



Tlp versus moonquakes to understand earthquake associated phenomena

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Are transient lunar phenomena (TLP) the lunar analogy of pre-seismic phenomena on the Earth? We would like to propose an interpretation of TLP correlated to moonquakes and to present the idea that observations of TLP would allow us to a better understanding of pre-seismic phenomena on the Earth. TLP ranges from bright flashes, to reddish or bluish glows, and to local obscurations of the lunar surface. There are similarities between TLP and pre-seismic earthquake phenomena, in fact on the Earth, seismic activity was and is associated with many luminous phenomena. In the current explanation, TLP are events that may be associated with out-gassing of volatiles collected in or beneath mare basalt flows, out-gassing can rise clouds of dust. In a similar way, on the Earth clouds were observed before earthquakes over the epicenters. Radon emanation was observed from the Apollo missions and also from studying earthquakes. TLP tend to occur near the edges of maria and in other regions of crustal weakness where fractures provide conduits, Radon emanations on the Moon tend to occur in the same places of TLP. On the other hand, on the Earth spatial Radon anomalies have been observed on active faults in California. But gas fluxes are strongly disturbed by water, crustal asperities and atmospheric perturbations, so a direct cause-effect relationship with earthquakes can be hard to prove. A link of TLP with tidal stress on the Moon was also shown. As the rate of moonquakes seems to be correlated with tidal forces, also earthquakes seem to be correlated to Earth tides. The stress on the Earth due to tides is ten times smaller than the stress caused by the weight of the ocean, but on the Moon, where there are no oceans, tidal stress is more than ten times greater than that on the Earth. A very important fact is that tidal field on the Earth does not have a constant direction and therefore has a complicated relation-

ship with the dynamics of earthquakes. Moon tidal field is near constant in direction and intensity modulation can be principally linked to the elliptic orbit of our satellite. Tidal field stable direction produces only an intensity modulation of stress in each place of the Moon, this can be a “stable” test to study the deformation of the Moon and their influence on moonquakes. The places where deformations and emissions can be recorded and correlated are the locations near TLP sites. In an unique mission it is possible to set seismographs, tilt-meters, gravimeters, electro-meters, magnetometers and alpha particle detectors to measure gas release from the lunar interior. Therefore, because of the lack of water and atmosphere and simple tidal field, the Moon seems to be a better natural laboratory to study the processes that link quakes and several emission phenomena. The gas emanation mechanism and the origin of the lunar atmosphere can be explained, also with the help of orbital experiments.