4.5.P15

The solid-phase controls on the mobility of heavy metals in waste rock impoundment, the abandoned Cheongyang mine, Korea

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A mineralogical and geochemical study of waste rock impoundment from the abandoned Cheongyang tungsten mine is presented. The main objectives are to characterize oxidation results of sulfide minerals and mechanisms controlling the behaviors of dissolved metals from the waste rocks. Mineralogical study of the waste rocks confirms the presence of secondary minerals such as anglesite, kintoreite, chalcocite, goethite, melanterite, marcasite, nustite and native sulfur, suggesting that dissolved metals (Pb, Cu, Fe, Mn and S) by oxidation process were mainly being attenuated by the precipitation of these solid phases. X-ray diffraction and SEM coupled with EDS show that dissolved metals (As, Cu, Pb and Zn) were also co-precipitated and adsorbed onto the Fe-(oxy)hydroxides, Fe(Mn)-hydroxides and Fe-(oxy)hydroxysulfates. These materials act as a quantitatively strong mineralogical sink for Pb (7.4-14.1 wt. %) and Zn (1.8-15.4 wt. %). The results show that the total amount of Cu adsorbed onto the (oxy)hydroxides ranges from 1.2 to 5.5 wt. %. Arsenic is co-precipitated or adsorbed on to mainly Fe-hydroxides (e.g. goethite). All other Fe-(oxy)hydroxides could also be a good scavenger for As. Poorly crystalline Fe-hydroxides have relatively high As contents (9.0-24.0 wt. %). These poorly crystalline Fe-hydroxides had evolved toward more crystallized phases, which contain less As contents(0.6-7.7 wt. %). These results are mainly due to the progressive release of As with the crystallization evolution of the poorly crystalline Fe-hydroxides. It is also attributed to the difference of specific surface areas between the poorly crystalline Fe-hydroxides and well-crystallized phases. The high degree of heavy metal attenuation results from precipitation (such as Fe, Mn, Cu, Pb), co-precipitation (such as As, Fe, Mn) and adsorption (such as As, Cu, Pb, Zn) reactions within waste rock impoundment at the abandoned mine area. The results of this study will assist in long-term prediction of the processes involved in the oxidation-dissolution-formation-processes cycles of secondary phases derived from sulfide oxidation, and provide information that will be needed to assess possible waste rock remediation programs.

4.5.P16

REE distribution patterns in zircons from a Devonian bauxite deposits and their application for zircon origin

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Zircon grains for the present study were extracted from bauxite samples collected from a Devonian bauxite deposit (Timan Fold Belt, Russia). The contents of REE in zircons were determined by Sensitive High Resolution Ion Microprobe (SHRIMP) after preliminary cathodoluminescent study.

According to crystal morphology and REE distribution patterns, three generations of zircons were distinguished. Zircon of the first generation is strongly corroded. Its core represents high REE contents and comparably flatten chondrite-normalized REE distribution pattern with no negative Eu anomaly and a very weak positive Ce anomaly. The rim is strongly depleted in REE contents, but the general trend of their distribution pattern is quite similar. Zircons from the second generation also have traces of weathering; their REE distribution pattern shows strong enrichment in HREE and sharp slope towards La, with no Eu anomaly as well. We relate this zircons to Vendian carbonatites known among the parent rocks of the crystalline basement. Zircons from the third generation are euhedral; their REE-distribution pattern represents a very deep negative Eu anomaly and a very weak positive Ce anomaly.

The U-Pb age dating of the same zircon grains (SHRIMP analyses) showed, that the concordant age of the first generation zircon is 700±10 Ma and the concordant age of the third generation zircons is 379±7 Ma. The latter age corresponds to the age of bauxite formation according to the prevailing opinion. Zircons of the second generation are not available for age dating due to very low U contents. On this basis, the explanation of the observed REE distribution patterns is given. We consider not only a possibility of zircon inheritance by bauxites from parent rocks, but also a possibility of its direct relation to deep chemical weathering. Various models are suggested.