Typical skarn-type lead-zinc deposits mining on the effect of heavy metals in surface sediment in North China

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Baiyinnuoer orefield is an important large lead-zinc deposit in northern China, which is located in the southern Greater Hinggan in Inner Mongolia, belonging to the epithermal-superepithermal magmatic and carbonate contact metasomatic skarn type deposit. Halihei river flows from west to east through the northern mining area. After decades of years of exploitation, while ensuring regional economic development, it affected the local ecological environment, that was studied focusing on the surface sediments.

From upstream to downstream 7 sediment samples were collected in Halihei river. After air-dried and sieved, pH and the total content and existence speciation of the main heavy metal in the samples were been determined.

Results showed that Pb、Zn and Cd were the main pollutants and the sediments in the river in the mine were severely contaminated. The geoaccumulation index and enrichment factor of Cd were the highest of the three. Pb and Zn in the samples were dominated by organic bound, Fe-Mn oxides bound and residual fraction. The ecological risk of Pb and Zn was medium inside the mine and low outside. In contrast, that of Cd was medium inside the mine and high outside, since Cd was dominated by carbonate state and ion exchange state. The amount of the ion exchange state, being negatively related with pH and varying inversely with the total amount and the other states, lowered inside the mine and raised outside. The average percentage of both states of Cd in the samples was 41% and the maximum was 60.9% outside the mine at downstream river.

The significant reason for this is that the wall rock of the deposit, being skarn type, is the carbonatite of Huangganglian formation of the Lower Permian. Sulfide deposits mining discharge of acid wastewater was neutralized by the wall rock, thus pH of the sediments was weakly alkaline (7.4-8.5) inside the mine and weakly acidic (5.6-6.8) outside. As the pH increased, Zn^{2+} and Cd^{2+} in the sediments dramatically reduced, especially for Cd^{2+}, and the adsorbability of that increased samely[1]. It was the primary cause that the ecological risk of Cd lowered inside the mine.

[1] Rim Azouzi *et al.*, (2015) *Environmental Earth Sciences*, **74**, 2967–2980.