GEOC 245: Arsenic oxidation by the mighty manganese soils of Graskop

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This study characterizes the physical and chemical properties and the reaction kinetics of the extraordinary manganese soils found in Graskop, South Africa. Manganese-oxides govern many geochemical reactions due to their abundance and high reactivity. Despite their importance in cycling redox sensitive compounds in natural systems, much remains unknown about the reactivity of manganese-oxides formed under environmental conditions. In order to study how these manganese-oxides react, soils were collected from Graskop, South Africa. Three soil profiles were excavated with a range of manganese concentrations. Each profile was further separated based on horizons, with some of the profiles contain over 20% manganese. Manganese nodules of various sizes are ubiquitous in these soils. The soil in each horizon was analyzed to determine the cation exchange capacity (CEC), point of zero charge (PZC), and pH. X-ray powder diffraction (XRD) was used to characterize the mineralogy of the crystalline material found in the clay fraction. The nodules present in the soils were also analyzed and their crystalline composition was determined with XRD. Finally, a series of batch reactions were used to determine the capacity of these soils and nodules to oxidize arsenite into arsenate. The conditions of the reaction were varied in order to elucidate how differing pH, arsenic concentration, and temperature influenced the oxidation reaction. Aliquots collected from these experiments were analyzed by inductively coupled plasma mass spectrometry (ICP-MS). Solid samples from these reactions were taken to SSRL and analyzed on beamline 4-3 to determine the changes in manganese oxidation state after reacting with arsenite under varying conditions. This study provides key insights to more fully understand the role of manganese-oxides in controlling redox sensitive reactions in the environment.

Sessions

GEOC 245: Arsenic oxidation by the mighty manganese soils of Graskop
Thursday, Mar 22 11:40 AM

Room 338, Ernest N. Morial Convention Center
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