***Earthlightis: Creaking Hills and Wobbling Valleys* – K. R. Y. Simha, Indian Institute of Science, Bangalore (E: simha@iisc.ac.in)**

Earthlightis continues with earlier Earth Day themes published in the Journal of Geological Society of India: *Earthmetics* and *Earthmia* written especially for school and college students and teachers to promote field observation skills for deeper geological interpretation. Obliquely subducting plates and junctions embrittle overlying mountain ranges. Arthritis refers to minerals depleted brittle bones and joints in the human body with inflammation (google Arthritis Foundation 2020). This word *earthlightis* is coined for highlighting the inexorable crackling, creaking and rumbling sounds accompanying uninterrupted seismic landscaping activity overlying obliquely subducting plate corners and junctions. Counting and correlating these continuous bursts of acoustic emission (AE) with the progressive accumulation of damage offers remote sensing and damage control of brittle bone, rock or wood.

Shillong and surroundings furnish a spectacular history of seismic events discussed passionately and documented continuously for centuries. The Geological Survey of India Memoir on 1897 Assam earthquake studied with tables and photographs is a 557 page masterpiece by Oldham, then an assistant superintendent with the Survey. Oldham begins the introductory narrative lamenting, “...an area of 150,000 square miles had been laid in ruins.... the hills rent and cast down in land slips, and the plains fissured and riddled with vents, from which sand and water poured out in most astounding quantities; and ten minutes had not elapsed from the time when Shillong was laid in ruins..”.

A recent 2019 Geological Society, London, Lyell special issue on Himalayan tectonics featuring Billham's comprehensive summary chronicled the effort of groups led by England, Molnar, Iyengar, Rajendran, Srivatsava along with a reference to the fracture expert Rice. A 2020 article led by Mallick speculated on Shillong obduction from subduction to its south augmented by obstruction at north and east plates. Other relevant contributions as introduced vividly in books by Valdiya and Fowler include a 7843 seismic events catalog spanning 1411-1999 led by Iyengar, while directing CBRI and hazard assessment modeling pertaining to the states of Tripura and Mizoram led by Seetharam (presently directing IIT Guwahati). Recent workers are increasingly preoccupied with forecasting catastrophic mega earthquake scenarios (Richter magnitude $M > 9$).

Fortunately, such extremely rare mega events having occurred once or twice in the recorded history suggest that continental subduction and tectonics overall are gradually trending downwards to a more predictable state of affairs like global weather and circulation. Should this conjecture come true, then the plates will be gently moving up and down carrying their cargo of continents like a feedback controlled system of escalators, elevators and conveyor belts in deep underground mines or mega shopping malls!

Subduction along jagged continental boundaries with large frictional obstruction, fortunately, is a long drawn process emitting a stream of thermal and acoustic premonitory signals. Advances in arthritis diagnostics include both thermal and acoustic assessment of bone and joint damage. This article title is intended to motivate a discussion of listing symptoms and signs of mega events *vis a vis* weaker events of say $M < 7$. An earthquake is labelled as *great* for

$M=8$ with $7 < M < 8$ connoting *major* events. The transition zone $7 < M < 9$ represents a mighty 2 million trillion joules energy barrier enough to propel a 1 km tall, 10 km wide and 100 km long mountain-fragment to an astounding speed of 100 kmph! These figures will help us gauge the ground reality for portraying regional tectonic scenarios in Shillong and vicinity.

Sprawling hilly terrain begins beyond Brahmaputra at Guwahati towards Tawang [elevation: 3048 m] to the north; and, to the east beyond Kohima and Imphal. Shillong offers a spectacular arena for locating a seismic observatory for subduction (SOS). Along with experts at IIT Guwahati, a 24/7 online SOS data can also supplement and refine existing databases covering larger aspects of Himalayan seismicity and tectonics. However, there is an urgent need for developing *microtectonics* addressing local issues such as Moho depth anomalies (google Moho!) for updating school and college curricula for preparing the next generation of seismologists and earthquake engineers.

Sloping down from Shillong to the south, Agartala and Aizawal complete the picture of a rugged mass of earth rumbling and creaking for millions of years with uninterrupted seismicity that began when India collided with Eurasia. Interestingly, Shillong can be visualized as the strategic center of a rugged clock dial of roughly 218 km radius with Kohima, Imphal, Aizawal and Agartala at 2, 4, 5 and 7 O' clock positions, respectively with Tawang (T) at 12 noon generating a pair of hilly triangles: SKI (Shillong-Kohima-Imphal) and SAA (Shillong-Agartala-Aizawal). This entire region is always at high risk from frequent landslides caused by steep slopes and rainfall especially in Aizawal perched on an anvil shaped ridge (google these towns for distance and elevation).

The circular arc TKIAA starting at Tawang with an average radius of 218.4 km and length 1292 km (by road) descends 3033 m like a geologically magnificent 210 degree spiral roller coaster whirling around the axis of Shillong! Like arthritis caused by osteoporosis, this entire 88,000 km² sector STKIAA comprises brittle and broken rock with poor cohesion. Rapid weathering and erosion by rain and wind constitute the principal factors undermining the stability of Himalayan hills and valleys. Continuous condition monitoring of roads and foundations with AE sensors along with seismic sensors could help alert and avert landslides and avalanches from excessive loads.

Large scale evolutionary tectonics has benefited greatly from satellite geodesy models such as GEODVEL which monitors the motion of 11 major plates tracking cities like Bangalore. These GPS based observation data have played a stellar role in validating the general theory of tectonics presuming large rigid plates which become inadequate for describing the motion of regions measuring a few hundred kilometers. Viewing Shillong and vicinity as a seismically active wobbling *microplate* cradled and rocked by a subducting basement offers excellent prospects for *microtectonics* emphasizing local faults and topography besides hydrogeological features. The braided Brahmaputra cutting through gorges and meandering along hills and towns across millennia, therefore, has a mysterious but decisive role in the fortunes of Shillong and surrounding.