Study of hydrobiogeochmical interfaces in petroleum contaminated shallow groundwater

Y.S. YANG[1,2*], X.Q. DU[1], W. FAN[1], Y. XIA[1] AND Y.A. LU[1]

[1]Jilin University, College of Environment & Resources, Changchun 130026, China (*correspondence: yangy6@cf.ac.uk)
[2]Cardiff University, School of Earth Sciences, Cardiff CF10 3YE, UK

Successful remediation of contaminated subsurface environment is always based upon good understanding of the geological, hydrogeological and biochemical conditions of the contaminated sites. We present a study of a petroleum contaminated soil and shallow groundwater site in the NE China, a cold and arid region and explore varous interfaces among the vadose and saturated zones by field, lab-based approaches and numerical modeling.

A leakage form a faulty oil abstraction borehole being identified with much fixing effort has produced a contamination in soil and sallow groundwater. The surveys focusing geology, hydrogeology, geochemistry and fractions of the petroleum contaminants were carried out systematically for a potential in-situ remediation with enhanced natural attenuation, air sparging and/or permeable reactive barriers.

With support of much monitoring data from the field samplings, a series of lab-based bench scale experiments were conducted for the treatbility and understanding of the fate and transport mechanism of the petroleum contamination. A detailed investigation of the size, distribution, types of prokaryotes present and their broad metabolisms, potential to degrade specific organic contaminants under various conditions (e.g. aerobic, anaerobic) and environmental impact and control were carried out. In actively degrading conditions the dominant community were determined by 16S rRNA gene profiling (PCR-DGGE) and selective DNA sequencing. These results will provide insight into metabolite flux balancing which can be used to understand the micro-scale interfaces between groundwater, subsurface geoenvironment and organic contaminants. The improved dispersive and reactive transport predictive modeling, based upon the reliable flow and advective transport modelling was achieved for macro-scale interfaced between vadose zone and groundwater table, also also a predictive transport to support in-situ remediation designs. The understanding of various micro-scale biogeochemical interfaces then can provide much better support for a cost-effective in-situ remediation strategy.

U-Pb Age and Hf Isotope of Zircon from Granite in Jiaduopule Fe-Cu Deposit, Tibet

Z.S. YANG[1]*, Z.Q. HOU[2], S.H. TIAN[1], X.J. MENG[1] AND Y.S. YU[1]

[1]Institute of Mineral Resources, CAGS, Beijing 100037, China (*correspondence: yangzhusen@vip.sina.com)
[2]Institute of Geology, CAGS, Beijing 100037, China

The Jiaduopule Fe-Cu deposit, located in the central part of Lahsa terrane, is a skarn-type deposit occurring between Cenozoic granite and marble of Permian Xiala Formation. The granite is mainly composed of coarse orthoclase (40%), plagioclase (25%), quartz (25%), and biotite (10%), with chemical composition belonging to shoshonite series, and trace element looking like upper crust.

Zircons separated from the granite are 100-200 μm long with length-width ratio of 1:1 to 3:1. *In situ* zircon U-Pb dating was carried out using the SHRIMP II system at the Beijing SHRIMP Center, Institute of Geology, CAGS. Cathodoluminescence images of the Zircon can be divided into 4 groups. The first group is dark gray without zoning in the core of some zircon, and 2 analyses yielded the ages of 412.8 ± 9.6 Ma and 589.4 ± 13.6 Ma. The second group is gray with oscillatory growth zoning, and 2 analyses gave the ages of 83.4 ± 2.2 Ma and 87.7 ± 2.8 Ma. The third group is gray to dark gray with or without oscillatory zoning, and 2 analyses yielded the age of 62.2 ± 1.7 Ma and 62.3 ± 1.6 Ma. The fourth group is light to gray with sect zoning, and 9 analyses gave the ages between 47.5 ± 2.0 and 55.3 ± 2.1 Ma (weighted mean of 50.9 ± 1.8 Ma, MSWD=2.33).

Of the 4 group zircons, 20 grains were analyzed for Hf isotope ratios using LAM–MC–ICPMS at National Key laboratory, the Northwest University. The $^{176}Hf/^{177}Hf$ ratios of the first group zircon is 0.281917 [ε_{Hf} (T) = -21.27], of the third group zircon are between 0.282729 and 0.282864 [ε_{Hf} (T) = -0.20 ~ +4.53], and of the fourth group zircon are between 0.282699 and 0.282930 [ε_{Hf} (T) = -1.50 ~ +6.68].

Based on the geological features of the granitic intrusion and skarn-type mineralization of Jiaduopule Fe-Cu deposit, the U-Pb dating and Hf isotope of zircon from the granite indicates that the granitic intrusion formed during the period of large volcanic activity (Linzizong volcanic sequences) caused by India-Asia collision. During the collision, the break off of the Tethyan oceanic slab from the India crust induced the upflow of mantle, which activated the volcano eruption and caused the melting of upper crust to generate the felsic magma that intruded with skarn-type Fe-Cu mineralization.

This work was supported by grants (Contract No. 2006BAB01A04 and 2002CB412600).