Rutiles in UHPM rocks from Sulu-Dabie orogen

Z.Y. CHEN

Institute of Mineral Resources, Chinese Academy of Geological Science (czy7803@126.com)

Electron probe and LA-ICPMS were used to analysis rutiles from ultrahigh pressure metamorphosed (UHPM) rocks from Sulu-Dabie orogen in eastern China, integrated with the investigations of petrography, petro-chemistry and mineralogy, main conclusions can be summarized as follows:

Magnesite + garnet + omphacite and corundum+ garnet + omphacite assemblage were firstly found as inclusion in rutiles, indicating that rutile may be formed at very high pressure (>5GPa) and temperature (>800°C).

Zr-in-rutile thermometry generally gave temperatures lower than metamorphic peak conditions in eclogites from Sulu-Dabie. Besides the effect of ultra-high pressure and retrograde metamorphism, element diffusion may be the primary factor that had reduced the Zr contents and temperatures in rutiles. Difference of Zr contents in some individual sample may be caused by inhomogeneous of Zr in rutile itself. However, the distributions of Zr in rutile have approached re- equilibrium after retrogression, Zr-in-rutile temperatures may record the diffusion closure temperature of Zr in rutile after re- equilibrium, which is close to the temperatures of amphibolite's facies.

In vein-free eclogites, HFSE such as Ti, Nb and Ta were only redistributed among different Ti-bearing mineral phase *in situ* or near *in situ* during prograde-peak-retrograde metamorphism, and did not show evidently transport, i.e. HFSE are not mobile during UHPM. Most of the coarse grain rutile-bearing quartz vein in eclogites must be syn-metamorphosed vein, and may be formed during quartz-eclogite facies, the Ti, Nb and Ta of rutile may derived from wall eclogites. However, the vein-forming fluid and Ti, Nb, Ta of hair-like rutile bearing quartz (crystal) vein may derived from gneiss.

The most important factors which control the mineralization of eclogitic type rutile deposit are protoliths property and UHPM. Ti-rich basaltic protoliths are the material fundamental for rutile deposit, high pressure to ultra-high pressure are prerequisite for this ore type.

A new generation of ^{230}Th dating techniques: Tests of precision and accuracy

H. CHENG[1], R.L. EDWARDS[1], X F. WANG[1], J. WOODHEAD[2], J. HELLSTROM[2], Y.J. WANG[3] AND X.G. KONG[3]

[1]U. of Minnesota, 55455, USA (cheng021@umn.edu)
[2]U. of Melbourne, Vic. 3010, Australia
[3]Nanjing Normal University, Nanjing, 210097, China

Following upon earlier work, we have developed techniques for precisely measuring ^{234}U and ^{230}Th (precisions of 1 to 2 epsilon units) using multi-collector inductively coupled plasma mass spectrometry. We have followed up by (1) applying methodology that increases sensitivity so that the method can now be applied to cave deposits with typical uranium concentrations and (2) undertaking experiments that establish and test the accuracy of the method.

One key hurdle is identifying materials with secular equilibrium isotope ratios, which can be used to determine the half-lives of both ^{234}U and ^{230}Th at high precision. We selected samples older than 2 million years which could have behaved as closed systems. Their measured ^{234}U/^{238}U and ^{230}Th/^{238}U ratios were identical within 1-3 epsilon units. We used these results to establish new half-life values for ^{234}U and ^{230}Th, consistent within errors with earlier determinations, but significantly more precise. The half-life precisions are similar to analytical precisions, however, accuracies are ~1‰, limited by errors in the ^{238}U half-life and in gravimetric standards.

Another fundamental issue is the degree to which natural materials behave as closed systems. We have tested for age accuracy with two stalagmite samples from Sanbao Cave, Hubei, China, which grew continuously between 515-640 and 310-620 ky ago. We previously established that 23 ky cycles in Sanbao Asian Monsoon records follow Northern Hemisphere summer insolation for the past 300 ky. Small diagenetic shifts or errors in half-life values would result in progressively larger shifts in age for progressively older samples. For example, an error of 5 epsilon-units in ^{230}Th or ^{234}U half-life or a similar magnitude diagenetic shift would result in an age offset of half of a 23 ky cycle at 600 ky. Using new half-life values to establish chronology, the 23 ky cycle signal of the stalagmite continues to match insolation back to 640 ky, supporting the accuracy of both the half-life values and the closed system assumption for these stalagmites. This new generation of ^{230}Th dating methods will likely play an important role in establishing precise and accurate late Quaternary chronologies back beyond 700 ky.