

The Noble Gases in Late Palaeozoic Chert and Lavas in Yunnan, SW China

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The contents and isotopic compositions of the noble gases in the Late Palaeozoic cherts, basalts, gabbros and picrites from Menglian, Lancang and Dali in Yunnan, SW China, had been determined. The R ($=^3\text{He}/^4\text{He}$) values in the cherts from Dali and Menglian are between 0.108×10^{-6} and 0.183×10^{-6} . The R values in the basalts, gabbros and picrites are as low as $(0.0108-0.108) \times 10^{-6}$ with average 0.0755×10^{-6} , and shown radiogenic He. This is attributed to an alteration by shallow liquid because the $^{40}\text{Ar}/^{36}\text{Ar}$ ratios in these rocks are 295.8—1529.4 with average 855.2, and far less than MORB and continental crust values. According to Ozima and Podeseck (1983) on fractionation factor, in our samples, F_3 are $(0.048-11.92) \times 10^{-4}$ with average 3.02×10^{-4} , indicate the effect between sea water and old ocean crust. F_{20} are $(0.16-32.17)$ with average 5.39, significantly riched ^{20}Ne , and are consistent with MORB. The excess in ^{84}Kr and ^{132}Xe are shown by high F_{84} (0.92—4.55, average 2.13) and F_{132} values (3.44—97.30, average 35.86), and imply that the Kr and Xe abundance patterns in these rocks are typical old ocean crust. It is interesting that the highest $^{40}\text{Ar}/^{36}\text{Ar}$ (1565.9) and the highest R value (0.183×10^{-6}) are found in a same chert sample from Menglian. It is well known that cherts were formed by thermal liquid sedimentary process. Hence, it is presumable that the primitive magmas had much higher R value than crust materials and higher $^{40}\text{Ar}/^{36}\text{Ar}$ ratio. Thus magmas could be ascended from MORB source. It is not eliminated, however, that some of the local primordial magmas were from lower mantle by plume (Fang and Niu, 2003).

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The role of the cell surface electric field on metal uptake by *B. subtilis*

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Bacteria require trace metals to satisfy the specific requirements of metal-enzymes and/or structural components. In order to sequester metals from the environment, bacteria have developed a cell surface electric field. The bacterial cell wall contains proton-active functional groups which can deprotonate to form negatively charged surface ligands. These deprotonated functional groups form surface charge and generate a surface electric field around the cell. The cell surface electric field controls the spatial distribution of ions and counterions at the bacteria-water interface and can strongly affect metal sorption reactions.

Electrophoretic mobility, acid-base titration, metal sorption experiments were conducted to examine the electrostatic interactions between metal cations and the cell surface electric field of *Bacillus subtilis*. The electrophoretic mobility of *B. subtilis* cells was measured as function of pH in 10^{-1} to 10^{-3} M KNO_3 electrolyte solutions. Zeta potential values were determined using the electrokinetic equation described by [1]. Acid-base titration experiments were conducted using an auto-titrator assembly in a N_2 atmosphere. And finally, metal sorption experiments were performed with 1.0 ppm of Ca, Sr and Ba metal standard and 1 g/L bacteria over a range of pH values and electrolyte concentrations.

The results show that Ca, Sr and Ba sorption onto *B. subtilis* is strongly dependent on solution ionic strength, suggesting that the metal ions are bound to the bacterial surface electric field via an outer-sphere complexation mechanism. Proton titration experiments yielded total surface charge density values which were used to calculate the surface electrical potential using the Donnan-shell model [2]. Zeta potential values determined by electrophoretic mobility experiments are good agreement with surface potential values estimated by the Donnan potential equation. Metal complexation constants for Ca, Sr and Ba sorption reactions were determined using a surface complexation model which accounts for the electrical potential associated with the bacterial cell wall. The results indicate that electrostatic forces play an important role in the uptake of metals by *B. subtilis*.

References

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