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Quantitative determination of chrysotile in massive serpentinites using DTA: Implications for asbestos determinations

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Abstract

There is increasing concern about the health hazard of asbestos from natural geologic deposits such as greenstones [natural occurring asbestos (NOA)]. Therefore, quantitative determination of the chrysotile asbestos content within massive serpentinites is a recurrent requirement of recent asbestos-inherent law regulations, due to the possible health hazard associated with the release of chrysotile fibers. Unfortunately, the obtainment of accurate and precise quantitative figures of the actual chrysotile content is strongly complicated by typical serpentinite textures, consisting of fine-to-ultrafine intergrowths of fibrous and non-fibrous serpentine minerals, often difficult to identify by conventional methods, such as X-ray diffraction or microanalytical approaches.

In this paper, we propose a reliable and straightforward method for the quantitative determination of chrysotile asbestos within bulk massive serpentinites, based on thermal analysis data and, specifically, on the distinctive thermal behavior of chrysotile, lizardite, and antigorite during dehydroxylation at 500–800 °C. Deconvolution processing of DTA endothermic signals in the dehydroxylation temperature range revealed good linear correlation between peak area ratios and chrysotile content, for both lizardite + chrysotile and antigorite + chrysotile samples. The DTA correlation curves have been used to determine the chrysotile content in two test serpentinites, revealing surprisingly high-chrysotile content. This novel method is of vast importance as it represents one of the most promising tools for chrysotile quantitative determinations in massive serpentinites, providing unbiased and accurate responses to recent asbestos-related law requirements.

Keywords: Chrysotile, asbestos, massive serpentinite, thermal analysis, quantitative determination