REE geochemistry in biogenic fossil and isotopic geochronology from the Cambrian-Ordovician boundary section in China

WANG YUANYUAN[1], LI HUIMING[2], LIU DI[2], TAO XIANCONG[2], ZHANG MENQUN[2] AND WANG YINXI[2]*

[1]Nanjing Institute of Geology and Paleontology, Academy of Sciences, Nanjing 210008, China (wangyuanyuanyugod@163.com)

[2]Center of Modern Analysis, Nanjing University, Nanjing 210093, China (*correspondence: yxwang@nju.edu.cn)

Aside from the sample belonging to an undetermined fossil group, all the 14 sample under the present investigation are inarticulate brachiopods of the family Acroteretidae which were found in the acetic acid insoluble residues from micritic limestone beds from Cambrian-Ordovician Boundary at Jilin.

All the REE and trace elements are measured with ICP-AES and ICP-MS instruments. Rb- Sr and isotopes are investigated by isotopic dilution analysis (TIMS).

.Ce abnormal values of all the investigated samples are higher than -0.10, suggesting the dominant anoxic conditions of water mass in times of the investigated interval from the Proconodontus Zone to the lower part of the Cordytodus lindstromi Zone. The intercept of HDA 9B1 shale clay mineral isochron and the lowest value of Sr isotopic ratio of limestones are all identical with the Sr isotopic ratio of seawater in Cambrian-Ordovician time. This is another important support to the conclusion that the Xiaoyangqiao section belongs to the Cambrian-Ordovician Boundary strata and the clay mineral isochron age (487±5.6Ma) of HDA9B1 is reliable.

The remarkable biotic events in a short period probably less than on million years during the Cambrian-Ordovician interval, and both the chemical and biological events seem intimately related to each other as cause and effect. This study also demonstrates that reliable ages can be often obtained by using the clay mineral method for Rb-Sr dating of sedimentary rocks.

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Microbial arsenite oxidation in soil column experiments

ZIMING YUE* AND RONA DONAHOE

Department of Geological Sciences, University of Alabama, Tuscaloosa, AL 35487 USA (*correspondence: zyue1@crimson.ua.edu)

Column experiments were performed to simulate soil contamination by the surface application of arsenic trioxide herbicide. Arsenite oxidation began early in the experiment and after 54 days, aqueous As (III) was completely oxidized to As (V) within the column residence time of 6.5 hours [1]. This rapid arsenite oxidation rate cannot be explained by inorganic processes, as the arsenite half life in water open to air is around one year [2].

Two series of serum bottle experiments were conducted to determine the mechanism of arsenite oxidation in the column experiments: both series were sterilized by autoclaving, then one series was inoculated with unsterilized soil. The bottles were opened to air for 10 minutes every day to maintain aerobic conditions and a bottle from each series was sacrificed every other day over a 20-day period. Chemical analyses of the aqueous solutions showed increasing arsenate concentrations with time in the non-sterile series, but no oxidation occurring in the sterile series during the same period. This indicates that arsenite oxidation in both column and serum bottle experiments was microbially mediated.

Microbial isolates were obtained from both column and serum bottle materials using an arsenite-enrichment method. They were identified by DNA sequencing and tested for arsenite oxidizing capability. The results showed bacteria *Burkholderia fungorum* (first report) and a new species of the genus *Burkholderia* isolated from the column materials were able to oxidize arsenite efficiently. The bacterial suspensions are capable of oxidizing at least 30 mg/(L·day) As (III) to As (V), and can survive pH conditions as low as 2.5. These bacteria are likely responsible for the rapid rate of arsenite oxidation observed in the column experiments.

[1] Yue & Donahoe (2009) *Appl. Geochem*. **24**, 650–656. [2] Eary *et al*. (1990) *Chemical modeling of aqueous systems II*. 379–396.