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6 McDonald JC, McDonald AD, Armstrong B, Sébastien P. Cohort study of mortality of vermiculite miners exposed to tremolite. Br J Ind Med 1984;41:43-44.

Authors’ reply

Case informs us that we “read the publications selectively”; we do not, but we try to base our opinions on well designed and carried out studies rather than on whim. Case poses three questions and then, in a series of ex cathedra pronouncements, answers them all. The first asks whether “non-asbestiform fibres can unambiguously be identified to the satisfaction of experts and regulators.” We are informed that such fibres can be identified with certainty by most competent mineralogists and geologists of which there was only one on the American Thoracic Society (ATS) Committee.1 His major interest has been measuring asbestos in the air. Your correspondent also gratuitously informs us that Abraham, Churg, and Sebastien have independently showed that “long thin high aspect ratio tremolite fibres are unequivocally present in some play- sands.” Abraham and Churg, although competent pathologists, have no geological expertise and most of Sebastien’s research has not been in this area. Case then quotes Pooley as stating that “differences in structure between massive acicular and fibrous morphology are not sharply defined, but rather represent points on a continuum” thereby implying that non-asbestiform fibres cannot be identified with certainty. He omits to mention that in the same publication Pooley wrote that “the particles produced from non-fibrous forms of these minerals, i.e. tremolite, actinolite, and anthophyllite, are often referred to as cleavage fragments and are quite distinct from a similar sized group of asbestos particles.” Selective or defective reading? Pooley and other expert mineralogists have subsequently voiced the same opinion elsewhere3 as has Schenk et al.4

Case goes on to state that for regulatory and health assessment purposes it is microscopical morphology that counts as potentially affected cells cannot distinguish between asbestiform and non-asbestiform fibres. We would suggest that this is not so and clear cut animal evidence exists to disprove this statement. Indeed, Stanton, in his animal experiments with various talcs was unable to induce tumours.5 Case states that six of the seven samples of talc injected contained no fibres in the Stanton range at all. He then goes on to say that the exact make up, sources, and preparation methods for these samples is unknown. He is wrong on several counts. Stanton et al in their paper state that each fibre used was from a separate and diverse source and selected to include extreme ranges of dimension.6 Moreover, the identity of each talc was made available to Ann Wylie, Professor of Geology, University of Maryland, and, furthermore, she was given access to all of Stanton’s mineral samples. The sources of the two tremolite asbestos samples were, however, unknown.7 As to whether affected cells can distinguish between asbestiform and non-asbestiform tremolite, although we are not experimental pathologists, we would also call the attention of Case to the studies of Endo-Capron et al who suggest otherwise.8

We are aware that talc is fibrogenic and can lead to pneumoconiosis, but the fact remains that talc is much less fibrogenic than amphibole types and, moreover, is non-carcinogenic. Case refers to studies of vermiculite, but omits to mention that the vermiculite in question was contaminated with asbestiform tremolite; a fact of which both of us were well aware since one of us was a coauthor of a paper relating to this topic9 and which was referred to in the ATS statement.10 Moreover, to compare present day exposures to talc with those that occurred in Merewether’s day when threshold limit values (TLVs) did not exist, and when dust counts in those exposed to talc were around 100-150 million p/cu ft suggests either startling naive or lubricious tendentiousness. According to Case the most important question that remains unanswered is “do non-asbestiform fibres lack biological effects?” Presumably, the question applies to non-asbestiform tremolite and other cleavage products, although this is not obvious from his letter. Clearly, such fibres have biological effects and indeed may produce fibrosis of the lung when inhaled as contaminants of talc and in concentrations way above the present TLV. The relevant question, however, is are they carcinogenic? In this regard talc has long been used as a means of inducing pleurodesis. In 210 subjects in whom direct application of talc and another phyllosilicate to the pleura was effected to prevent recurrent pneumothorax there was no increased incidence of either lung cancer or mesothelioma.9 Thus the overwhelming evidence is that non-asbestiform cleavage products contained in talc are non-carcinogenic and they should not be treated as if they are. We are also told in passing that the decision of CPSC was based on a narrow interpretation of the law. Are we to assume that broad and sweeping generalisations are preferable, especially when applied to specific circumstances and to specific hazards?

