

## Geochemical processes of soil and groundwater contamination by Cr(VI) from natural sources

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Soil and groundwater contamination with hexavalent chromium (Cr(VI)) is of serious concern especially in industrialized areas over the world as Cr(VI) is the 2<sup>nd</sup> most common inorganic contaminant. Reduction of Cr(VI) to Cr(III) followed by its precipitation as or directly to Cr(OH)<sub>3</sub>(s) is generally the best strategy for Cr(VI) removal because this process substantially alleviates both the toxicity and mobility of Cr. Thereby, processes and mechanisms for Cr(VI) reduction by various reductants have been extensively investigated. Besides the anthropogenic contamination, natural Cr(VI) contamination of soil and groundwater without any anthropogenic source has been reported over the world. Since Cr commonly exists as a trace constituent of various rock forming minerals in the oxidation state of +III, the oxidation processes of Cr(III) would likely be responsible for the natural Cr(VI) contamination processes. We have investigated the potential reaction pathways of Cr(III) oxidation to elucidate the geochemical processes of natural Cr(VI) contamination.

In this study, we examined the oxidation of Cr(OH)<sub>3</sub>(s) by birnessite. These two solid phases are those of the most common solid phases of Cr and Mn, respectively, under the near surface environmental conditions. Cr(OH)<sub>3</sub>(s) oxidation was examined with solid suspensions containing Cr(OH)<sub>3</sub>(s) and/or birnessite (1.0 g/L of each solid) fixed at pH 7–9 with buffers. Sparingly soluble Cr(OH)<sub>3</sub>(s) was readily oxidized by birnessite and released substantial amounts of dissolved Cr(VI) in the mixed suspensions. The apparent rate and extent of Cr(OH)<sub>3</sub>(s) oxidation increased with increasing pH. The oxidation was catalyzed by reaction intermediate during the early stage of reaction (ca. 10 h) at all pHs. At pH 7 the production of Cr(VI) reached plateau in about 10 d but was continued for 33 d at higher pHs until the experiments were ceased. In addition, the processes of Cr(OH)<sub>3</sub>(s) oxidation by birnessite were substantially accelerated in the suspensions open to the atmosphere compared to those purged with N<sub>2</sub>. The geochemical processes inhibiting or accelerating Cr(OH)<sub>3</sub>(s) oxidation under the experimental conditions will be discussed.

## Age and geochemical constraints on the genesis of Late Cenozoic volcanic rocks in central Myanmar

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The central Myanmar basin in which Late Cenozoic volcanism occurred is marked by the existence of the dextral Sagaing fault linking the eastern Himalayan Syntaxis in the north and the Andaman Sea in the south. Here new and comprehensive age results of the volcanic rocks from volcanoes of Mt. Popa, Monywa and Singu are reported. They display two distinct stages of eruptions, including a mid-Miocene stage from ca. 14 to 13 Ma and a Quaternary stage <1 Ma, with a pronounced >10-m.y. magmatic gap in between. While calc-alkaline rocks showing arc-like lava features are abundant, an apparent change in magma composition is observed between these two stages. The mid-Miocene rocks are dominated by intermediate compositions (SiO<sub>2</sub> = 53-61 wt.%) and typical of high-K calc-alkaline nature. They exhibit similar Nd isotope ratios ( $\epsilon_{Nd} = +2.6$  to  $+1.4$ ), suggesting a juvenile mantle origin possibly related to the subduction of the Indian oceanic slab beneath Asia. The Quaternary rocks, however, are mainly basaltic compositions but show heterogeneities. There are (1) high-Al basalts with high-K calc-alkaline geochemistry:  $\epsilon_{Nd} = +3.1$  to  $+2.1$ , (2) absarokites: Al<sub>2</sub>O<sub>3</sub> = 13-15 wt.%; MgO = 10-12 wt.%;  $\epsilon_{Nd} \approx +3.5$ , and (3) intra-plate alkali basalts: K<sub>2</sub>O = 2.6-3.5 wt.%;  $\epsilon_{Nd} = +1.6$  to  $+0.9$ . We interpret the long magmatic gap as a consequence of transition of the Indian oceanic slab from oblique convergence/subduction to strike-slip movement. It took place in the mid-Miocene, when the dextral motion of the Sagaing fault system initiated and opening of the Andaman Sea began. All these processes were related to the India-Asia collision that caused plate reorganization and eventually “rollback” of the Indian oceanic slab in this region since 1 Ma. Thus the Quaternary volcanism renewed owing to rise of the geotherm resulted from upwelling asthenosphere and small-degree melting of different domains of pre-Miocene subduction-related enriched mantle beneath central Myanmar.