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Acoustic, electromagnetic emission and atmospheric electric disturbances prior to earthquakes. Laboratory tests and modeling.

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Joint analysis of the observations of acoustic, electromagnetic emission and atmospheric electric fields prior to some earthquakes is carried out. Rheology of rocks evidences of the existence of the stage of inelastic strain at the final phase of earthquake nucleation which describable by progressive accumulation of dislocations (microcrakes) detectable by generation of acoustic, electromagnetic emission and electric field. The results of simultaneous measurements of acoustic and electromagnetic emission in laboratory modeling during the failure of sediment rocks (argillite, sandstone, salt) corresponds with in situ observations. Because of high degree of signal attenuation the sources of pre-seismic acoustic signals could be located only in the vicinity of the gauge. Thus, the registration of the burst of the acoustic emission events proves the existence of the intensive strain process in the subsurface layers of the Earth crust caused by the impending shock. The uncertainties of EQ prediction are consistent with the ambiguity of theoretical models based for the most part on the static theory of elasticity, although the process under investigation is neither linear nor static. It is proposed the phenomenological model of the description of inelastic deformation of the rocks based on the creep (and relaxation creep) phenomena. The comparative analyses of the results of laboratory modeling and in situ measurements suggest that creep phenomena can be regarded as a kinetic process of the destruction in the interiors. In contrast to the nucleation process on a long- and medium-term scale, the final phase is characterized by abrupt activation of the process of stress-strain state variation and increasing of the strain rate by the orders of magnitude that considerably increases signal-to-noise ratio of the strain rate dependent disciplines. These conditions

are favorable to diagnose of the moment of the brittle destruction of the specimen in laboratory tests and rock volume in the focal zone. The results are discussed on the base of cracking mechanism. The theoretical and empirical formulas for estimating the ultimate radius of the strain-sensitivity zone and the duration interval of tertiary stage of creep in the focal zone of EQ are proposed. The strengths weakening process at the final period acquires to greatest extent the self-regulating character. Being completely non-linear and chaotic as a whole the process of earthquake nucleation does have predictable (short term) elements. The examples the scientific prediction of local earthquakes in the North Caucasus are given.

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