CHAPTER – VIII

Summary and conclusion

The northeastern parts of India have developed its complex tectonic fabric due to the northward expedition of the Indian plate which collided with the Eurasian plate and this process is still continuing. The Shillong plateau was built as a result of contractional deformation due to this Indo-Eurasia collision, and is a domicile of high tectonic activity, the close sequential episode of four great earthquakes in the past century including the Great Assam Earthquake of 12 June, 1897 of 8.7 magnitudes on Richter's in the Shillong plateau. In addition to this great earthquake many lower magnitude earthquakes have been recorded later on instrumentally. A comprehensive study of seismotectonics in the region necessitated a multidimensional approach to assess the palaeoseismicity of the expanse. The consequence from such investigation would definitely assist in addressing the dilemma of the earthquake hazard evaluation more pragmatically. This resent research work on the palaeoseismological aspects of the Shillong plateau led us to recognize geological and archeological evidence for large earthquakes, and estimate the probable reoccurrence period of such brutal earthquake in the part of the Shillong plateau.

The deficiency in seismicity records of the region earlier than 100 years and data on the recurrence of detrimental earthquakes led us to investigate the palaeoseismicity of the Shillong Plateau.
Present study area is located in the Shillong Plateau and the Brahmaputra plains casing the two parts of Assam and Meghalaya representing the Mesoseismal area of the 1897 great Assam earthquake.

Trenching have been carried out in the northern part of Shillong plateau sites in hope of substantiation for palaeoseismicity stimulate liquefaction structure and features like sand blow, sand dyke, micro fault and seismically induced seismic deformational structures. To locate these features, multidisciplinary approaches have been adopted like the comparative study of toposheet, satellite images interpretation and field certification for the outcome. Random field level village surveys were done to collect report from elderly people who had witnessed the earthquake incidence in the past. Historical and documentation evidence on past earthquake and previous literature etc. was also taken into consideration, Based on above ideas trench site are estimated, while evaluation of field location care has been taken to gratify the tectonic setting of that area, sedimentological prospect in relation to geomorphology and the local information if any available. We have covered famous earthquake lake Chandubi, 1897 earthquake created Chidrang fault, Kulshi fault influenced periphery abundant channels of Kukshi river of Kukurmara area, historically depicted archeological site of Kamakhya, Jagi ruins, Madankamdev ruins, Dhubri and Dapsi fault controlled site like Rangapani in Garo hills etc. Complete trenching and field documentation is done in each section. Although there are various trench sections which
does not preserve any palaeoseismic signature, hence gives a negative inference to understand the prehistoric geo-activity and ground signature.

The Study site Chandubi lake is located in the northern foothill of the Shillong Plateau in the Kamrup district of Assam having 119 Ha area of water spread in the year 2002. The lake has lost 88.36% of its original water spread area since 1911 which has transformed into alluvial tracks.

Similarly the Ukiam Lake, one of its associates, which had water spread of an area about 311 Ha in 1911-13 completely transformed into alluvial plains by 1967-68. This huge sediment fill-up process in short span of time is found to be related to neotectonic activities allied with palaeoseismicity of the region. Sample was collected from the lake area, moreover seismite was also discovered in the other part around Chandubi area. The result of the TL Dating shows the age of the seismite sample is 4000 ± 560 Years. This can be correlated with the sample dated as 4074+570 years collected from Chandubi Lake. This indicates that the lake was subjected to high seismotectonic sufferings. In Chidrang area three phases of sand dykes are found in crosscutting position, the larger dyke was intruded by small dyke and sediments layers supporting there seismic events. It can be understood from TL dating that chidrang-1 dyke was formed within 5000 yrs to 1800 yrs (approx) whereas the Chidrang -3 dykes was formed within 1800 yrs to present (approx).

In Lohargaht section near Batha River was trenched, which has the preservation of palaeoseismic activity in the form of sand dyke. Sample was collected for TL dating.
Archeologically important sample Jagi pottery section from Jagi, historically and archeologically important site Kamakhya temple broken brick and pottery were sampled and dated by TL dating method. It is seen that both Jagi and Kamakhya pottery debris are closely associated with each other, they all falls in same age group of loharghat seismotectonic palaeoliquefaction structure sand dyke. The above comparison supports the fact that these archeological remnants are the result of major earthquake destruction within limit of approximately 1000 yrs to present time in the shillong plateau. This result can be related to the 1897 earthquake event, The bottom destroyed brick of kamakhya sample dated as approx 1500 yrs can be compared with Chidrang -3 sand dyke (palaeoliquefaction) dated as approx limit range from 1550 yrs. to present time. Both the geological and archeological facts clearly indicate that there was a Major Earthquake stating the terrain subjected to devastating earthquake which took place in a range of within 1500 yrs. to present today. Inference can be drawn that Kamakhya temple may be subjected to at least two major earthquakes and destruction and reconstruction of temple or temple premises might took place at least twice before this present structure of temple.

Kukurmara trenched section has recent sedimentary deposits with alternate sand and clay bands which is ideal condition for palaeoseismic structure and its occurrence preservation. The irregular variation of OSL date with respect to sand layers sequence are due high seismic activity, This area has numerous sand blow structures like sand sill fracture fill etc.
The sediments has mixed from both top and bottom level due to high ground acceleration. The upper limit of Kukurmara paleoseismic date ranges from 65 to 110 yrs. It can infer that the area is subjected to devastation of 1897 earthquake which is 114 year old from today and can be well correlated with S4 sample of Kukurmara liquefaction dated as 110 yrs from today. (with correction of dating instrumental error margin)

In Rangapani trenched section it is seen that the sand dyke R-2 sample of Rangapani approx within 5330 yrs from today comes in close association with major event of Chidrang-1 rounded as 5000 yrs range to present. So it can be inferred that within approx 5000 yrs from today there was a major earthquake event took place in the Shillong plateau. The sand dykes of Chidrang-1 and sand dyke of R-1(Rangapani) may represent same seismotectonic event.

The deformation of Rangapani concludes that this raw 6000 to 8000 yrs (or 5330yrs after correction) age may be the time of Dapsi thrust activation too.

From sedimentological analysis it is seen that "seismites" of liquefaction origin are developed in sand size particles. The silt and mud normally escape lead to development of the seismites. They are poorly sorted and subjected to low velocity than normal depositional mechanism.

The field evidence for the big dimension and coarse nature of Chidrang-1, Kukurmara seismitie and sequence, Rangapani highly deformed layer and seismitie, Coarse and massive nature of Chadrang-4, destruction of concrete Kamakhya temple probably indicate much higher intensity
earthquakes (>8) in comparison to Chidrang-3, Lohargaht, probably lies between 6<M<8).

Conclusion
The Palaeoseismological study has been carried out in the mesoseismal zone of the 1897 Great Assam earthquake in Assam and Mehgalaya. Multiple events of the major earthquakes have been identified, Kukurmara possesses liquefaction feature which can be directly linked with 1897 earthquake. Kamakhya temple debris, Jagi village potteries and Loharghat palaeoseismic signatures can be related to each other. The destruction of kamakhya temple or temple premises and Jagi human settlement area and formation of sand dyke in Loharghat can be linked with earthquake event that took place within 1000 yrs to 1897 calendar date Assam earthquake.

In this research work the identified youngest date/event in the present study area is about younger than 110 years near about 1897 earthquake and the oldest date/event is of 5000 yrs (5330) before. The Major earthquake Me ≥ 6 seems to occur in the study area, which can be extended to all over Lower Assam including Shillong plateau, at a recurrence interval of about 1000 years.