Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18367

A reconsideration of the hazard connected to exposure to cristobalite dusts

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The long-lasting investigation on the health effects due to exposure of crystalline silica respirable dusts has determined a huge improvement in the knowledge of the specific features able to determine these effects as a variable entity. The molecular and mechanistic foundations of the crystalline silica toxicity have been explored both under controlled laboratory conditions and directly in occupational settings, so as to allow close comparisons between model and actual exposure conditions.

By far, this research has been focused on quartz, the most abundant and ubiquitous silica polymorph (even in the occupational context) while only side research has been carried out on cristobalite, the other natural polymorph having distinctive economic interest. This latter had been the object of relevant interests in the occupational settings connected with the calcination of diatomaceous earth.

This study provides a state-of-the-art review on the characteristics of the cristobalite dusts in the occupational settings, in relation to some recent traced epidemiological clusters of silica-related diseases. The aim of this work is the comparison of the results from experimental studies carried out in different contexts where cristobalite is used as raw or byproduct material in industrial production processes. Four different case studies (gold micro-casting, raw materials for artificial stone production, stone workshops, dental alginates production) were investigated by means of in-depth XRD, SEM, TEM, and spectroscopic investigations, evidencing both relevant specificity for each production process and some common features among these different occupational settings. The results suggest that also the toxicological effects of cristobalite should be sought in the organisation of the surface structural terminations (i.e. the nearly free silanols that act as toxicological primer for quartz), in close relationship with the diffused structural defectivity observed in all industrial cristobalite materials.