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The effects of water rock interaction and the human activities on the occurrence of hexavalent chromium in waters. The case study of the Psachna basin, Central Euboea, Greece.

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High concentrations of heavy metals, particularly of the toxic hexavalent chromium, are recorded in surface and ground waters in many areas, and constitute one of the most severe environmental problems nowadays. The natural genesis of chromium is associated with the geological environment (peridotites and serpentintites). Chromium is structured in many minerals, mainly in spinel (e.g. chromite), in silicate minerals such as phyllosilicate serpentine minerals, chlorite, talc and chain-silicate minerals of pyroxene and amphibole group. Chromium is found in two forms in soils, waters and rocks, the hexavalent and the trivalent one. The relation between Cr(III) and Cr(VI) strongly depends on pH and oxidative properties of the area; however, in most cases, Cr(III) is the dominating variant. The natural oxidation of trivalent to hexavalent chromium can be achieved by manganese oxides, H_2O_2, O_2 gas and oxy-hydroxides of trivalent iron. Anthropogenic factors may also cause the process of chromium's oxidation.

In the Psachna basin, Central Euboea, Greece, high concentrations of hexavalent chromium were recently measured in spring- and drill- waters. In this work, we study the effect of the geological environment and of the anthropogenic activities on the water quality with emphasis on chromium. A detailed geochemical, petrological and mineralogical study of rocks and soils was carried out by means of optical microscopy, XRF, XRD and SEM/EDS. Ground and surface water samples were physically characterized and hydrochemically studied by means of ICP and AAF.

Combined result evaluation indicates a natural source for the trivalent chromium in waters, attributed to the alteration of Cr-bearing minerals of the ultramafic rocks. However the oxidation of trivalent to hexavalent chromium results from anthropogenic activities, mainly from intensive agricultural activities and the extensive use of fertilizers and pesticides causing nitrate pollution in groundwater. It has been shown that there is a strong correlation between the nitrate concentration and the hexavalent chromium one; therefore it is believed that the presence of nitrates operates as oxidant for trivalent to hexavalent chromium. On the contrary, in natural areas, without anthropogenic activities, it was observed that the hexavalent chromium concentration in groundwater is lower. Besides, a strong correlation was also observed between chromium and yttrium concentrations in natural areas, pointing to a natural source of chromium, since chromium and yttrium exist naturally in a strongly bonded form.