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A perspective multidisciplinary geological approach for mitigation of effects due to the asbestos hazard

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Asbestos-bearing rock sequences constitute a remarkable natural hazard that poses important threat to human health and may be at the origin of diseases such as asbestosis, mesothelioma and lung cancer). Presently, asbestos is classified as Category 1 carcinogen by world health authorities. Although regulatory agencies in many countries prohibit or restrict the use of asbestos, and discipline the environmental asbestos exposure, the impact of asbestos on human life still constitutes a major problem. Naturally occurring asbestos includes serpentine and amphibole minerals characterised by fibrous morphology and it is a constituent of mineralogical associations typical of mafic and ultramafic rocks within the ophiolitic sequences. Release of fibres can occur both through natural processes (erosion) and through human activities requiring fragmentation of ophiolite rocks (quarrying, tunnelling, railways construction, etc.). As a consequence, vulnerability is increasing in sites where workers and living people are involved by dispersion of fibres during mining and milling of ophiolitic rocks.

By analysing in the field different exposures of ophiolitic sequences from the Italian peninsula and after an extensive review of the existing literature, we remark the importance of the geological context (origin, tectonic and deformation history) of ophiolites as a first-order parameter in evaluating the asbestos hazard. Integrated structural, textural, mineralogical and petrological studies significantly improve our understanding of the mechanisms governing the nucleation/growth of fibrous minerals in deformation structures (both ductile and brittle) within the ophiolitic rocks. A primary role is recognised in the structural processes favouring the fibrous mineralization, with correlation existing between the fibrous parameters (such as mineralogical composition, texture, mechanics characteristics) and the particles released in the air (such as shape, size, and amount liberated during rock fragmentation). Accordingly, we are confident that definition of an analytical protocol based on the geological attributes of the asbestos-bearing rocks may constitute a propaedeutical tool to evaluate the asbestos hazard in natural environments. This approach may have important implications for mitigation effects of the asbestos hazard from the medical field to the engineering operations.