Some basic problems in ground based seismo-electromagnetics (seismo-EM)

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1.Anomalies immediately before earthquakes (EQs)

When the lead time of alleged EM precursors are long, it is less convincing that they are really related to EQs and the credibility of the whole seismo-EM may be questioned. However, when repeated anomalies are observed minutes before EQs, their association would be much more convincing. We introduce that such anomalies (pulses of msec duration) have in fact been observed commonly by the VAN group for a long time. However, because of apparent uselessness of short lead times for EQ prediction purpose, they have not been widely reported so far.

2.Co-seismic anomalies

One of the most common counter-arguments against seism-EM is that no co-seismic signal is observed while pre-seismic signals are observed. In fact, however, signals at the time of EQ have been almost routinely observed in Greece, Japan and USA. However, they were always observed at the time when seismic waves arrived and not at the origin time. They should be called co-seismic wave signals. So far, therefore, it is true that no reliable true co-seismic signals have been observed.

If true co-seismic signal does not exist, can that be a reason for denial of pre-seismic signals? Not necessarily. It can rather be a key information for understanding the mechanism of EQ and seismo-EM. Lab experiments show high frequency EM signal emission at rock fracture, which suggests the same may happen at EQ. High freq. signals at focal depth cannot reach earth surface. Even if they do, usual DC-ULF field apparatus cannot record them. This is one explanation for non observation of true co-seismic signals. However, there is a serious flaw in this explanation: since fracture along faults of large EQ will take some time, so that measurable low freq. convolution component will also be generated. Then, a logical conclusion is that EQ is not fracture but sliding of existing faults which produces no EM signals. Information on EM effects of fault sliding with high speed associated with EQ is scanty. In any case, EQ is a stress releasing process whereas precursory phenomena occur during slow stress increasing process. They are entirely different physical processes.

3.No pre-seismic EM signals at long awaited 2004 M6 Parkfield EQ.

USGS scientists stated that since nothing was observed at best equipped Parkfield, EM in general is unlikely useful for short-term prediction. Although we have some doubt on their methodology and data analysis, here we tentatively accept their results that there indeed was no EM precursors and seek some legitimate reason for non existence at Parkfield of something so often observed in Greece and Japan. One possibility is as follows:

San Andreas Fault is known for its weakness (sliding at low stress), perhaps due to ample water.

Therefore, it may be suspected that EQ takes place before any EM signal is generated. For generation of DC-ULF precursory EM signals, two main models are suggested. One is the solid state physics related model originally proposed by the VAN group and the other is the more popular electrokinetic model. Both models need certain level of stress to operate, before the the critical stress for EQ is reached. Although needing a thorough quantitative examination, we propose that if the stress level that can be sustained at San Andreas Fault is exceptionally low, both observations in San Andreas Fault zone and elsewhere may be explained.