may be the causative agent. However, there can be no doubt but that his faith is in sericite as opposed to free silica. If I might lapse into the language of the turf, Dr. Jones backs "Sericite" so

heavily for the race that he has established it a very firm odds-on favourite. But just as a "saver" he has a small bet on "Free Silica," which he considers the best outsider.

The Medical Board here in Stoke have, in their official capacity, dealt with several hundred cases of the disease in life and on the post-mortem table. We have relied on the "free silica" hypothesis and in practice have found it extremely reliable. We have never yet discovered a single authenticated case in which there was no exposure to free silica. Locally knowledge of the disease is widespread, and yet we have never discovered a single case from the Staffordshire fireclay industries, sanitary, tiles, brick, or Jet and Rockingham, and while we do not know, we presume the local clays contain abundant sericite. Dr. Jones has told us much of his investigations in this country and abroad. We would plead with him not to pursue his investigations abroad but to come to Staffordshire, where we have the finest collection of clay industries in the whole country if not in the whole world. Moreover, we have men who will be honoured to be allowed to assist him in the elucidation of the problem.

Let us now briefly examine the sericite hypothesis. In his original contribution and again referred to in the present lecture, the absence of silicosis in the Kolar goldfield was cited as one of the main props. Recently, in reply to this assertion, the medical authorities of the Kolar goldfields published in the medical press a letter stating that, after consultation with the experts of the South African Silicosis Medical Bureau, cases of silicosis do unquestionably occur in Kolar, and they even go so far as to suggest that the lower incidence of the disease there as opposed to South Africa is due to the fact that the rock contains only 5 to 20 per cent. of free silica as against 43 to 98 per cent. obtaining in the South African banket.

The next prop was the absence of the disease in the Scottish coalfield. To-night Dr. Jones has indicated that the Medical Board have certified four cases in this area. I believe five cases have been certified to date.

You will recollect that it was the terrible devastation by the disease among the ganister workers on the outskirts of Sheffield, the Outbridge, Deepcar area, which led to the first scheme for compensation for the disease in this country, viz. the Refractories Industries (Silicosis) Scheme 1919. I believe this ganister contains considerably over 90 per cent. of free silica and no sericite, but Dr. Jones asserts that, if one searches carefully, small pockets of sericite can be discovered. Whatever the truth is, I submit that the ganister crushers are exposed to a dust which is overwhelmingly free silica and only very little sericite.

Now let us consider the position in the local pottery industry. History relates that it was in the year 1720 that Thomas Astbury accidentally discovered the qualities of calcined flints and introduced this material into the earthenware paste. Previous to this