The discovery of mass independent oxygen isotopic compositions in nitrate deposits from Turpan-Hami Basin, Xinjiang, China

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The Turpan-Hami Basin in eastern Xinjiang, China is a close inland basin and one of the driest regions on the Earth, with annual rainfall averaging 15mm. A large nitrate ore field was found recently in this basin. The nitrate mineral deposits were located along the Lanzhou-Xinjiang railway, with 400km east-west extension. The total amount of nitrate resources in Turpan-Hami Basin is up to 2.5 billion tons, as much as Atacama Desert super-scale nitrate deposit in Chile. The Turpan-Hami Basin nitrate deposit is one and only in inland. The nitrate deposits are divided mainly three types: (1) Bedrock fissures-filling sodium nitrate deposits, (2) Quaternary alluvial-pluvial sediment fissures-filling sodium nitrate deposits, (3) Modern saline type niter deposit.

The $\delta^{17}O$, $\delta^{18}O$ of nitrate were measured by fluorination and thermal decomposition method, the $\Delta^{17}O$ values got by two methods are similar each other and vary from 12‰ to 17‰. An obvious oxygen isotope mass-independent fractionation (MIF) of nitrate is found firstly in inland basin. The experiment and observation data proved that oxygen isotope MIF of nitrate are the result of photochemical reactions in the troposphere and stratosphere [1]. Thus, evidence from MIF oxygen isotopic compositions of nitrate indicate that nitrate deposits in Turpan-Hami Basin are product of long term atmospheric deposition of nitrate aerosol particles produced by photochemical reactions. The atmospheric nitrate maybe universal, but forming nitrate deposit needs extremity driest weather.

[1] Michalski *et al*.(2004) *GCA* **68**, 4023-4038.

Microbial weathering of Limestone and Dolomite

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Knowledge in the biogenic weathering of carbonate rocks is imperative to understanding any geochemical and enviromental process in Karst area. Here we study the interactions of selected microorganisms with limestone and dolomite to evaluate the capacity and mechanisms of microbial weathering. Experiments are conducted using three strains of bacteria and three strains of fungi isolated from the surface of Triassic limestone and dolomite in the karst terrains in South China’s Guizhou Province. Preliminary results indicate that, while the presence of microbes significantly intensified the rock weathering, fungi exerted a stronger effect than bacteria. The strongest influence came from the strain FeM001 which increased Ca release from calcite and dolomite by 173 and 156 times, respectively, relative to deionized water at the same pH. No correspondence between pH and calcite dissolution was observed as the microbe’s ability to secrete acids was not correlated to the extent of Ca release. Carbonic anhydrase was isolated from all the experimental strains. In addition, a suite of organic acids/ligands, both simple and complex, secreted during microbial growth were identified including ethanol, acetol, diose, acetic acid, hexanoic acid, soleal, kojic acid, 2-propenoic acid, 2-furanmethanol, 2-hydroxycyclopent-2-en-1-one, 2(5H)-furanone, 2,3-dihydro-3,5-dihydroxy-6-meyhyl-4H-pyran-4-one, 4-cyclopentene-1,3-dione, 5-hydroxymethyl dihydrofuran-2-one, 5-methyl-2-furfural, and 5-(hydroxymethyl)furfural. These results strongly suggest that microbial weathering of carbonate rocks is a multifaceted process that may include microbe-rock physical interaction, enzymatic catalyzed metal ion release, as well as acid and ligand promoted dissolution. They further imply that laboratory work using simple organic acids cannot be treated as an effective proxy to understand microbial weathering in natural environments.