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Erionite and other fibrous zeolites in volcanic environments: the need for a risk assessment in Italy

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In many European countries in the ’90s there was a significant increase in mortality linked to mesothelioma, a cancer of the lung, involving pleural, pericardial and peritoneal mesothelial cells, which unfortunately has no cure at present. Though most of these cases have been attributed to t asbestos, in Italy at least 17% of cases of mesothelioma is still not fully explained. In the years between 1990 and 2000, it was discovered that the inhalation of erionite fibers (a zeolite group mineral, that can be found in altered volcanic rocks) was the cause of a regional epidemic of mesothelioma in some villages of Cappadocia (Turkey). Erionite, in fact, was recently included in Class 1 (highly carcinogenic) by the World Health Organization, up to 800 times more carcinogenic than asbestos; on the other hand, little is known about the toxicity of other fibrous zeolites, commonly intergrown with erionite, such as offretite and mordenite. Erionite was reported in different regions of Italy; nevertheless, a systematic mapping of its distribution, the quantification of its presence in rocks and data about airborne fibers are still missing. We carried out first preliminary sampling in Veneto, in Tertiary volcanic rocks, mainly hydrothermally altered basalts. The first mineralogical investigations by means of XRPD, SEM-EDS and OM confirmed the presence of small amounts of erionite and abundant fibrous offretite, in vugs of basaltic rocks. Intergrowths and overgrowths with other fibrous minerals are quite common, and the morphological-chemical similarities among these zeolites pose a special analytical problem, with the need of combining different techniques. Our first findings, combined with the fact that zeolites are important industrial minerals, emphasize the need of a risk assessment in Italy and Europe, because there are no systematic studies on the distribution of erionite or similar fibrous zeolites in the environment. The knowledge of the epidemiology of mesothelioma linked to erionite in Italy is extremely scarce: INAIL, through its database of occupational diseases, can provide essential information for epidemiological research. An effective risk assessment in Italy will require coordinated actions from government agencies, local health authorities, Universities and research centers, in order to record the actual presence of fibrous zeolites, recognizing mineral species and quantifying their abundance in rock deposits. The different geological conditions through time of volcanic deposits will be compared with an updated "database" on the physical-chemical-geological conditions of formation of zeolites. In sites where the presence of fibrous zeolites has been validated by laboratory tests, we will proceed with accurate field surveys and sampling campaigns, in order to determine detailed geological-stratigraphic and structural features, and resolving precisely the thickness, areal extent and volume of lithostratigraphic units containing these minerals. These data will be entered into a GIS to produce a result that can be used immediately and in the long-period by research institutes, local authorities and regional agencies for environmental protection. In sites where the presence of hazardous fibrous minerals has been validated, we will plan airborne fibers sampling campaigns, and we will assess the extent of airborne dispersion produced by natural agents and by man activity. In the case that these sites host active mining or quarrying activities, we will quantify the airborne fibers contamination at workplaces and propose measures for environmental risk mitigation.