A new method to estimate fault activity based on the fraction of saturation of quartz luminescence and ESR signals in fault rocks

*塚本 すみ子[1]、Guralnik Benny[2]、大橋 聖和[3]、大坪 誠[4]
*Sumiko Tsukamoto[1], Benny Guralnik[2], Kiyokazu Oohashi[3], Makoto Otsubo[4]

1. Leibniz Institute for Applied Geophysics、2. Wageningen University、3. 山口大学、4. 産業技術総合研究所
1. Leibniz Institute for Applied Geophysics, 2. Wageningen University, 3. Yamaguchi University, 4. Geological Survey of Japan/AIST

The activity of faults is usually estimated from the fault-displaced Quaternary sediments, containing both measurable displacement markers as well as dateable materials (Research Group for Active Faults of Japan, 1991). However, geologically- or geomorphologically-recognized faults especially in erosion area are not always cutting, or covered by, dateable Quaternary units. For such faults, there is currently no available method to evaluate their activity. The same problem also arises for the detection and dating of seismic slip events from borehole cores. In this presentation, we introduce a new concept to evaluate fault activity using the fraction of saturation of trapped charge in quartz –specifically, of the optically stimulated luminescence (OSL), thermoluminescence (TL) and electron spin resonance (ESR) signals. These signals, alone or in combination, have the potential to quantify the activity of faults with presently unknown slip rates, in Japan and elsewhere.
Active faults in Japan are categorised according to their slip rates into three classes (A, B, and C-classes) (Matsuda, 1975). An A-class fault experiences more frequent and larger-energy earthquakes than B- and C-class faults, contributing to a greater removal of trapped charge in quartz by frictional heating. Therefore, our working hypothesis is that the fraction of trapped charge saturation of A-class faults should be significantly lower than that of B-class faults, which themselves are lower than those of C-class; i.e. the fraction of trapped charge saturation is a function of the fault activity. By inverting the fractions of saturation using their corresponding trap kinetic parameters, one can estimate one of the following: the frequency, the temperature, or the duration of the resetting events (earthquakes), if the other two parameters are independently constrained.
In this presentation, we share our preliminary results from the Atotsugawa Fault, central Japan (including experimental data, modelling and inversion), and discuss the method’ s potential contribution to understanding fault mechanics (flash heating, in particular) and to estimate fault activity.

References:
Matsuda, T., 1975, Magnitude and recurrence interval of earthquakes from a fault. *Zisin (2nd ser.),* 28, 3, 269-283.
Research Group for Active Faults of Japan, 1991. Active Faults in Japan. University of Tokyo Press, Tokyo.

キーワード：ルミネッセンス、電子スピン共鳴、熱年代学、断層活動度
Keywords: luminescence, electron spin resonance, thermochronology, fault activity

