International Geology Review, 52: 955-963 (2010)
International Geology Review

Restrictive definition of asbestos and the assessment of potential health hazards: insights from Northern Chile

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(*Accepted 6 July 2009*)

When asbestos fibres become airborne, they can be inhaled into the lungs, where they may cause significant health problems. The latter includes progressive pulmonary fibrosis (asbestosis), pleural disease (effusion and pleural plaques) and malignancies such as bronchogenic carcinoma and malignant mesothelioma. The term asbestos applies to a group of hydrated fibrous mineral silicates including those belonging to the serpentine group of phyllosilicates (chrysotile) and amphiboles. However, only the 'asbestiform varieties' of amphiboles such as grunerite (amosite), riebeckite (crocidolite), anthophyllite, tremolite and actinolite are regarded as asbestos (*s.s.*). This implies that 'non-asbestiform varieties' of such minerals, that nevertheless generate acicular cleavage fragments, cannot be regarded as asbestos *s.s.* We argue that a discussion on the term asbestos goes beyond mere semantics, because for environmental regulatory bodies, the definition of a term can make the difference between classifying a mineral as harmful or non-harmful. A case of mesothelioma in the small mining town of La Higuera, northern Chile, may shed some light into this matter, because this form of cancer is almost always caused by exposure to asbestos. The town hosts about 20,000 t of fine-grained tailings left behind after flotation of Cu sulphides during 1950–1979. The ore was extracted from actinolite-rich, copper-iron vein deposits. We show that, if a 'non-asbestiform variety' of amphibole (e.g. La Higuera actinolite) is finely ground, it will cleave to asbestos-like acicular crystals and as such has the potential to induce similar health hazards to those posed by asbestos (*s.s.*).

Keywords: asbestiform amphibole; actinolite; mesothelioma; mining; La Higuera; Chile

Introduction

A major problem with viruses and antibodies is that the latter will not recognize the former as a harmful pathogen unless they have detailed information regarding that specific strain. We consider that the same can be applied to the world of environmental mineralogy regulatory bodies (either national or regional). The term asbestos raises universal concerns, but what is the difference between asbestos and asbestiform particles? Do non-asbestiform

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ISSN 0020-6814 print/ISSN 1938-2839 online

DOI: 10.1080/00206810903211278
http://www.informaworld.com