Geophysical Research Abstracts
Vol. 21, EGU2019-9456, 2019
EGU General Assembly 2019

A mechanism of aftershock rate reduction

Elena Pasternak (2) and Arcady Dyskin (1,3)

(1) University of Western Australia, Department of Engineering, Dept of Civil, Environment and Mining Engineering, Crawley, Australia (arcady_m@me.com), (2) University of Western Australia, Department of Mechanical Engineering, (3) Beijing Research Center for Engineering Structures and New Materials,, Beijing University of Civil Engineering and Architecture (BUCEA), China

Aftershocks – acoustic/seismic signals emitted by defects or cracks (microscopic with respect to the seismic event/failure) produced after a major seismic event or material failure – can last for quite some time. Their rate is observed to decrease with time according to a power law (modified Omori's law). The aftershocks are conventionally assumed to be produced by residual stress left after the seismic event or failure. The rate reduction is associated either with the exhaustion of the places available for defect production or with a stress relaxation process of a kind. Possible variety of such mechanisms seems to contradict the robustness of the observed universal relationship given by modified Omori's law.

We develop a different explanation of the rate reduction. We note that it is not the residual stress but rather residual strain which is left after the seismic event or failure. The defect-producing residual stress is proportional to the strain, but the coefficient (the modulus) reduces in the process of defect accumulation. That reduction depends upon the type of defects/cracks, their distribution and orientation. This affects the value of Omori's exponent, p such that: $p=1$ (the original Omori's law) reflects exponential reduction of the modulus, typical for isotropic distribution of accumulated microcracks or sliding zones; $p<1$ (modified Omori's law) reflects power law reduction of the modulus produced for instance by parallel sliding zones; $p>1$ corresponds to the emergence of a critical number of defects and the power law reduction of the modulus as the number of defects tends to the critical one.

Thus the theory developed can help recovering the aftershock mechanism based on the observed Omori exponents.