Next we note with interest that the second reference to Addison’s and Davis’s studies relates to a meeting that recently took place in New York.10 In referring to this work, Case writes “that the one tremolite characterised
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before the experiment as fibrous (spicules) but not asbestiform, ultimately produced mesothelioma in 70% of the animals.7 The investigators themselves did not say this "fibrous" tremolite was non-asbestiform! They then went on to write that "these findings could indicate that the cleavage fragments of tremolite have little carcinogenicity, but that their recognition and separation will need carefully considered criteria." Such criteria exist. It is perhaps germane that over 60% of those attending this meeting were claimants' lawyers or their retinue, many of whom earn between $1 and $20 million a year on a contingency basis. Moreover, it also came to light that the sum of $40,000 from the claimants' lawyers' litigation escrow account found its way into the coffers of the organizers of the conference, thereby ensuring that the organizers were in a position to invite those scientists who shared their viewpoint.7 Certain of the investigators at the conference had been receiving payment from plaintiff's lawyers for the express purpose of screening asbestos exposed workers and then directing any worker with alleged asbestosis to the lawyer's paralegal who was in attendance and who would then offer the lawyer's services on a contingency basis.

Finally, your correspondent is under the impression that we used the word "tergiversate" as an alternative "to use subterfuge". The Oxford English Dictionary, which we trust needs no reference, gives five alternative meanings of which "to use subterfuge" is the fifth. "Tergiversate" is derived from tergum or back, and verte to turn; hence, to turn one's back. We were implying that the US Occupational Safety and Health Administration was turning its back on scientific evidence, but perhaps Case is correct and in reality they are resorting to subterfuge.


On talc, tremolite, and tergiversation

Sir,—Reger and Morgan (1990;47: 505-7) addressed an important issue regarding the health effects of the mineral tremolite asbestos. Just what is tremolite asbestos?

The definition of asbestos used by the United States Occupational Safety and Health Administration (OSHA) is one that OSHA made up itself. At the time, little notice was given to the change due to OSHA not specifically indicating its intention to redefine asbestos. The OSHA has argued, with the support of its research advisory group, the National Institute for Occupational Safety and Health (NIOSH), that it had always intended to include elongated cleavage fragments of three of the five regulated amphibole asbestos minerals under the asbestos standard. Recently OSHA has proposed removing non-asbestos tremolite, actinolite, and anthophyllite from the standard. The rationale and limitations of this argument have been described by Reger and Morgan elsewhere.7

By redefining asbestos, OSHA/NIOSH broke with mineralogical science. Their definition became known as the federal definition. Elongated cleavage fragments, using both the methodology and definition required by OSHA statute, became known as federal asbestos fibres or federal fibres. Perhaps it should have been referred to as the OSHA/NIOSH definition because other federal agencies in the United States (Environmental Protection Agency, Consumer Products Safety Commission, and the Mine Safety and Health Administration) either do not follow this definition or have not adopted it. Mineralogical science does not even define these elongated cleavage fragments as fibres. The company mining and producing tremolitic tcalc, referred to by Case, found that their tremolitic tcalc, using the OSHA definition, contained tremolite asbestos rather than the cleavage fragments that their mineralogists said were present. This helps explain their keen interest in definitions.

The most significant determination, for the health hazard evaluation of a tremolite specimen, is if, by mineralogical criteria, the specimen is asbestos. Exposure to tremolite in this form should be rigorously controlled as one would control exposure to any other amphibole asbestos mineral.7 If the tremolite specimen is found by mineralogical criteria to be non-asbestos, by careful analysis using transmission electron microscopy the specimen will be found to contain a few hundred ppm elongated cleavage fragments. Some may have similar lengths and widths as asbestos fibres. Populations of elongated cleavage fragments will have a greater variation in diameter as a function of length than asbestos, tending to have lower aspect ratios. Those visible using a phase contrast microscope (at a magnification sufficient to provide resolution of ~0.5 μm) that are >5 μm in length and possess a 3:1 aspect ratio are "OSHA/NIOSH asbestos fibres." Mineralogically these "fibres" are not asbestos and we support the conclusions of Reger and Morgan that no data exist to show that non-asbestos tremolite possesses the same pathogenic properties as asbestos. In fact, the biological data available support the significance of the mineralogical distinction.

With the methodology used by OSHA to monitor the occupational environment, phase contrast microscopy, the analyst cannot readily dis-