

Interactive comment on “The results of experimental studies of VLF–ULF electromagnetic emission by rock samples due to mechanical action” by A. A. Panfilov

Anonymous Referee #2

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The present paper entitled “The results of experimental studies of VLF–ULF electromagnetic emission by rock samples due to mechanical action” by A. A. Panfilov presents the results of laboratory experiments on electromagnetic emission excitation by rock samples due to different forms of mechanical loading. The author describes how the used samples generate electric impulses with different spectra when the impact action, gradual loading or dynamic friction is applied. The paper presents that strong electromagnetic signals, generated while rock samples were fracturing, accompanied by repetitive weak, but perceptible variations of the electric field intensity in short frequency range. As a first comment we believe that abstract has to modified to

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present the results with a clear and readable way.

In the Introduction the author reports the existing literature in order to justifies that many earthquakes are accompanied by electromagnetic (EM) anomalies. Since the spectrum of the existing-claimed EM anomalies is quite broad the author has to add the following in the references in order to present with a fair way the existing long effort in the field. 1. Nomikos, et al., Latest aspects of telluric and electromagnetic variations associated with shallow and intermediate depth earthquakes in South Aegean, *Annali di Geofisica*, XL, 2, 361-374, 1997 2. Nomikos K., Vallianatos, F., Transient electric variations associated with large intermediate-depth earthquakes in South Aegean”, *Tectonophysics*, 269, 171-177, 1997. 3. Nomikos, K., Vallianatos, F., Electromagnetic variations associated with the seismicity of the frontal Hellenic Arc, *Geologica Carpathica*, 49/1, 57-60, 1998. 4. Vallianatos F., Nomikos, K., Seismogenic radioemissions as precursors to earthquakes in Greece, *Physics and Chemistry of the Earth*, 23/9-10, 953-959, 1998.

Regarding the “. . . .different mechano-electrical transformations in hypocenter of the earthquakes. . .” we believe that the author has to use the term “generation mechanism”. To support his ideas on the matter the following published work has to appropriate mentioned 1. F. Vallianatos and A. Tzanis, Electric current generation associated with the deformation rate of a solid: Preseismic and coseismic signals, *Physics and Chemistry of the Earth*, 23/9-10, 933-939, 1998. 2. F. Vallianatos and A. Tzanis, A model for the generation of precursory electric and magnetic fields associated with the deformation rate of the earthquake focus, in M. Hayakawa (ed.), *Seismic Atmospheric & Ionospheric electromagnetic Phenomena*, Terra Scientific Publishing Co., Tokyo, Feb., 1999. 3. F. Vallianatos and A. Tzanis, On possible scaling laws between electric earthquake precursors (EEP) and earthquake magnitude, *Geophysical Research Letters*, Vol.26, No. 13, 2013-2016, 1999. 4. A. Tzanis, F. Vallianatos and K. Makropoulos, Seismic and electrical precursors to the 17.1.1983 M7 Kefallinia earthquake, Greece: signature of SOC system, *Physics and Chemistry of the Earth*, 25/3,

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281-287, 2000 5. A. Tzanis, F. Vallianatos and S. Gruszow, Identification and discrimination of transient electric earthquake precursors: Fact, fiction and some possibilities, *Phys. Earth Planet. Int.*, 121, 223-248, 2000. 6. A. Tzanis and F. Vallianatos, A critical review of ULF electric earthquake precursors, *Annali di Geofisica*, 44/2, 429-460, 2001 7. A. Tzanis and F. Vallianatos, "A physical model of electrical earthquake precursors due to crack propagation and the motion of charged edge dislocations, in *Seismo Electromagnetics (Lithosphere-Atmosphere-Ionosphere Coupling)*" by TERRAPUB, 117-130, 2002 8. F. Vallianatos and A. Tzanis, On the nature, scaling and spectral properties of pre-seismic ULF signals, *Natural Hazards and Earth Systems Sciences*, 3, 237-242, 2003. 9. Vallianatos, F.; Triantis, D.; Tzanis, A.; Anastasiadis, C.; Stavrakas, I., Electric earthquake precursors: from laboratory results to field observations, *Physics & Chemistry of the Earth*, 29, 339-351, 2004. 10. V. Uritsky, N. Smirnova, V. Troyan and F. Vallianatos, Critical dynamics of fractal fault systems and its role in the generation of pre-seismic electromagnetic emissions, *Physics & Chemistry of the Earth*, 29, 473-480, 2004.

