Surface microtopographic and chemical behavious of dissolved zircon at 180°C

RUCHENG WANG, HAIPING LU AND XIANCAI LU

State Key Lab for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, China

We report results of dissolution experiments on alluvial grains of zircon from Hainan (China) combined with powder grains of zircon at 180 °C for 240 to 712 hours with 1M HCl, 1M NaCl and 2M NaCl solutions as reactive fluid. Electron-microprobe analyses shown that they are both poor in U and Th (UO_2 and ThO_2 < 0.1 wt%, respectively). Correspondingly, Raman spectrscopy have been carried out in order to investigate the damage degree of the zircon grains. The spectral profiles have shown that two types of zircon grains have silimar high crystallinity.

Atomic force microscope (AFM) was used to study the microtopography of alluvial zircon grains before and after dissolution. The starting zircon crystals presented well-developed terraces and steps, while the compared observations revealed that terraces and steps are mostly dissolved. Pits were observed at the terrace near dissolved steps, and are as large as 1.89 μm wide and 160 nm deep. On the surface of zircon grain for 712 hours, 1M NaCl, we observed a string of nano-sized powders near a step, which should be considered as ZrO_2 precipates.

X-ray photoelectron spectroscopy (XPS) measurements indicated that zircon sufferd incongruent dissolutions. Si has elevated dissolution rate that Zr, indicating the possibility of formation of Zr-enriched thin layers at the surface of zricon after dissolution.

ICP-MS was used to analyze the reactive solutions. The results revealed that the release of Zr, Hf and U were enhanced with dissolution. HCl solution was more reactive for zircon if compred with NaCl solution.

Study on physical and chemical stability of zircon may provide insight into both the dissolution and overgrowth of zircon, and will have implications for mineralogical analogues of storage of radioactive wastes.

The material origin of red residua overlying carbonate rock in Guizhou, China

SHIJIE WANG*, CHENGXING SUN AND XIUMING LIU

State key laboratory of environmental geochemistry, Institute of Geochemistry, CAS, Guiyang 550002 China. (*hdh@public.gz.cn)

The red weathering crusts in the karst regions of Guizhou are the important part of the red weathering crusts in southern China, but there has been a long-standing controversy about their material source and origin. Mainly on the basis of the geological field characteristics of the sleeved red weathering crusts and the studies of their mineralogy, geochemistry and grain size parameter, this paper discusses their material source and origin. Significant differences in mineralogy and geochemistry for the various profiles, especially for the adjacent profiles, exclude the possibility that long-distance Aeolian sediments, volcanic ashes, and overlying (or at the higher levels) clastic rocks serve as a unified, important material source. Extremely low content of quarts indicates that the commonly seen feldspar silicarenite is not the principal material source. In addition, the facts that the soil layers have well inherited the REE distribution patterns of the basement rocks and soil layers in most of the profiles are characterized by MREE enrichment relative to shales also exclude the possibility that clayey rocks and shales are the major material sources of red clay. Differences among the weathering crust profiles can be well explained in terms of the differences in acid-insoluble substances extracted from the basement rocks, indicating that they are the result of weathering of the underlying carbonate rocks and of the (semi-) *in-situ* accumulation of acid-insoluble substances. Some of the profiles even show some characteristics of the typical weathering crusts and possess the textural features of normal weathering sequence profiles. The characteristics of grain size show that the red weathering crusts display a good inheritance relationship with the underlying basement rocks (carbonate rocks) too. The consistency and gradation in grain- size distribution characteristics of acid-insoluble substances in the basement rocks and overlying red weathering crusts have confirmed that the weathering crusts possess the features of in-situ weathering.

Acknowledgments

This project was jointly supported by National Natural Science Foundation of China (Grant No. 49833002, 40273015) and the “Western Light” Program sponsored by Chinese Academy of Sciences.