Characterization of sources of inhalable particulate matter (PM_{10}) in the old processing and smelting site of Lavrion, Greece

N. SKARPELIS*, A. ARGYRAKI AND A. GRYPIOTI

Department of Economic Geology and Geochemistry, University of Athens, 15784 Athens, Greece (*correspondence: skarpelis@geol.uoa.gr)

In Lavrion, after the re-opening of the mines in 1864, gravity separation and flotation processing of Pb-Ag-Zn ore, calamine calcination, and smelting of ancient slags and galena concentrates resulted in large stockpiles of wastes causing severe impact to the environment. Most of the stockpiles and the heaps of slag still remain uncovered and exposed to weathering. Mineral grains are thus easily dispersed in the urban area as a result of a wind-induced process.

In this study the mineralogy of dust grains collected on air filters by using portable air pumps exposed for 8 hours as well as dust samples collected from outdoors flat surfaces within the Lavrion urban area was studied by means of X-ray diffractometry (XRD) and Scanning Electron Microscopy (SEM/EDS). The mineralogy of mineral waste, flotation tailings and slag stockpiled in the surrounding area was also investigated for comparison. The amount of Total Suspended Particulates (TSP) was below 200 μg/m^3 for the particular days of sampling and the mineralogy of the PM_{10} grains collected on the air filters is similar to that of dust. The PM_{10} fraction of the dust is dominated by grains of carbonates (mainly calcite, Mg-calcite and dolomite), quartz, muscovite, chlorite and fluorite, originating from the dumps of the gravity separation mineral waste. Minor grains of a Pb-arsenate, a glassy Fe-Ca-Al-silicate slag phase high in Zn and Pb, and grains of a non-stoichiometric association of Fe-Pb-As and Pb-As elements (possibly a variety of mimetite) were identified. Lead minerals (cerussite, anglesite and plumbojarosite) are rarely found in most samples. Chemical analysis on the < 75 μm grain fraction of outdoors dust samples yielded very high Pb, As, Cd, Ni, Cu, Zn, Fe, Mn, and Sb concentrations.

The results highlight the importance of inhalable dust as an exposure medium threatening the health of Lavrion population. Since it was proved that, for the mineral waste produced by gravity separation processing, the contamination of groundwater is not a major concern, surface low-cost covers and armor stone at the slope face of the piles could be used for significant reduction in public health hazards.

Microbial respiration at sub-zero temperatures in laboratory ices

MARK SKIDMORE[1], CORIEN BAKERMANS[1], TIM BROX[1], BRENT CHRISTNER[2] AND SCOTT MONTROSS[1]

[1]Department of Earth Sciences, Montana State University, Bozeman, MT 59717, USA (skidmore@montana.edu)
[2]Department of Biological Sciences, Louisiana State University, Baton Rouge, LA 70803, USA

Basal ice from glaciers and ice sheets contain gas (CO_2, N_2O, CH_4) concentrations elevated above atmospheric. These data suggest potential biogenic gas production at sub-zero temperatures in the basal ice. Theoretical calculations indicate that the aqueous veins that exist between ice crystals provide a microbial habitat within the ice. Further, viable bacteria have been recovered from both meteoric glacier ice and debris rich basal ice in numerous locations worldwide. We are developing a simple laboratory model to extend knowledge about the effect of microbial activity on CO_2 concentrations in ice matrices using two bacterial isolates from Antarctic ice. We report on the respiration of ^{14}C-acetate at sub-zero temperatures by the isolates in our laboratory ices, and the physical environment of the aqueous veins.