Low temperature thermochronology of fault zones: an overview and examples

TAKAHIRO TAGAMI [1]

[1] Division of Earth and Planetary Sciences, Graduate School of Science, Kyoto University, Sakyo-ku, Kyoto, 606-8502, Japan. tagami@kueps.kyoto-u.ac.jp

The timing of faulting episodes can be constrained by radiometric dating methods with low closure temperatures applied for fault roks. Fault-zone materials suitable for dating are produced by tectocic and geochemical processes, such as (1) fragmentation of host rocks, followed by grain-size reduction and recrystallization to form mica and clay minerals, (2) secondary heating/melting of host rocks by frictional fault motions, and (3) mineral vein formation as a result of fluid advection associated with the fault motions. The thermal regime of fault zones consists primarily of the following three factors: (a) regional geothermal structure across the fault zone and background thermal history of studied province bounded by fault systems, (b) frictional heating of wall rocks by fault motions, and (c) heating of host rocks by hot fluid advection in and around the fault zone.

Thermochronological methods widely applied in fault zones are K-Ar ($^{40}Ar/^{39}Ar$), fission-track, and U-Th methods. In addition, OSL, TL, ESR and (U-Th)/He methods are applied in some fault zones, in order to extract temporal imformation related to low temperature and/or very recent fault activities.

In the present contribution, I briefly review the thermal sensitivity of individual thermochronological systems, which basically controls the response of each method against faulting processes. Then, representative examples as well as key issues are highlighted to date fault gouges, pseudotachylytes, mylonites and carbonate veins from a variety of tectonic settings. Coupled with structural geological information, the low termperature thermochronology is widely applicable to both modern and aincent fault zones, placing valuable constraints upon geological, geomorphological and seismological processes.

:

T. Tagami, 2012. Thermochronological investigation of fault zones. Tectonophys., 538-540, 67-85, doi:10.1016/j.tecto.2012.01.032.