Identification of subtle signature of active tectonic deformation: Example from Indian Peninsula

Singh Yogendra*[1] and Biju John*[1]

[1]National Institute Of Rock Mechanics – Eshwar Nagar, Outer Ring Road, Banashankari 2nd Stage, Bangalore, Karnataka, India

Abstract

Identifying active faults from plate interior regions, where the rate of deformation is low, pose serious challenge because of low preservation potential promoted by faster erosion. Peninsular India is one of such terrain where even moderate earthquakes can cause heavy damage of life and property due to unexpected nature of event. Due to low stress accumulation and smaller slip rates, mainly because of their intra-plate location, faults generally do not develop a clear fault scarp. However, there are several studies identified active faults in various intracratonic settings including Indian peninsula. These studies mostly carried out through paleoseismic investigations. Since detecting fault related structures are difficult in these terrains, some of the studies used morphometric analysis successfully to identify subtle signature of active fault traces. The present study is another attempt to track down segments of active faults through vide range of morphometric analysis.
The central Kerala region, of Peninsular India, is experiencing seismic events (of the range of M=5.0) since historic period. The NW-SE trending Periyar fault, oriented favourably for movement in the present compressive stress regime, is identified as causative structure in some of the events. The present study focused on the Northwestern end of this fault where there are reports of seismicity since 1989.

The study area mostly constitutes charnockite and is characterized by well-developed foliation, at places. The area is drained by Vaddakancheripuzha, Karuvannur river and their tributaries. The studies identified dominating three segments (c1, c and d) of NW-SE trending lineaments running across the drainage system branched from Periyar fault. Morphometric analysis using third and fourth order streams identified several anomalies in the vicinity of lineaments. Asymmetry factor (AF) indicates the anomalous results in the vicinity of c1 as compared to other region of same relief. High values of transverse topography symmetry factor (T) observed for the 3rd / 4th order drainages in the vicinity of c and c1 lineament. Low values of mountain front sinuosity (Smf) and valley floor valley height ratio (Vf) along c and c1 lineament.

A number of brittle faults were identified related to these lineaments exhibiting fault gouge and damage zone. Observed slicken lines indicates that these deformation are consistently indicating 'North' directed movement agreeable with ongoing tectonic stress regime of Peninsular India. Seismicity data too spatially associated with the NW-SE trending lineaments. The association of morphometric anomalies earthquake events and brittle faults with the NW-SE trending lineaments may be indicating that the area is responding to the ongoing

*Speaker

stress conditions. Since this area is connected with the source zone of M= 5.0 earthquakes through periyar fault, seismic monitoring is required to understand the behaviour and potential of this source zone.
Key Words: Periyar, Lineaments, Deformation, Tectonic, Geomorphology