ELECTROMAGNETIC NATURE OF UNUSUAL PHENOMENA BEFORE EARTHQUAKES AND THEIR USE FOR SHORT-TERM WARNING: KOBE, IZMIT AND TAIWAN EARTHQUAKES

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Summary

After earthquakes at Kobe in Japan, Izmit-Turkey and Taiwan, the survivors reported to have witnessed various mysterious phenomena prior to the earthquakes such as unusual animal behavior, lightning, formation of peculiar-shaped clouds and incredible malfunctioning of home electric appliances. These phenomena were elucidated to be caused by intense electromagnetic (EM) pulses following the experiments to simulate/reproduce the phenomena. A theory on generation and propagation of seismicEM signal (SEMS), actually pulsed EM waves, have been developed taking an ensemble of piezo-compensating free charges. These pulses can neither be measured by a proton magnetometer nor by sampling at a low frequency because of the sharp pulse width of around 0.1 ms. The phenomena reported by lay citizens essentially SEMS measurements may be used against the world trend of "negative thinking", i.e., "impossibility of a short-term earthquake prediction".

Introduction

Lay citizens retrospectively reported to have witnessed various mysterious phenomena such as unusual animal behavior, lightning, formation of peculiar-shaped clouds, fogs and mysterious malfunctioning of home electric appliances before the recent earthquakes at Kobe/Japan (1995), Izmit/Turkey (1999) and Taiwan (1999). Some of these phenomena were exactly the same as those in legends and folklores on earthquake precursors. Scientists are skeptical of these reports and consider that what lay citizen reported cannot be objects of serious scientific research. Do these reports reflect mass hysteria or obsession relating superstitions especially in Eastern culture or some wishful afterthought under stress of natural disaster? Should studies of these precursors be treated as paranormal science like those of UFO and cold fusion? If not, what do animals detect, why do they react unusually, and why did lightning, clouds and other happenings occurred? Can one predict earthquakes and save people with these precursors? The DC potential measurement (the VAN method) and electromagnetic (EM) waves at a wide range of frequencies from ULF to VHF were reported to have been observed before earthquakes. We have elucidated earthquake legends and stories on physical basis of electromagnetism and reproduced/simulated by laboratory EM experiments. Intense pulses of EM waves are generated at the time of stress changes prior to an earthquake (Ikeya et al., 1997a) and caused these incredible stories. Simple experiments, which are educational to high school pupils and students in a science course (Ikeya et al., 1997b), will be presented to elucidate the phenomena scientifically.

Precursor phenomena and their elucidation

Collected statements on earthquake precursors from witnesses must be explained scientifically based on a quantitative theory developed on a hypothesis and should be further reproduced/simulated in experiments. So far, the statements and legends ended as just records and speculation. (a) Earthquake Lightning (EQL) Luminous appearance in sky are recorded from ancient time as described by Milne (1890) more than a hundred years ago. Earthquake lightning (EQL) discussed by Terada (1932) scientifically was photographed. Mechanisms on EQL proposed so far are as follow. (1) Thermoluminescence of dust particles (2) Triboluminescence by friction of minerals (3) Neutralization of charged aerosols (4) Atmospheric lightning by a dark discharge We have no evidence of hot debris explosion from the geological fault zone. Atomic and molecular ions might emit light by neutralization. However, charged aerosol with diameters of 1 -100 mm will not emit visible light by neutralization since the energy is dispersed to constituent atoms. A dark discharge may be generated by free electrons accelerated by intense pulsed electric field through ionization and excitation of atmospheric molecules (Takaki and Ikeya, 1988). An intense field generation before a large earthquake with a mechanism of piezoelectric polarization (Finkelstein and Powell, 1972) was once discarded since piezoelectric polarization of quartz grains in rocks would immediately be compensated in a conductive earth. How large charge densities are sustained in a fault zone has been the subject of major controversy. Pulsed EM waves due to piezo-compensating charges is discussed later.