

Luminous phenomena due to impact shear fracture of various rocks

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Seismo-electromagnetic (s-EM)/luminous phenomena could be occurred due to dynamic shear deformations/fracture of rocks during not only a main shock but also the fore- and after-shock. In order to understand the source mechanism, the seismic luminous phenomena, a kind of s-EM, from impact shear fractured rocks were conducted using a Sharpy impact tester equipped with a CCD camera at room temperature in ambient atmosphere. In historical documents, luminous phenomena were often eye-witnessed during sector collapse associated with earthquakes, such as Gokken-zan (1701 Hoei EQ), Mayu-yama (1792 Shimabara, Unzen EQ), Ibuki-yama (1909 Kohnno EQ). These mountains are consists of not only granite that has been often used in the laboratory tests, but also tuff, pyroclastic, limestone and etc.

The experimental conditions are: the impact speed was 4m/s. the impact energy was 25 J. The shutter of the CCD camera was opened for about 1 second between just before and after the impact at the ISO speed of 25,600. In addition to the impact tests, we also conducted both the thermally stimulated electron emission (TSEE) experiments and the thermal desorption mass spectrometry (TDMS) experiments.

As the results, intense luminosity was observed from fracturing rocks including biotite. Limestone and pyroclastic also showed luminous phenomena, but serpentine, ignimbrite and deposits of volcanic ash and sand did not. The mechanism of luminosity will be discussed in terms of ionization/discharge, thermo-luminescence and combustion of flammable gases contained in pyroclastic.

Keywords: luminous phenomena, shear fracture of rocks, seismo-electromagnetic, Sharpy impact test