Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS29-P04 Room:Convention Hall Time:May 24 16:15-17:30

What is the factor controlling the increase in vitrinite reflectance along faults?

Hiroyuki Furuichi[1*], Kohtaro Ujiie[1], Arito Sakaguchi[2], Akito Tsutsumi[3]

[1]Life and Env. Sci., Univ. Tsukuba, [2]JAMSTEC, [3]Sci., Kyoto Univ.

The detection of frictional heating along faults is crucial to assessing the level of shear stress during the earthquake. Recent studies suggested that the increase in vitrinite reflectance along faults may result from frictional heating. Commonly, the maximum temperature during frictional heating was estimated using the chemical kinetics model of vitrinite maturation described by a first order Arrhenius law. However, the factor controlling the increase in vitrinite reflectance along faults remains poorly understood. Moreover, the application of the chemical kinetics model for estimation of peak temperature during a short-lived thermal event has not been tested. Here, we conducted high-velocity (1.3 m/s) friction experiments on a mixture of 90 wt% clay-rich powder from the megasplay fault in the Nankai accretionary prism and 10 wt% coal grains from the Kumano forearc basin sediments under wet (water-saturated) and dry (room humidity) conditions. The measurement of vitrinite reflectance and the observation of microstructures were carried out after the experiments. Both wet and dry tests show rapid slip weakening and increase in temperature. The comparison of vitrinite reflectance before and after the experiments indicates that the increase in vitrinite reflectance was observed only in the sample after the dry test, particularly in portions where size of coal is reduced by comminution. In contrast, grain-size reduction is invisible in the sample after the wet test, possibly because of the generation of fluid pressure prior to comminution. The vitrinite reflectance calculated from the commonly used kinetics model is higher than that measured after the experiments, suggesting that the kinetics model tends to overestimate the peak temperature in faults. Our results indicate that vitrinite reflectance is never increased by a short-lived rapid heating alone; comminution is necessary for an increase in vitrinite reflectance. The new kinetic model of vitrinite maturation considering the effects of comminution is need for better estimation of temperature rise along faults.

Keywords: vitinite reflectance, frictional heating, comminution, Nankai Trough