Modification of paleo-strain rate meter for dynamically recrystallized quartz

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Estimating paleo-strain rate of rocks in upper-middle crust precisely is important, and Takahashi et al. (1998) provided a paleo-strain rate meter from fractal geometry of dynamically recrystallized quartz aggregates. Experimental studies of the dynamically recrystallized quartz aggregates have been carried out for the purpose of revealing the relationship between deformation conditions and microstructures (e.g. Masuda and Fujimura, 1981; Hirth and Tullis, 1992). As a result, changes of recrystallized grain shapes in conjunction with deformation conditions has revealed. Manish (2010) applied the paleo-strain rate meter for naturally deformed quartz rocks in India, and estimated strain rates in order of which were significantly larger than strain srates in natural conditions (Pfiffner and Ramsay, 1982).

We modified paleo strain rate meter provided by Takahashi et al. (1998) by taking into account of the change in activation energy for creep across the phase transition of quartz. Takahashi et al. (1998) revealed that fractal geometry of recrystallized grains were determined by Z-parameter, which is a function of temperature, strain rate, and activation energy for creep. The temperature range of quartz deformed in the natural fault is in the range of , while on the other hand that of experiment is in the range if (Fukuda and Shimizu, 2017). Kirby (1977) found the change in activation energy for creep across phase transition of quartz. So, we utilized the activation energy for volume diffusion of oxygen species by Faver and Yund (1991) to strain rate meter. We estimate strain rate of natural quartz rocks with modified paleo-strain rate meter, and the recalculated strain rate to be , which is reasonable in the temperature range of natural fault.

Keywords: paleo-strain rate meter, dynamic recrystallization

