# SOIL GEOCHEMISTRY AND CANCER - A CASE OF MEDICAL GEOLOGY, ISRAEL

MOSHE SHIRAV-SCHWARTZ[1]*, SHIMON ILANI[1], LUDWIK HALICZ[1], OLGA YOFFE[1], YEHUDIT HAR LAVAN[1], AVIAD ZICK[2], YAKIR ROTTENBERG[2]

[1]*Geological Survey of Israel, Jerusalem, 95501, Israel*
[2]*Hebrew University Medical Center, Ein Kerem, Jerusalem, 91120, Israel*
***moshe.shirav@gmail.com***

The natural geochemical background of the north-western part of Israel (The Haifa district) is governed by element associations depicting common heavy minerals, carbonates and clays, volcanic rocks (Mg, Cr, Co, V, Ni, Mo), phosphate-rich chalks and cherts (P, Zn, U, As, Cd) and barium-rich limestones. In the course of a detailed geochemical survey, few locations in which soils were locally polluted mainly with Cr, Zn and Cd were identified. The city of Haifa and its suburbs is located within the surveyed area, along with major industrial facilities that emit hundreds of tons of metals into the air per year. The soils in these vicinities are characterized by an accumulation of various trace metals (As, Cd, Pb, Sb, Mo, Mn) as a result of long-term discharge from numerous industries and deposition following transportation by runoff and prevailing weather systems. The use of isotopic ratios of lead (206Pb/207Pb) pointed out a steal plant as one source for some metal pollutants in the area. Thus, the buildup of these trace metals in soils can serve as a proxy for evaluating the exposure of inhabitants in the area to pollutants of anthropogenic origin. An assessment of cancer occurrence in the Haifa district vs. the rest of Israel (1:1 ratio) was carried out, based on an historical prospective study of 175,704 citizens of the Haifa district who participated in the Israeli Central Bureau of Statistics (CBS) 1995 census and followed-up until 2007. The hazard ratio (HR) for cancer incidence was calculated across a wide variety of socio-demographic variables, demonstrating an increased risk of developing cancer in the Haifa district comparing with the rest of Israel (HR=1.12, 95% CI: 1.08-1.23, $p<0.001$). Smoking rates in the Haifa district did not explain the increased cancer incidence. Calculating the average concentration for each trace metal in every census block and linking it to the home address of participants in the cancer study suggested a trend of increased risk of cancer incidence (HR 1.12, 95% CI: 1-1.28, $p = 0.053$) in cadmium-rich areas after adjusting for demographic variables.

Keywords: geochemistry, cancer, cadmium