Fission-track dating of faults with plastically deformed biotites

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Theory and Setting

Fission-track (FT) thermochronometric analyses were carried out to constrain timing of faulting accompanied by plastic deformations of biotites. Biotites are plastically deformed when the host rock is at higher temperature than about 200–300°C [1, 2]. At such a high temperature, FTs of apatite are expected to be annealed in a geologically short period. Therefore, thermal history of the host rock around the faults reconstructed based on apatite FT thermochronometry can be useful to constrain the timing of the fault slips.

FT analyses were conducted around faults distributed in the late Cretaceous Kojaku Granite, southwest Japan. The faults are grouped into ENE-strike left-lateral α system and NNE-strike right-lateral β system, which are conjugated [3]. A minor right strike-slip overlapped along a part of α system was idetified as the latest surface based on the cross-cutting relationships. Biotites deformed plastically were commonly observed along the faults including the latest surface [3].

FT Analytic Results and Interpretation

Apatite FT ages ranged 48–17 Ma. Younger ages were obrained around the latest surface, while the ages got younger with distance from a basaltic dyke formed at ~19 Ma [4]. Considering the age errors and FT length patterns, host rocks around the latest surface are thought to be reheated due to the basaltic intrusion. Forward modeling was performed to verify the interpretation; time-temperature history after the basaltic intrusion was computed at each distance from the dyke and converted into FT parameters. The calculated parameters were consistent with the observed FT parameters, implying the younger ages reflect the dyke intrusion. Considering the results and bulk thermal history of the Kojaku Granite [4], the fault slips could have occurred just after the granitic emplacement at ~68 Ma and/or basaltic intrusion at ~19 Ma.

[1] Stesky *et al*. (1974) *Tectonophys* **23**, 177-203. [2] Stesky (1978) *Can J Earth Sci* **15**, 361-375. [3] JAEA (2014) http://www.jaea.go.jp/04/turuga/jturuga/press/2014/03/p140314-2.pdf, (J). [4] Sueoka *et al*. (2016) *J Geogr* **125**, in press, (J+E). (J: in Japanese, J+E: in Japanese with English abst)