The speciation of organic matter in soil mineral organic associations – Inference from STXM and N, C and Fe NEXAFS

PETER S. NICO[1]*, MARCO KEILUWEIT[2], MARKUS KLEBER[2], PIERRE-JOSEPH HATTON[3], BERND ZELLER[3] AND DELPHINE DERRIEN[3]

[1]Earth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, USA
[2]Department of Crop and Soil Science, Oregon State University, Corvallis, OR, USA
[3]Département Ecologie des Forêts, Prairies et milieux Aquatiques, Institut National de Recherches Agronomiques, Centre de Nancy, France

The role of mineral organic interactions in the long-term protection of soil organic matter against decomposition is increasingly recognized as a key process in terrestrial carbon cycling. In this investigation we were specifically concerned with whether the differences in surface properties between Fe containing soil minerals and non-Fe containing soil minerals exerted a significant fractionating influence on the chemistry of C and N in the associated organic material. We employed a density fractionation procedure in order to isolate organic mineral micro-aggregates with only thin layers of associated organic material. It is assumed that these closely associated layers are the most likely to show the influence of mineral surface properties. We then interogated these micro-aggregates using the scanning transmission X-ray microscope (STXM) and near-edge X-ray absorption fine structure (NEXAFS) spectroscopy. While there was not a single universal fractionation pattern, the N associated with Fe tends to be of a different chemical composition than that associated with non-Fe regions. The implications of theses observations for the mechanisms of mineral-organic interactions are discussed.

Geological features and origin of the Wulandele molybdenum deposit occurring in Sonid Zuo Qi, Inner Mongolia

F-J NIE, S-H JIANG AND Y-F LIU

Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing 100037, China (*correspondence: nfjj@mx.cei.gov.cn)

Located at central part of the Paleozoic-Mesozoic tectono-magmatic belt of the Chagan Obo-Aoyoute-Chaobulen along the southwestern edge of the Siberian plate, the newly discovered Wulandele deposit is a large-scale porphyry Mo deposit occurring in the central-eastern Inner Mongolian Autonomous Region. Up to present, it is also the largest Mo-only deposit occurring within China-Mongolian border area. During the Indosinian to Yanshanian orogeny, intensive tectonic and igneous activities resulted in the large-scale granitoid magmatism in Wulandele and its neighbouring area. The Wulandele quartz diorite stock was emplaced in the Hercynian biotite granite batholith located in Ordovician to Permian volcano-sedimentary sequences. It consists of mainly fine-grained quartz diorite and porphyritic quartz diorite and that have no difference in mineral assemblage. Mo mineralization occurs entirely within the Wulandele quartz diorite stock as veins, veinlets and disseminated blocks. In general, the disseminated ore blocks consisting of mainly impregnation, radioflake, aggregated flakes are obviously cut by Mo-bearing quartz vein group comprising veinlets and veins. Studies show that Mo mineralization occurs in two main stages: early disseminated ore stage and late vein ore stage. Re-Os isotopic data from the early disseminated ore defined a correlation line corresponding to an age of 224.5 ± 2.5Ma. In contrast, Re-Os isotopic data from the late vein group have a correlation line corresponding to an age of 134.1 ± 3.3Ma. Fluid inclusion studies show that the quartz samples from the early disseminated ores are characterized by CO_2-rich, variable salinity (16-32wt% equiv. NaCl), and have variable homogeneous temperature of 360°C to 480°C. Quartz samples in late vein ores have homogeneous temperature from 250°C to 390°C, with variable salinity of 6-25wt% equiv. NaCl. Sulfur and oxygen isotopic data indicate that the ore-forming fluid was dominated by magmatic water at the early disseminated ore stage, and is characterized by mixture fluid of magmatic water and heated meteoric water at the late vein ore stage. The deposit is believed to be a product of both Indosinian and Yanshanian intra-plate granitoid magmatism along the southwestern margin of the Siberian plate.