

The application of Multi-purpose geochemical analysis in south of Chifeng, Inner Mongolia, China

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The southern Chifeng is located in the connecting zone between northern margin of the North China Platform and the Tianshan-Xingmeng orogenic belt. The unique tectonic environment enhance the complexity of geochemical condition. Based on statistics, this study evaluates whether the research of geochemistry can offer assist in delineating the prospective area.

In this study, concentrations of 14 elements were measured using atomic absorption spectroscopy in 3771 samples from the south of Chifeng. The multivariate statistical analyses were applied in the study area, which include R-cluster analysis, factor analysis and the correlation analysis. The comprehensive analyses classifies the ore-forming elements into four groups: the first group of Mo and W which indicates the high-temperature hydrothermal mineralization; the second group of Cu, Ni, Mn and Zn indicating the middle-temperature hydrothermal mineralization; the third group of Ag, Bi, Au, Sn, As and Sb indicating the midhigh-temperature hydrothermal mineralization; the last group of Hg and Pb which indicates the low-temperature hydrothermal mineralization. The multipurpose geochemical analysis suggests that the multi-stage mineralization, multi-period mineralization and the superposed mineralization can exist simultaneously in the study area. Furthermore, combining with the means of spectral analysis (S-A) and concentration area (C-A) which can delineate anomalies caused by mineralization, we can propose prospecting areas for some specific hydrothermal mineralization polymetallic deposits.

Fractionation of Li isotopes during mineral dissolution of granite

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During the last decade, numerous studies have explored the use of Li isotopes as potential tracers for silicate weathering. Li isotope fractionation occurs during water/rock interactions and typically leads to a heavier isotopic composition of natural waters compared to the corresponding source rocks. This makes Li isotopes a good candidate to trace weathering in soils or at catchment scale but the exact processes governing the isotopic variations observed in surface waters are still not fully understood. It has been suggested that a preferential incorporation of light Li (⁶Li) in secondary phases is responsible for the heavy Li isotope signature of surface waters. It has also been suggested that a preferential leaching of heavy Li (⁷Li) during rock minerals dissolution could yield heavy isotopic composition in surface waters. Experimental studies confirmed the first hypothesis [1, 2], but the second one was not yet explored in detail.

In this study, we conducted dissolution experiments with crushed granite in fluid-flow reactors. The crushed granite (100-200 μm) was leached for one month at pH values ranging from 2.5 to 5.5 with two different acids: HCl (proton promoted dissolution) and oxalic acid (proton and ligand promoted dissolution). The chemical composition of the effluent was analyzed by ICP-OES and quadrupole-ICPMS, and the Li isotopic composition was determined using a Nu Plasma 1700 MC-ICPMS. Fe, Mn, Mg and Li were released into solution at higher relative rates than Si, Al, K and Na, suggesting preferential dissolution of phyllosilicates such as biotite. Despite this preferential dissolution, only a small isotopic fractionation was observed (~1‰), with ⁶Li being released preferentially into solution.

Our results imply that the heavy Li isotopic composition observed in surface waters cannot be explained by a preferential release of ⁷Li into solution during granite dissolution. Secondary processes, such as precipitation of secondary phases, may be a more likely explanation for the observed isotopic variations in surface waters.

[1] Pistiner & Henderson (2003) *Earth. Planet. Sci. Lett.* **214**, 327-339. [2] Vigier, Decarreau, Millot, Carignan & France-Lanord (2008) *Geochim. Cosmochim. Acta.* **72**, 780-792.