

DEPARTMENT OF EARTH AND PLANETARY SCIENCES

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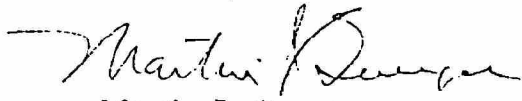
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS 02139

7 October 1972

Dear Dr. Goudie,

I am enclosing a face copy and three Xerox copies of my report on the Washington meeting, which you requested in your letter of September 25. I have also taken the liberty of including some biographical material on myself in order to strengthen your hand if it is necessary to defend the authority of some of the remarks I make concerning the results of the meeting. In particular, I would like to draw your attention to the first book I ever wrote which you will find on the last page of the biographical information. I taught this subject for perhaps 20 years, so I feel that the remarks made concerning Lewin's identification of chrysotile can be justified.

Sincerely,



Martin J. Buerger

Dr. A. L. Goudie,
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New Brunswick,
New Jersey.

J&J-0130690

JNJAZ55_000017710

In the following report (first paragraph, page 2), Professor Buerger's statement indicating the use of step scanning by Professor Gordon Brown and Colorado School of Mines Research Institute should be corrected to Johnson & Johnson and Colorado School of Mines Research Institute.

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The Washington Meeting of September 21, 1972

of

Johnson and Johnson

with the

Food and Drug Administration

and

Conclusions to be drawn from the meeting

by

Martin J. Buerger

October 7, 1972

J&J-0130692

As a preliminary to the meeting with the Food and Drug Administration, those associated with Johnson & Johnson met early on the afternoon of the previous day, September 20, in the Holiday Inn, to review their findings. The Johnson & Johnson staff included Dr. Fuller, Dr. Shelley, Dr. Rollé, Jack Sheltz and Dr. Nashed. Associates of Johnson & Johnson included Walter McCrone and Ian Stewart, Fred Pooley, Sidney Pollack, Gordon Brown and Martin Buerger. These reported to the other members of the group the results of their investigations of the purity of the talc used in the Johnson & Johnson talcum powder known as "Shower-to-Shower". The general conclusion was that none of the work revealed any trace of contamination of "Shower-to-Shower" talc by the mineral chrysotile.

The meeting of the Johnson & Johnson group with the Food and Drug Administration took place September 21, 1972, on the 6th floor conference room of 200 Avenue C, S. W., Washington D. C. It was chaired by Dr. Schaffner, who introduced, before the meeting, Messrs. Weissler, Winniger, Carolla and a number of visitors whose names were not clearly given. Professor Seymour Lewin of the Department of Chemistry, New York University, consultant to the Food and Drug Administration, was also present but was not introduced.

Dr. Schaffner asked the Johnson & Johnson group to present its findings first. Fred Pooley began by giving the results of his examination of the raw material used for "Shower-to-Shower" talcum powder. This talc is imported from a mine at Val Chisone, Italy, just north of Turin. Pooley discussed his very extensive and exhaustive tests using various techniques including megascopic identification of minerals, petrographic microscopic examination and x-ray powder diffraction study. As a result, he concluded that there was no evidence for the existence of chrysotile in any samples, even in those assembled as far back as 1949. Thus, chrysotile does not exist in the source material from which the commercial product is made.

The x-ray diffractometer work was reported independently by Professor Gordon Brown of the Department of Geology of Princeton University and by Dr. W. T. Canear of the Colorado School of Mines Research Institute.

Both used diffractometers operated in the step-scanning method. The details of their experimental work can be described as elegant and conclusive. Neither of these competent mineralogists found any evidence for the contamination of "Shower-to-Shower" talcum with chrysotile. An outline of the work which had been done under my direction using the Guinier camera was presented next. This work had shown that, if 5% chrysotile is added to a sample of talc, the contamination is easily detectable and cannot be missed. With long exposures, as little as 1% chrysotile can be detected as a contaminant. No contaminant was found in the "Shower-to-Shower" talcum.

Walter McCrone demonstrated that chrysotile can be detected at levels as low as 1% by "optical staining" techniques. With the aid of this method, he was able to certify that "Shower-to-Shower" talc contains no chrysotile.

Jack Sheltz demonstrated the power of differential thermal analysis in detecting chrysotile. That mineral produced a record which is characterized by two specific and sharp peaks by which its presence can be determined readily down to a level of 1%. Using this test, it was evident that the Johnson & Johnson product could not contain as much as 1% chrysotile.

