

Blackening of fault gouge by pyrolysis of carbonaceous mineral

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Earthquake slip induces frictional heating and comminution of mineral grains on the fault and interseismic physicochemical process produces the fault gouge. The fault gouges sometimes exhibit various colors (white-pink-green-gray-black), and in particular those developed in sedimentary rocks show gray to black. However, the origin of the change in color was not fully understood, and its relationship to slip parameters such as friction work and heat was not also revealed. Therefore, in this study, we focus on the blackening of the fault gouge originated from the sedimentary rocks. We first performed frictional and milling experiments on the mixture samples of clay mineral (montmorillonite) and coal (bitumen), and then investigated the spectroscopic feature by using visible, infrared, and Raman spectroscopies. We recognized blacker sample after friction experiment with higher initial content of coal, and confirmed the Raman G and D bands on the surface of clay mineral. Thus, we inferred that frictional heating induced thermal decomposition of carbonaceous material and the pyrolytic gases adsorbed on the surface of mineral grains resulting in the blackening. Furthermore, black-fault gouges in natural might have experienced high temperature at >300 °C.

Keywords: carbonaceous material, pyrolysis, frictional heating, fault gouge