MINERALOGICAL AND ENVIRONMENTAL STUDY ON SERPENTINE AND AMPHIBOLE ASBESTOS IN THE PARÂNG MOUNTAINS, ROMANIA

TOPA, B.A.[1]*, TÓTH, E.[2] & WEISZBURG, T.G.[1]
[1] Department of Mineralogy, Eötvös Loránd University, Pázmány Péter sétány 1/C, H-1117 Budapest, Hungary
[2] Eötvös Museum of Natural History, Eötvös Loránd University, Pázmány Péter sétány 1/C, H-1117 Budapest, Hungary
* E-mail: topabogi@gmail.com

The term asbestos is used for fibrous minerals that have been widely used in industry due to their special properties. It is a natural nanomaterial – a single fibre often has a diameter of only a few 100 nm. These fibres easily become airborne and respirable, and the inhalation of asbestos fibres in large quantity poses a serious risk to health. That is why the use of asbestos is now forbidden in most developed countries and asbestos is being removed from the built environment. Asbestos gained a regulatory definition (morphological and mineralogical criteria), enabling this way the measurement of its concentration in the main exposure medium (air) and the establishment of permissible exposure limits.

Being a morphological variety of certain minerals, asbestos surrounds us not only in our built environment, but also in nature. Natural asbestos occurrences can also be health risk sources, depending on a number of factors, including the size of the outcropping area, the probability of dust formation and the human presence.

We studied three, partly natural, partly artificial outcrops in the northern part of the Southern Carpathians, Romania, to assess their potential health risk. The first two localities are next to the Transalpina road (DN 67C), crossing the ridge of the Parâng Mountains, to the north of the peak Urdele. Recent road constructions have made these natural outcrops easily accessible by car. By cutting through the metamorphic (serpentinite, amphibolite and chlorite schists) rocks on the upper part of the ridge, the asbestos-bearing rocks got more exposed and their erosion rate increased. The first studied locality is the few 100 meters long road cut itself, a favourite break place of increasing transient tourism, the second is a nearby waterfall. The third occurrence is next to a dirt road in the valley of the Polatiştea River (tributary of the Jiu River), with similar rock types.

Following macroscopic observations in the field, samples were taken from the exposed and eroding rock veins, composed of white or green, lath-shaped and fibrous minerals, that were either perpendicular (cross-fibre) or parallel (slip-fibre) to the plane of the veins. Loose white filament bundles from the roadside and soil samples (with whitish fibres) near the waterfall have also been sampled. Air sample was taken on a gold-coated filter next to the uppermost exposure, where respirable dust formation is highly probable due to the open, almost always windy location and the presence of loose fibre bundles. Being at the same time a tourist outlook area, this location is supposed to carry the greatest health risk (by the inhalation of asbestos fibres).

We used X-ray powder diffraction (XPD) and scanning electron microscopy (SEM+EDX) for the qualitative phase analysis, and SEM to study the micromorphology of the selected minerals and soil aggregates. Airborne fibre concentration was quantified by SEM+EDX.

The collected white fibrous material is tremolite (with varying iron content), with many fibres fitting the legal asbestos size-range (illustrations are given in TÓTH & WEISZBURG, 2012). Other dominant phases of the samples are serpentine group minerals (antigorite, lizardite). Antigorite laths are in the asbestos range, too, and although it is not classified as asbestos by law, it may carry health risk (CARDILE *et al.,* 2007).

Air asbestos concentration was calculated two ways: if only legal asbestos (tremolite) is considered, airborne asbestos concentration is 17.5 fibre/dm^3, if also serpentine fibres are counted, the concentration is 35 fibre/dm^3. Both fibre concentrations exceed the current Hungarian environmental background (1 fibre/dm^3) and indoor asbestos clearance control limits (10 fibre/dm^3). It means that asbestos exposure is too high here for permanent living and/or working. For tourists driving through the transalpine road and stopping for a few minutes to enjoy the panorama, these outcrops are not regarded as major health risk, as exposure to asbestos dust is short. However, the paved road is getting more popular among cyclists, who inhale very intensively, thus sampling the air more efficiently and for longer time than motorised tourists. An additional risk may be associated with future permanent buildings (restaurant, hotel *etc.*) on the pass, therefore, coverage of the most asbestos-rich rock surfaces might prove useful. For better health risk assessment, the application of TEM is suggested to better discriminate between the serpentine minerals in air samples of mineralogically complex natural environments.

References

CARDILE, V., LOMBARDO, L., BELLUSO, E., PANICO, A., CAPELLA, S. & BALAZY, M. (2007): International Journal of Environmental Research and Public Health, 4(1): 1–9.

TÓTH, E. & WEISZBURG, T.G. (2012): Acta Mineralogica-Petrographica, Abstract Series, 7: this volume.