

(U-Th)/He thermochronologic analysis of the median tectonic line and associated pseudotachylyte

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Introduction and Ages

Fault-generated pseudotachylytes (PST) were reported along the Median Tectonic Line, Mie Pref., Japan [1]. The PST was formed after mylonitization of the Hatai Tonalite under amphibolite to greenschist facies conditions, and had been post-dated by cataclasis. We succeeded to date zircons separated from one of the PST and the mylonited Hatai Tonalite ~10 cm distant from this PST using the (U-Th)/He method. The measured ages, 60±3 Ma (1SE) and 54±2 Ma (1SE), respectively, were approximately concordant with the previously-reported zircon fission-track (ZFT) age of this PST, 60.0±3.5 Ma (1SE.; [2]). On the other hand, the ZFT age of the same protolith as for our (U-Th)/He dating was 70.2±2.7 Ma (1SE; [2]). This age was older than both of our zircon (U-Th)/He (ZHe) ages and the ZFT age of the PST.

Interpretation

Our implication deduced from these thermochronologic constraints is that the ambient temperature for generating the PST, at least 10 cm scale, was higher than the closure temperature of ZHe (~180°C; [3, 4]). In addition, the ambient temperature was estimated to have been lower than at least the upper limit of the partial annealing zone of ZFT (~330°C; [5]). Shimada *et al.* [1] estimated the ambient temperature for generating the PST as 200-300°C from the existence of the Type-III deformation twin of calcite and the cataclastic-plastic transition of quartz. Our implication was consistent with them.

[1] Shimada *et al.* (2001) *J. Geol. Soc. Japan* **107**, 117-128.

[2] Takagi *et al.* *J. Geol. Soc. Japan*, in submission. [3] Reiners and Farley (2002) *Tectonophysics* **349**, 297-308. [4] Reiners *et al.* (2004) *GCA* **68**, 1857-1887. [5] Yamada *et al.* (2007) *Chem. Geol.* **236**, 75-91.

²⁴⁰Pu/²³⁹Pu atom ratios in water columns of the Japan Sea: Temporal variation and transport processes

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Introduction

The principal source of ²³⁹Pu (half-life of 2.41 × 10⁴ yr) and ²⁴⁰Pu (half-life of 6.56 × 10³ yr) in the ocean is the fallout derived from atmospheric nuclear weapons testing. In the North Pacific Ocean, the principal source can be further distinguished as two distinct sources of plutonium: close-in fallout from nuclear weapons testing at the Pacific Proving Grounds (PPG) in the Marshall Islands and global fallout. The atom ratio of ²⁴⁰Pu/²³⁹Pu is known to be a useful tracer to identify the sources of plutonium in the ocean. The objectives of this study are to measure the ²³⁹⁺²⁴⁰Pu activities and ²⁴⁰Pu/²³⁹Pu atom ratios in seawater from the Japan Sea and to discuss the transport processes of plutonium in the oceanic margin.

Materials and Methods

Seawater samples were obtained during the R/V Hakuho-Maruk Cruise in 1984. The samples were collected at Stn. AN-16 in the Yamato Basin and Stn. AN-21 in the Tsushima Basin. Seawater samples also were obtained during the R/V Natsushima Cruise in 1993. An objective of the 1993 Natsushima Cruise was to re-visit AN-16 and AN-21 of the 1984 Hakuho-Maruk Cruise. The ²⁴⁰Pu/²³⁹Pu atom ratios were measured with sector-field ICP-MS.

Results and Discussion

The atom ratios of ²⁴⁰Pu/²³⁹Pu showed no notable variation from surface to the bottom with an average ratio of 0.24. The atom ratios of ²⁴⁰Pu/²³⁹Pu in water columns of the Japan Sea were significantly higher than the mean global fallout ratio of 0.176 ± 0.014 [1] and 0.180 ± 0.014 [2]. These high atom ratios proved the existence of close-in fallout plutonium originating from the Pacific Proving Grounds. The contribution of the PPG close-in fallout was calculated to be 34.6 Bq m⁻² obtained for 1993 in the Yamato Basin and the Tsushima Basin, which corresponded to 40 % of the ²³⁹⁺²⁴⁰Pu inventory in the water column.

[1] Krey *et al.* (1976) IAEA-SM-199-39, 671-678. [2] Kelley *et al.* (1999) STOTEN **237/238**, 483-500.