eEarth Discuss., 1, S54–S55, 2006
www.electronic-earth-discuss.net/1/S54/2006/

eEarth Discussions

Interactive comment on "Stimulated infrared emission from rocks: assessing a stress indicator" *by* F. T. Freund et al.

F. T. Freund et al.

Received and published: 16 August 2006

The experiment described in our paper was designed to validate a basic principle, namely that the recombination of p-hole charge carriers at the rock surface leads to the emission of infrared photons at a wavelengths (frequencies) which correspond to transitions between vibrationally excited O-O bonds. The experiment was set up in such a way that the p-hole charge carriers, stress-activated in one portion of the rock sample, had to travel a "large" distance to the emitting surface, where "large" means larger than the range over which the applied stress would act (in particular at the beginning of the loading process).

The predicted narrow emission bands were observed. Hence, we submit that we have provided evidence for hole-hole recombination luminescence in the thermal infrared region. So far none of the parameters have been varied that are important to assess the applicability of this fundamental process to actual earthquake scenarios: depth in the Earth's crust, i.e. overload pressure, temperature and - very important - the presence or absence of pore water, intergranular water films and water-soaked gouges.

Laboratory experiments (unpublished) have shown that allowing blocks of granite and anorthosite to soak up pore water does not noticeably impede the propagation of p-hole charge carriers. These electronic charge carriers can even cross 1-2 cm thick layers of liquid water (though the direction of the current changes). In addition it has been demonstrated (unpublished) that p-holes flow through layers of sand and soil.

If p-holes can travel through 40 cm unstressed rock in a laboratory experiment, we can confidently predict that they should be able to travel through kilometers of rock in the field. Therefore, p-holes activated by stress deep in crystalline basement rocks, in the seismogenic zone, should be able to propagate upward toward the Earth's surface. Since the propagation of these electronic charge carriers seems not to be hindered by pore water nor by granular material (sand and soil), the p-holes should be able reach the surface of the Earth and to recombine, leading to the non-thermal hole-hole recombination IR luminescence described in our paper.

Friedemann Freund

Interactive comment on eEarth Discuss., 1, 97, 2006.