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Strontium isotope and chemical compositions of rainwaters from Guiyang, Guizhou Province, China

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Land-use and industrial activities are considered the most important driving forces in the ongoing processes of alteration in atmospheric chemistry. Most of these anthropogenic influences on the atmospheric chemistry are due to emissions of nitrogen, ammonia and sulfur. Oxidation of these chemicals and subsequent scavenging by precipitation have caused widespread acidification of precipitation and extra inputs of nitrogen and sulfur to terrestrial and aquatic systems, with several deleterious consequences to the environment, such as decline of forests and crop productivity, increase of lake and soil acidification and loss of biodiversity [1]. With a fast economic development, energy consumption has increased significantly in the last two decades in Guizhou Province. This has led to widespread coal combustion as an important alternative of energy generation. Acid rain, therefore, has been an atmospheric environment problem especially of several big cities in Guizhou Province. In order to identify and quantify contaminant sources and their fluxes to the catchment, we have conducted a study on chemistry of the rainwaters over Guiyang, a capital city of Guizhou Province.

Twenty-two bulk rainwater samples were collected from Jan. 11, 1999 to Oct. 24, 2001, and analyzed for their chemical and isotopic compositions. Ca^{2+}, Mg^{2+}, SO_4^{2-} and NO_3^- are the principal ions in the rainwater samples. The sum of Ca^{2+} and Mg^{2+} accounts for 78%-96% of the total cations, while SO_4^{2-} for 28%-98% of the total anions. As compared with rainwaters of several big cities in eastern China, the rainwaters samples show significantly high SO_4^{2-} and NO_3^- contents, and high enrichment of these ions over Cl^-. Enrichment of SO_4^{2-} and NO_3^- in the rainwater samples are mainly due to industrial inputs.

Sr concentrations of rainwaters vary from 0.02 to 0.33μmol/L. $^{87}Sr/^{86}Sr$ ratios range from 0.707934 to 0.709080. Combined with element ratios of major cations, the variation in Sr isotopic compositions shows that the cations, such as Ca, Mg and Na have two principal sources, rock/soil chemical weathering, and anthropogenic sources, with marine input very small.

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Assessment of sources and pathways of atmospheric contaminants in precipitation over central Bohemia

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Sources and pathways of selected chemical contaminants in bulk precipitation over central Bohemia were assessed in samples collected monthly near a small town Kostelec n. Č. lesy, approx. 30 km SE from Prague, capital of the Czech Republic. Samples have been collected currently since 1990. They were analyzed to determine the concentration of selected major cations and anions (including main acidifiers NH_4^+, SO_4^{2-}, NO_3^-, Cl^-), as well as of several contaminants (As, Be, Cd, Cu, Ni, Pb, Zn, F^-), mostly of anthropogenic origin.

The sources of individual components are estimated using the data sets of the content of individual elements/ions that are mutually screened by the correlation analysis. With respect to the distribution patterns of analytical values in the individual sets, the non-parametric Spearman correlation coefficient is applied for the analysis. In order to approximate the correlated parameters to the actual content of studied substances in the atmosphere (unaffected with the precipitation intensity) we mathematically modify the correlation analysis involving the wash-out process into the assessment. The correction is also involved in the analysis, to eliminate the varying decreasing temporal trends in deposition of the individual chemical contaminants. The results are discussed with respect to the prevailing synoptic situations occurring over central Bohemia.

Set of the bulk samples shows strong mutual correlation of the main acidifiers - compounds of N, S (and F). Good correlation occurs also at the typical elements originating from the flue gases of the combustion chambers burning low quality brown coal - As, (Be), Cd, Cu, Pb, and Zn. The only strong correlation of Cl with Na (and Mg) indicates that majority of these elements originates from the oceanic spray. The content of pollutants in precipitation depends on the types of air masses and on the rout of their approach to the sampling site.

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