Review Article

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The Biology of Cleavage Fragments: A Brief Synthesis and Analysis of Current Knowledge

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Key Words

Amphibole • Chrysotile • Cleavage fragment • Biopersistence • Animal studies • *In vitro* studies

Abstract

Asbestos is a commercial term referring to 6 fibrous minerals from 2 mineralogical classes: serpentine and amphibole. Chrysotile, or white asbestos, is the only serpentine mineral. The asbestiform habit of amphibole asbestos is far more toxic than chrysotile. However, most amphibole minerals are found in the "non-asbestiform" state that pose few, if any, health risks. Comminution, whether deliberate during crushing or grinding, or incidental in usage may produce structures known as "cleavage fragments" from a wide variety of sources. A considerable body of evidence, gathered over the last 30 years, demonstrates that amphibole cleavage fragments do not show the same toxicity as their asbestiform analogues. Since there still continues to be confusion and controversy on this point, this review is aimed at resolving a major portion of this controversy. It has done so by bringing together the supporting mineralogical, animal and human evidence from many sources. These observations demonstrate that cleavage fragments and amphibole asbestos fibers have fundamentally different properties and these differences are biologically relevant. Indeed, the toxicity of respirable cleavage fragments is so much less than that of the fibrous amphiboles that by any reasonable measure they are not biologically harmful.

Introduction

Asbestos is a commercial term referring to 6 fibrous minerals from 2 mineralogical classes: serpentine and amphibole. Chrysotile, or white asbestos, is the only serpentine mineral. As fibrous asbestiform minerals amphiboles are far more toxic than chrysotile (see Ilgren and Chatfield for review) [1]. However, most amphibole minerals are found in the "non-asbestiform" (non-fibrous) state that pose few, if any, health risks [2]. Amphiboles may be associated with a variety of very common industrial minerals such as serpentine, talc, vermiculite and certain marbles [3,4], and may also be a component of many rocks used as aggregate, road stone, or building materials [5]. Comminution, whether deliberate during crushing or grinding, or incidental in usage may produce structures known as "cleavage fragments". Some elongated cleavage fragments are difficult to distinguish from amphibole asbestos fibers using counting criteria routinely employed for regulatory purposes. It is very

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