

# Environmental-geochemical survey results in the Rosh Pinah Region, Namibia

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**Abstract.** Results of an environmental-geochemical survey in the Rosh Pinah Pb-Zn mine area show that dust blown from ore crushers, ore concentrate dumping grounds and the tailings dam is spread over large areas of the environment in Rosh Pinah. The dust emanating from the crusher appears to be a major environmental problem as it contains high average metal values of up to 11.1% Zn, 3.82% Pb, 0.12% Cu, 81.8 ppm As, 1.05 ppm Hg, 5 ppm Cr and 260 ppm Cd. Although the dust from the tailings dam contains relatively lower metal values (1.4–1.9 % Zn, 0.4% Pb, 638–970 ppm Cu, 0.7–2 % Mn, 54–110 ppm As, 0.15–0.22 ppm Hg, 7–16 ppm Cr, and 638–970 ppm Cu), the dust fallout from the tailings dam pose great danger to human health as it contains 25–23% of particles smaller than 10 µm on average. The dust contamination halo at Rosh Pinah is elongated towards the northwest, in accordance with the prevailing wind direction during summer. Northerly and northwesterly winds in the winter spread the dust over a larger area, particularly in the broader environs of the tailings dam. Although most of the dust is transported by wind to uninhabited mountain area, the northeastern part of Rosh Pinah and the northern section of its informal settlement are affected by the fallout tail. Apart from the dust-fallout from the tailings dam, the transport of Pb-Zn concentrates from Rosh Pinah contributes significantly to the contamination of soils along the road to Ausnek.

High concentrations of total S (up to 12 wt. %) and maximum values of As (225 ppm), Hg (1.14 ppm), Pb (43,030 ppm) and Zn (93,060 ppm) illustrate the extent of soil contamination in the uppermost part of the soil horizon in the immediate vicinity of the tailings dam. The highest concentrations of total S, Mn, Hg, As, Cd, Cu, Pb and Zn in stream sediments occur in the immediate vicinity of the tailings dam, but the heavy metal concentrations rapidly decrease downstream, and do not show any specific pattern at distances of over 300 m from the settling pond. Limited acidification of the upper soil layer exists only in the vicinity of the ore dressing plant mainly as a result of weathering of sulphide containing dust.

Water extracts from the flotation tailings are non-toxic, with contents of phenols, total and releasable cyanide, As, Cd, Hg, Ni, Pb and Se lower than permissible values valid for toxic wastes. However, water extracts from the flotation tailings may endanger the water flea (*Daphnia magna*) population whose immediate toxicity (92 to 100%) considerably exceeds the limiting value of 30%.

Other species, notably aquarial fish, freshwater algae (with the exception of one sample) and seeds of vegetation have low immediate toxicity values. Heavy metal concentrations in the groundwater are low due to the near neutral (7.3-7.7) pH values of the groundwater which keep the metals insoluble. Several recommendations, including covering the slopes of the tailings pond with the grass species *Lolium pratensis* to minimise dust emissions, are provided in order to minimize the impact of mining and ore dressing operations on the local environment and human health at Rosh Pinah.

**Keywords:** Heavy metals, soil pollution, environment, Rosh Pinah, Namibia, tailings

## Acknowledgements

The study originated within the Project of the Development Cooperation between the Czech Republic and Republic of Namibia. Interpretation of results was carried on within the IGCP/SIDA Project 594 “Assessment of impacts of ore mining and mineral processing on the environment and human health in Africa”.