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Tectonic Controls on Biogeochemical Cycling of Potentially Toxic Elements (PTEs) in Mining Areas: Structural Geology, Element Migration Pathways, and Human Exposure Risks in the Jinding Pb-Zn Deposit, Lanping Basin

YATING SHEN[1,2], LI CAO[3], XUANHUA CHEN[2], LIQIANG LUO[1], SHUAI ZHU[1] AND JIAN LIU[3]

[1]National Research Center for Geoanalysis, Beijing, China
[2]Institute of Geology, Chinese Academy of Geological Sciences
[3]National Research Center for Geoanalysis, China

The Jinding Pb-Zn deposit, located in Yunnan Lanping Basin, China, is a significant mining area with serious potentially toxic elements (PTEs) issues in surrounding environment. Biogeochemical surveys in this region are crucial for understanding PTEs distribution and migration, evaluating environmental and health risks, and guiding ecological restoration. At present, most of the research on the biogeochemistry of PTEs in mining areas focuses on the distribution characteristics and ecological effects of elements. However, research on the impact of tectonic geological factors on biogeochemical processes is relatively weak. Especially in the Jinding Pb-Zn deposit area of the Lanping Basin, there is no systematic study on how the tectonic geological background affects the migration and transformation of elements in soil, water bodies, vegetables, and humans. Integrating tectonic and biogeochemical studies can offer insights into how geological structures influence element cycling, which is essential for comprehensive environmental management in mining areas.

Biogeochemical surveys were carried out in the Jinding deposit area. The contents and species of PTEs in the farmland soil in the surrounding area, main rivers, vegetables and crops, as well as the nails and hair of villagers were analyzed. Combining with structural geology, the tectonic geological characteristics of the area were analyzed to explore their influencing mechanisms on biogeochemical processes.

The study found that tectonic geological characteristics significantly determine the biogeochemical processes in the Jinding deposit area. Fault structures may provide channels for element migration, promoting the movement of elements among different media, resulting in a specific distribution pattern of PTEs in soil and water bodies near the faults. The differences in stratigraphic lithologies affect the parent material sources of the soil, thus causing differences in the background values of PTEs in soils in different regions. These tectonic geological factors act together, affecting the absorption and accumulation of PTEs by crops and vegetables, as well as the species and toxicity of PTEs, which in turn affect their enrichment in humans through the food chain, providing a new perspective for a comprehensive understanding of the biogeochemical cycle in mining areas.

References:
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