Vanadium dynamics in soils impacted by vanadiferous titanomagnetite ore mining

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Vanadium (V) plays a highly critical role in natural systems due to its potential essence and toxicity to organisms. To date, knowledge about V biogeochemistry is scarce so that assessing the impact of V enriched solids on the terrestrial environment is still difficult. Two soil profiles overlaid with and without ores and mining rests close to the vanadiferous titanomagnetite ore mining site were sampled. We attempted to characterize the mobility of soil V under the influence of mining activities and to estimate the potential risk of V to the adjacent environment by analysing the vertical V distribution, speciation of V oxidation state and its sequential distribution in different organic and mineral fractions. Additionally, HPLC-ICP-MS coupling was taken for speciation of V(V) and V(IV) in water and EDTA extracts of soils to understand V bioavailability and its potential toxicity.

Except the very high V concentrations (784 ppm) in the surface layer composed of mining rests, the soil V concentrations vary little along both soil profiles (343-356 and 143-201 ppm), suggesting the general low V mobility. Speciation of soil V based on sodium carbonate extraction indicates that more than 85% of total V in soil is tetravalent, which is generally rather insoluble and strongly absorbed [1]. Results of sequential extraction show totally different fractionation patterns comapred to the other metalloids e.g. arsenic. Vanadium prefers to enrich in crystalline fractions and residues, while arsenic is abundant in poorly crystalline fractions. Interestingly, the proportion of V in the crystalline fraction and residues is independent of the depth (~69%) in the unpolluted soils, but the relevance of these two fractions increases from 52% to 82% with the depth along the polluted soil profile, suggesting the potential influence of mining materials on V binding forms in soils. Pentavalent V predominates in both water and EDTA extracts, reflecting higher mobility of V(V) than V(IV). This further implicates elevated toxicity for the plants and soil organism due to higher toxicity of V(V) compared to V(IV).

[1] Wehrli & Stumm (1989) *GCA* 53, 69-77.

Paleoclimate reconstruct of Late Triassic Xujiahe Formation Sichuan Basin in Southwest China

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Formation of Upper Triassic in Sichuan Basin China is abundant in gas resource, with proved gas resource of more than hundreds of billion cubic meters. As a result, the formation has become an important area for the gas industry of China.

Xujiahe Formation can be divided into six members with a texture of interbeded sandstones and mudstones, like a sandwich. The paleoclimate is an important reason for the texture. Three methods named palynoflora, clay minerals, and eigen elements were used in this paper to reconstruct the paleoclimate when Xujiahe Formation was sediment. Mudstone samples of the six members were taken from six different areas of the entire basin, and then analyzed to reconstruct the paleoclimate, respectively. The palynoflora indicated that the paleoclimate background of Xujiahe Formation was hot and humid, belonging to tropics-subtropics zone. Making use of clay minerals, the ratio of Kaolinite and Illite (K/I) was used to analyze the Paleoclimate, which reduced the ambiguity. Using the ratio of Calcium and Magnesium (Ca/Mg) and Strontium/Barium (Sr/Ba), the details of paleotemperature and paleomoisture (paleosalinity) were analyzed. It can be seen that the paleotemperature and paleomoisture of Xujiahe Formation fluctuated regularly against the setting of tropics-subtropics. Member Xu 1 was formed in transitional facies when the paleoclimate was hot and humid. Member Xu 2 was formed in the climate of hot and arid. When member Xu 3 was formed, the temperature and moisture were all higher than Xu 2. It belonged to palustrine environment. After shortly decrease of temperature and moisture in Member Xu 4, it became hottest and wettest during the period when Member Xu 5 was formed. The temperature and moisture declined slowly in Member Xu 6, and the paleoclimate became relatively warm and aridity. It is the fluctuation of paleoclimate that led to the forming of the sandwich sedimentation structure of Xujiahe Formation in Sichuan Basin Southwest China.

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