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INVESTIGATION OF POSSIBLE ASBESTOS CONTAMINATIONS IN TALC SAMPLES

Hutchinson Report
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SCANNING ELECTRON MICROSCOPE EXAMINATION

Specimens of powdered talc were received from Johnson & Johnson Co. and from McCrone Associates. Analysis of these samples using the scanning electron microscope was requested in order to determine the possible content of fibrous crysotile asbestos contained in the talc samples. The first lot of material examined was labeled by McCrone Associates Lewin.

The samples were mounted on one half inch aluminum electron microscope stubs with silverprint glue. The glue was first placed on the aluminum stub and the sample was then pressed to the surface of the wet silver print. A jet of pure Freon was used to remove excess talc from the surface. The specimens were then shadowed with a thin layer of carbon and gold providing a conductive path to the specimen stub. The stubs thus prepared were placed in the scanning electron microscope which was operated at 20 kilovolts electron beam energy and were examined at magnifications between 20 and 25,000 times. The initial effort was directed toward detection of the presence of fibrous morphologies in the basically sheet structured talc bodies. To this end crysotile asbestos specimens were prepared as outlined above and observed in the S.E.M. as illustrated in Figure 1.

To be noted, of course, is the highly fibrous structure as opposed to the layered structure of the talc bodies. The asbestos fiber can be seen to shred both at the ends and on occasion at the center of a fiber bundle giving an appearance not unlike rope but on a much magnified scale.

Having established the general appearance of asbestos, suitable samples were selected for examination in a scanning electron microscope. A magnification of 1,000 times seems quite adequate to pick up any appreciable fibrous morphology present within the talc sample. In order to make the survey as quantitative as possible, a grid of pictures was mapped on the surface consisting of five pictures on each side of

a square covering thus 25 squares at 1,000 times magnification. Numerous fibrous structures were observed during this examination of both the original Lewin material and the Shower to Shower material supplied by Johnson & Johnson. Examples of these micrographs are shown in the following figures. Figure 2 shows one such fibrous material which is in fact split on the end and is generally within the limits of possible diameter of an asbestos fiber. The general character of the split at the end, however, rather than being shredded, gives a somewhat more solid appearance indicative of an organic fiber such as wood. Figure 3 shows an area at the center which may possibly indicate an asbestos structure. Slight differences in character, however, exist. Although the rough appearance of this body is shredded, careful examination indicates that it is more than likely an edge on view of a talc structure.

Figure 4 shows another such structure. In addition, however, at the center of the micrograph indicated by the arrow, is a small broken fiber which is too small to identify for certain as either talc or asbestos. Other such examples are seen in Figures 5 and 6. These may probably be discounted on the basis of their very short length. One such fiber which is sufficiently long to be suspect is seen in Figure 7, taken at 500 times magnification. These are, however, seldom encountered. Figure 8 and 9 show higher magnification pictures of such fibers taken at 5,000 and 10,000 times respectively. These cannot be entirely discounted although the net volume involved, even if they are asbestos fibers, is extremely small.

Figure 11 shows an example in the lower right hand corner of a fiber which is almost certainly wood. Asbestos cannot possible take such a small radius of curvature without being entirely shredded. One rather curious fiber found during this investigation is shown in Figure 12. It is roughly the proper size and length but shows a most curious end structure. This is more than likely a talc body which has encountered an on endcollision and become shredded during its processing. No evidence of microstructure indicative of asbestos was found.

CHEMICAL EXAMINATION OF FIBERS

Considering that little could be categorically determined to be asbestos in the material based solely upon morphology, efforts were made to use microchemical analyses of such fibers in the scanning electron microscope. These efforts involve the use of a non-dispersive X-ray detector, which analyzes the X-rays energy resulting from electron beam impingment. Areas as small as a 1,000 Angstrom fiber can be analyzed under suitable conditions. Figure 15 and 16 show traces of an oscilloscope picture in which the energy of X-rays is displayed along the horizontal scale and the number of X-rays arriving at the counting detector is displayed on the vertical scale. In Figure 15 an asbestos fiber was used as an object for X-ray analysis by reducing the electron scan image to a line which was aligned along the asbestos fiber. The asbestos fiber was imbedded in the talc matrix and was in fact part of the doped specimen. A number of elements can be identified from this trace. The ones which are certain to be part of the specimen itself rather than artifacts of the instrument are magnesium and silicon. This pattern was used as a standard and compared to other counts taken from suspect fibers in other fields of view. Efforts were made to maintain the geometry the same as that in the standard. An example of such an effort is seen in Figure 16. No strong similarities could, however, be shown in any fiber sample.

TRANSMISSION ELECTRON MICROSCOPY

Considering the lack of success in obtaining definitive results by scanning electron microscopy transmission electron microscopy was tried. Specimens were mounted by standard techniques of swirl dispersion on electron microscope grids covered with a formvar film. A large number of grids were examined and numerous examples of fibrous material were seen. Of the large number of grids examined, three examples of fibers which upon examination by electron diffraction could be classified as likely candidates for crysotile asbestos in the shower to shower material and one example was found in the Lewin material. These are shown in Figure 16, 17, 18

and 19. In Figures 17a and 18a, electron micrographs of the transmission type show the typical stranded appearance of crysotile asbestos. In each case, Figures 16 through 19, the diffraction pattern is closely similar to that indexed for crysotile asbestos. Figure 18a is a double exposure of the diffraction pattern and the bright field micrograph. In order to avoid confusion as to the area used in diffraction, the bright spot at the center of the micrograph is a delineation of the area used in diffraction. The diffraction pattern, however, is rotated by roughly 40° from the axis of the specimen. It is felt therefore that crysotile asbestos does exist in the specimens of shower to shower and Lewin supplied to this laboratory. It is, however, further concluded that, on the basis of samples supplied to us, transmission electron microscopy can only find a total material by volume of less than 1/100 of 1 percent crysotile asbestos in the shower to shower material and less in the Lewin material.

CONCLUSIONS

The extensive investigation reported here must conclude that the scanning electron microscope by itself is unable to make distinctions between asbestos fibers within samples of talc and other such fibers of wood, wool, and talc fibers. Only the shredded appearance (not found in any specimen examined other than that purposely doped with asbestos) is the sole basis for assuming the existence of asbestos in the specimens. Efforts to use non-dispersive X-ray detection yielded a negative result, and could not be used as well. Transmission electron microscopy shows less than 1/100th of 1 percent asbestos in the material given to us. Neither scanning microscopy alone or in conjunction with microchemical analysis can be reasonably expected to prove the existence of crysotile asbestos in talc.

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