CHARACTERIZATION OF As-RICH IRON OCHRE PRECIPITATES FROM MINE DRAINAGE WATER OF KOLÁRSKY VRCH Sb (Au) DEPOSIT (MALÉ KARPATY MTS., SLOVAKIA)

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The natural arsenic-iron ochres formed from mine drainage waters in the abandoned Sb (Au) deposit (Kolársky vrch deposit, Malé Karpaty Mts., Slovakia) were studied. All of them precipitate and accumulate at near-neutral to neutral pH, whereby no distinct seasonal fluctuations in pH were recorded. Chemical compositions of water differed mostly in concentrations of SO_4^{2-}, As, and Sb. Concentration of As and Sb, to a smaller extent Fe and SO_4^{2-}, reflects seasonal changes. These are best pronounced in the samples from tailing drainage pipe.

After removal of organic and mineral detritus and dissolved salts, samples of ochreous precipitates were dried and digested in hydrochloric acid for the total element determination. Ratios of oxalate to dithionite-extractable iron (extraction in ammonium oxalate, and sodium dithionite-citrate-bicarbonate solution, respectively) were used to assess the relative crystallinity of poorly ordered iron oxyhydroxides. Mineral composition of fresh precipitates was determined using X-ray powder diffraction and infrared absorption spectroscopy. Morphology of precipitates was studied by means of transmission electron microscopy.

The iron ochre accumulations from the tailing drainage pipe form accretion cone of intercalating red- and yellow-coloured ochres, situated on the streambank and partially flooded by stream water. Except of newly precipitated ochres the accretion cone contains organic and mineral detritus.

Red-coloured ochres (?maturated) accumulate in the centre of accreted cone and are overlain by the layer of yellow-coloured younger precipitates. Chemical composition of these two phases strongly differs: red precipitates are extremely enriched in As (up to 13.02 wt%, mole ratio $Fe_{tot}/As = 1.84$) and Sb (up to 1.64 wt%), whereas in yellow phase concentration of these elements is distinctively lower (hundreds ppm).

Organic compounds were encountered in all samples, contents of total organic C were up to 4.7 wt%. Also infrared spectra clearly evidence its presence by the COO-band at 1387–1399 cm^{-1}.

The high contents of As in samples from tailing impoundment drainage pipe sediments is pronounced in IR spectra. Features at 812 cm^{-1} could be assigned to AsO^{3-} or AsO^{4-} compounds (FARMER, 1974). Absorption bands of ν^1 (SO_4^{2-}) at 980 cm^{-1} and ν^4 (SO_4^{2-}) at 610 cm^{-1} are supressed probably due to increased As-contents (CARLSON & BIGHAM, 1992). Unfortunately the present state of knowledge does not allow for proper determination of As speciation in oxyhydroxides. Infrared spectra of the samples from two other localities (Budúcnosť and Sirková adits) indicate presence of ferrihydrite.

X-ray diffraction patterns show for poorly ordered material in all studied samples, diffractograms consist of one or exceptionally two very broad maxima at d-values typical for iron oxyhydroxides.

This study was financially supported by the Slovak Scientific Agency (VEGA 2062).

References

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