Seasonal variation of ^{231}Pa and ^{230}Th fluxes in the West Caroline Basin

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Introduction

^{231}Pa and ^{230}Th are produced uniformly in seawater from radioactive decay of dissolved uranium isotopes and at the constant activity ratio of 0.093. Both are rapidly adsorbed on settling particles and scavenged from the water column into the underlying sediments. ^{230}Th is the most particle-reactive. Its flux to the seafloor should approximate its production rate in the water column. These characteristics have led to a wide range of applications as tracers of particle scavenging (Nozaki *et al*., 1981; Anderson *et al*., 1983).

Materials and methods

Sediment trap experiments were carried out in the western equatorial Pacific. Settling particles were collected from the West Caroline Basin by using time-series sediment traps and analyzed for ^{231}Pa and Th isotopes. Surface sediment samples collected with a multiple core sampler were also analyzed for ^{231}Pa and Th isotopes. Two sediment traps were deployed at depths of 970 m and 2940 m (1800 m above the bottom) from January to November 1999.

Results and discussion

The ^{230}Th concentrations in settling particles ranged from 0.73 to 2.64 dpm/g at 970 m depth and 2.37 to 6.71 dpm/g at 2940 m depth. The ^{231}Pa concentrations in settling particles ranged from 0.14 to 0.41 dpm/g at 970 m depth and 0.22 to 0.62 dpm/g at 2940 m depth. The flux-weighted mean concentrations of ^{231}Pa were 0.28 and 0.39 dpm/g at depths of 970 m and 2940 m, respectively. The ^{231}Pa and ^{230}Th fluxes showed large seasonal variations, similar to the trend of the total mass fluxes. The maximum ^{231}Pa and ^{230}Th fluxes occurred from late February to early March at 970 m depth. Larger ^{231}Pa and ^{230}Th fluxes were observed in March and June at 2940 m depth. The scavenging of particle-reactive ^{230}Th was tied most closely to the flux of organic matter and biogenic opal at 970 m depth and to the flux of carbonate at 2940 m depth in the West Caroline Basin

References

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Experimental study on hydrothermal annealing of fission tracks in zircon

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Introduction

Increasing temperature causes fading of fission tracks (FTs) in minerals. Many annealing experiments were already conducted in atmosphere. On the other hand, mineralogists think that the existence of fluid increases rate of phase change and resolution of crystals. In order to elucidate whether or not the FT annealing at hydrothermal condition is the same as that at atmospheric condition, we performed zircon heating experiments using a hydrothermal synthetic machine.

Experimental Methods

The zircon grains were shut into platinum capsule with ion exchanged water and heated in Tuttle type reactor. Heating time is 100 hours: 11 hours heating was also performed for preliminary experiments. We performed the experiments at 458_‹C ? 611_‹C and temperature is constant within ±5°C for 100 hours after reaching plateau. Pressure was kept constant for all experiments as 1000kg/cm? (98MPa), equivalent of the crustal depth about 3km.

Observation was conducted according to conventional methods (Yamada *et al*., 1995a).

Results and Discussion

For both 11 and 100 hours heating, the track length ? temperature relationships are indistinguishable within 2 standard errors between the present hydrothermal and previous atmospheric annealing data (Yamada *et al.*, 1995b). The relationship between the normalised mean track length and standard deviation of track length distribution is indistinguishable between this and previous studies (Yamada *et al.*, 1995b; Tagami *et al.*, 1998). In addition, the etched shape of confined and 4ƒÎ surface tracks look similar between the two type of annealing. These lines of evidence suggest that there is no significant differences in track annealing characteristics between the two. It is therefore implied that the annealing kinetics established so far can be applied to thermal history analysis of rocks that were subjected to hydrothermal conditions in nature.

Reference

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