From these several independent investigations, it was most obvious that the Johnson & Johnson "Shower-to-Shower" talcum powder was made from a mine whose product was free from chrysotile, and that, after the product was made, it was still free from chrysotile asbestos. It must be emphasized that this common conclusion was reached by half a dozen competent scientists applying the diverse tests of x-ray diffraction by three distinct techniques, petrographic-microscopic examination by two distinct techniques, and differential thermal analysis. There can be no doubt that "Shower-to-Shower" talcum as made by Johnson & Johnson is not contaminated by any appreciable amount of chrysotile asbestos.

With this background, it was a shock to hear Professor Lewin say that, while he agreed with these results, he now relied on certain optical tests which proved that chrysotile was really present in substantial quantities in "Shower-to-Shower" talcum. He then passed out to everyone in the room a set of five sheets containing 14 sequences of three pictures to support his view that he can easily detect chrysotile in certain samples.

Professor Lewin's discourse, while beautifully delivered, contained points which cannot be accepted by trained mineralogists. His identification of chrysotile is, in my opinion, based upon an application of crystal optics which takes no account of the optics to be expected of plastically deformable layer-structures such as talc and chlorite. It also ignores crystal habit, especially the well-known habit of chrysotile.

As a type example of his identification of chrysotile, Professor Lewin showed pictures of a piece of talc, immersed in a liquid whose refractive index was 1.580, and called attention to the Becke-line test of its refractive index (a) when one edge was parallel to the vibration direction of the polarizer, and (b) when that edge was perpendicular to the vibration direction of the polarizer. The longer edge of the piece displayed a refractive index less than 1.580 when the edge was in a horizontal position on the page, whereas the rest of the piece of talc showed a higher refractive index. Since a talc crystal has two of its indices, β and γ , approximately in the plane of (001), both equal to about 1.589, the talc crystal lying on the microscopic slide might be expected to display higher refractive indices than 1.580. But, Professor Lewin pointed out, one of the edges displays a lower refractive index. Ergo: the edge is not talc but chrysotile, whose refractive indices are lower than 1.580, specifically, 1.546, 1.550 and 1.557. But this deduction overlooks the well-known plasticity of talc, the very characteristic which causes it to be soft and which recommends its use as talcum powder. Any bending of the edge of a talc crystal (and this cannot be avoided in the making of a microscopic slide, and is a characteristic which is bound to be exaggerated if its existence is ignored) results in the changing of the orientation of the edge of the talc platelet which is bent, so the lower α refractive index of

1. 539 of talc begins to be displayed. Thus, talc edges are unsafe places to determine a refractive index unless it is first ascertained that the edge in question is undamaged. This applies also to the edges of upper and lower partial flakes of a talc crystal which have become bent; such bent flakes appear to lie within the crystal. To prove that an observed low refractive index is not talc, it must be shown that it is one of the principal refractive indices of chrysotile. This Professor Lewin has not done, nor did he seem to understand this objection to his identification of the bent flake as chrysotile when it was drawn to his attention. Thus, Professor Lewin has presented absolutely no proof that any chrysotile is present in any of his samples. This negative result should be compared with all the negative tests shown by x-ray diffraction, with the competent crystal-optical studies by Walter McCrone, with the results of differential thermal analysis tests, and with the fact that there was no chrysotile in the raw material as mined, to start with.

Finally, the crystal habit of the part of the preparation which shows the low refractive index does not have the well-known habit of chrysotile asbestos. This mineral is a pyrophyllite-type sheet rolled up to form a tube with neat parallel sides and, more generally, is characterized by a cylindrical contour. None of Professor Lewin's photographed items labelled "CHRYBOTILE" conform to this habit properly. In fact, his first example is so obviously a bent-edge effect that it displays its origin by the irregular black shape of the extinguished mass when the stage is at 0° and 90°. There is another edge extinguished when the stage is at 45°.

At the end of Professor Lewin's discourse, I commented on the lack of conformity of Professor Lewin's low-index areas with the known habit of chrysotile asbestos. He attempted to dodge this objection by pointing out that the compound $Mg_6(Si_4O_{10})(OH)_8$ is polymorphous, the polymorphs being known as chrysotile, antigorite and lizardite. But, of these three, only chrysotile has the form of asbestos; the other two are layer structures and without any of the habit characteristics of asbestos (chrysotile asbestos itself has three polymorphs, α , β and γ , but all are known to have the asbestos

crystal form because all are sheet structures rolled into tubes.) Layer structures which do not have crystal habits consisting of rolled-up tubes are not more injurious to health than talc itself, for it is not the chemical composition but the asbestos-form crystal habit which is injurious.

My conclusion is that no tenable evidence has been advanced to show that any Johnson & Johnson product was made with talc which contains chrysotile asbestos, and no tenable evidence has been advanced to show that the product as sold and manufactured contains chrysotile asbestos.