Regional and Urban Geochemistry in the Qinhuangdao Area, Hebei Province of China

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1. Introduction

The study area is located on the north coast of Bohai Sea in the northeastern part of Hebei province. It covers about 7500 km². Two towns, Beidaihe and Shanghaiguang, in this area were studied in detail. Archean and Lower Proterozoic metamorphic rocks and granites are widely scattered in the northern and central areas. Sediments of different ages in the northern and south-central area include carbonates, sandstones, shales, volcanic sediments and a coal layer. The cover rock in the southern part of study area along the coast is mainly Quaternary.

2. Material and Methods

In the mountainous and hilly areas of the northern and central parts of the study area, 1503 stream sediment samples were collected within the scope of the Regional Geochemistry National Reconnaissance Program with a sample density of one sample per km²; 491 topsoil samples (0-20 cm depth) were collected with the same sample density in the southern part of the study area. The 191 subsoil samples (60-80 cm depth) were taken with a density of one sample per 4 km². The <20 mesh soil fractions of all the samples and the stream sediments were analyzed for 39 elements. About 152 topsoil samples were collected in Shanghaiguang at the eastern end of the Great Wall and in Beidaihe, the famous summer resort. These samples were analyzed in the BGR laboratories for 43 Elements.

3. Results and discussion

The concentrations of As, B, Cd, Mo, Pb, Sb, Si, Sn, Ti and Y in stream sediments in the central and northern parts of study area are lower than the national stream sediment background values, which are mainly of natural origin, i.e., related to the composition of the parent materials. The elevated average values for Al, Co, Cr, Cu, F, Fe, K, Mg, Na, Ni, P, Sr, V, Zn, and Th indicate regional mineralizations and metal deposits. The concentrations of Na, Si, Sr, and Cl in the soil of the southern and central parts of the study area are distinctly higher than the national soil background. This is closely related to the widespread distribution of sandy soils in the southern part of Qinhuangdao. It may be concluded the somewhat elevated Na and Cl concentrations in the southern and central parts of study area are from atmospheric deposition.

4. Conclusions

The metal concentrations in the subsoils of the Qinhuangdao region are not significantly different from the regional background; these soils can thus be considered as unpolluted. Elevated concentrations of Cd, Hg, P and S in the topsoil are caused by anthropogenic pollution. Shanghaiguang, an old town, shows accumulations of heavy metals (Hg, Cu, Pb, Zn, Sn) and P that may be due to anthropogenic pollution. At Beidaihe, a resort, there are only slightly elevated Hg, Pb, and Zn values. The distribution of pollution index values shows that the degree of pollution is much less than in metropolitan areas, such as Beijing, Berlin and Hangzhou, and can be neglected. Concentrations of Hg, Pb, As, Sb, Cd, Cu, Zn, Cr, Ni, and Co are sometimes higher than in rural regions. The pollution index maps show that the small towns in the study area where there are no large industrial plants are not seriously polluted with heavy metals and other trace elements.

The regional geochemical sampling in the Qinhuangdao region permitted us to determine the background level of major and trace element concentrations in the topsoil of the towns and surrounding areas as well as for the subsoil and stream sediments.

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