

X-RAY CRYSTALLOGRAPHIC STRUCTURE OF MINERALS RELATED TO ASBESTOS

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The crystal structures of the two main asbestos-forming minerals, the amphiboles and serpentines, are surprisingly very different. The amphiboles are "chain silicates" in which SiO_4 tetrahedra are linked to form bands four tetrahedra wide and of very great length. These bands run parallel to the asbestos fiber axis and are linked laterally by cations, mainly Ca and Mg in tremolite; Na, Mg and Fe in crocidolite; Mg and Fe in amosite and anthophyllite. The tempting correlation of the chain unit of crystal structure with asbestiform nature is, however, too facile. Many amphiboles are not asbestiform, and as the serpentine minerals show, some asbestiform minerals do not have a chain structure.

The serpentine minerals are "layered silicates" in which SiO_4 tetrahedra are linked to form thin sheets of great lateral extent. The tetrahedra all point in the same direction and their apical oxygens are part of an $(\text{O},\text{OH})\text{-Mg-(OH)}$ sheet which is itself formed by $\text{Mg-(O},\text{OH)}$ octahedra. Thus the fundamental serpentine layer is polar and has a tetrahedral and octahedral component. The mismatch in dimensions of these two components generally leads to curvature of the layers and in chrysotile asbestos the layers form either scrolls or concentric cylinders with very high length/breadth ratio and with length parallel to the fiber axis. Other forms of serpentine, however, with chemistry very similar to that of chrysotile do not exhibit asbestiform morphology.