The author states "The difficulty of studying the seismic-electromagnetic (SEM) precursors' nature consists in the absence of precise description of the processes that occur in the zones where the earthquakes are preparing". This is not correct. A number of models has describe-propose models on the processes that generate SEM signals appears . The list above along with the work of Hayakawa, M.: *Atmospheric and Ionospheric Electromagnetic Phenomena Associated with Earthquakes*, Terra Sci. Pub. Co., Tokyo, 996 pp., 1990. Hayakawa, M. and Fujinawa, Y.: *Electromagnetic Phenomena Related to Earthquake Prediction*, Terra Sci. Pub. Co., Tokyo, 667-677, 1994. are typical examples

In the following line the author states "Also, a big amount of technogeneous EM interferences makes detection of SEM signals complicated." This is correct. A discussion on the matter is given in A. Tzanis, F. Vallianatos and S. Gruszow, Identification and discrimination of transient electric earthquake precursors: Fact, fiction and some pos-

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sibilities, *Phys. Earth Planet. Int.*, 121, 223-248, 2000.

In the next paragraph the author addresses the laboratory experiments show reporting that " even those that do not contain piezoelectric materials, can generate EM emission in wide frequency range, under mechanical stress At this stage a long collection of experimental results exists where the author has to state 1. I. Stavrakas, D. Triantis, Z. Agioutantis, S. Maurigianakis, V. Saltas and F. Vallianatos and M. Clarke, Pressure stimulated currents in rocks and their correlation with mechanical properties, *Natural Hazards and Earth Systems Sciences*, 4, 563-567, 2004 2. D. Triantis, I. Stavrakas, C. Anastasiadis, A. Kyriazopoulos and F. Vallianatos, An analysis of pressure stimulated currents (PSC), in marble samples under mechanical stress, *Physics and Chemistry of the Earth*, 31, 234-239, 2006. 3. D. Triantis, C. Anastasiadis, F. Vallianatos, P. Kyriazis and G. Nover, Electric signal emissions during repeated abrupt uniaxial compressional stress steps in amphibolite from KTB drilling, *Nat. Hazards Earth Syst. Sci.*, 7, 149-154, 2007. 4. F. Vallianatos and D. Triantis, Scaling in Pressure Stimulated Currents related with Rock Fracture, *Physica A*, 387, 4940-4946, 2008. 5. F. Vallianatos, A. Nardi, R. Carluccio and M. Chiappini, Experimental evidence of a non-extensive statistical physics behavior of Electromagnetic Signals emitted from rocks under stress up to fracture. Preliminary results. *Acta Geophysica*, 60(3), 894-909, 2012.

The author states that "... choice of VLF-ULF range for our researches is associated with the distinctive features of a long EM wave propagation in different mediums. Obviously, some part of the EM radiation, generated in the hypocenter of the earthquake, can reach Earth surface." The author has to justify this statement. Some of the above references will support him (

Furthermore in the next line he notes that "... Also we took in consideration the net of seismic-electromagnetic stations, situated in Magadan region. These stations register EM anomalies, probably of seismic nature, in VLF range." The author has to make clear what is the meaning of this paragraph, explaining in details why the SEM station in Magadan are refereed .

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In the discussion the author has to compare the present results with that previously existing. They have to stress on the possible physical mechanisms that generate the SE signals. Last but not least a correction in English from a native speaker is required.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 7821, 2013.

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