CHAPTER 2

REVIEW OF LITERATURE

2.1 International and National Status

Researchers who have worked in the Morphotectonic, Morphometric, Seismotectonic and GPR analysis are quoted hereinunder. Apart from that, some of the researchers who have contributed in the Mophotectonic, Morphometric and Seismotectonic analysis are also referred separately in the individual chapters.

Hatam Quanbari and Soad Pelark (2015) used morphotectonics indices such as Asymmetery factor and Hypsometry integral to identify the tectonics activity level in Jahan abad- Abadeh Task basin. Suryawanshi and Golekar (2014) have worked on lineaments and drainage anomalies of Bhatia and Jaigarh Creek, Ratnagiri to explain how the structures control the drainages. Diehl et al. (2013) have studied about the geometry, kinematics and models of back – arc extension along the Andaman Sea Plate boundary using a new set of significantly improved hypocenters, global centroid moment tensor (CMT) solutions and high- resolution bathymetry. Paiboon Nuannin and Ota Kulhánek (2012) studied the temporal and spatial FMD (frequency-magnitude distribution) of earthquakes in the Andaman-Sumatra region. The results reveal that large earthquakes occur when b decreases by more than~0.3-1.0, suggesting that variation of b can be used as a medium-term (months-years) earthquake precursor. Paul et al. (2012) observed from the GPS data the uplift in the Andaman region is opposite the uniformly downward prediction of the viscoelastic models, and these models also fit the horizontal motions very poorly. Reddy et al. (2012) explained Transient postseismic mantle relaxation following 2004 Sumatra earthquake and implications of seismic vulnerability in the Andaman-Nicobar region through GPS measurements. They explained that the three possible modes of stress transfer govern the mechanism in which one earthquake prompts or triggers

another. Syed Amer Mahmood and Richard Gloaguen (2012) investigated the active tectonic activity resulting from Indo-Eurasia collision using DEM derived drainage network and geomorphic indices. Emad AL- Heety (2011) mapped the earthquake frequency – magnitude distribution (b value) as a function of depth in the intraplate regions of the earth and about 590 well – located events in the different intraplate regions are selected for this analysis. Rudersdorf et al. (2011) have collected the new evidence for neotectonic activity of the fault zone of Granada Basin, Padul – Nigüelas fault zones Spain with classical geological field work and modern geophysical methods, such as ground penetrating radar (GPR). Sarp et al. (2011) studied the morphotectonic properties of Yenicaga basin area of Turkey using remote sensing and GIS analysis techniques. SRTM data and five different morphometric indices including Mountain Front Sinuosity (Smf), Valley Floor Width to Height Ratio (Vf), Stream Length Gradient Index (Sl), Hypsometric Curve And Integral (HI), Drainage Basin Asymmetry are applied. Som et al. (2011) used campaign mode and continuous GPS data from 2005 to 2008 to examine the evolving strain pattern in Andaman Islands after the Great Sumatra–Andaman earthquake. Vahid Hosseini Toudeshki (2011) has worked in morphometric analysis using geomorphic indices such as stream length gradient index, mountain front sinuosity ratio of the width of valley floor to valley height, transverse topography symmetry factor and drainage basin shape as a main tool for recognition of active tectonic deformation using DEM in the Ghezel Ozan river basin of northwestern Iran. Andrea Figueroa and Jeffrey Knott (2010) examined tectonic geomorphology of the Sierra Nevada mountains (California) to get the evidence for uplift and basin formation. Digital Elevation Models (DEMs) were used to calculate geomorphic indices such as Mountain front sinuosity, Valley floor width to valley height ratio, Relief ratio, longitudinal profiles and Concavity of tributaries. Aron Meltzner el al., (2010) have recorded the relative sea level change extracted from coral microatolls on fringing reefs directly above the southern end of the December 2004 Mw 9.2 Sunda megathrust rupture which provided a repeated history of gradual interseismic subsidence followed by sudden coseismic uplift. James Cochran (2010) investigated the Morphology and tectonics of the Andaman Forearc. According to him the elements of the forearc are the accretionary prism and outerarc ridge, a series of forearc basins and major N–S faults. The accretionary prism is an imbricate stack of fault slices and folds consisting of ophiolites and sediments

scrapped off the subducting Indian Plate. Tejpal Singh and Awasthi (2010) have worked on stream profiles along five major streams in the Western Sub-Himalaya with special emphasis on the reactivation/active tectonics and found distinct anomalies in river profiles. Low mountain front sinuosity and low valley width to height ratio results reflected the active tectonic deformation along Intra-Foreland Thrust. Chakraborty and Prosanta Khan (2009) attributed that the oblique subduction has initiated strike-slip motion in the Northern Sumatra-Andaman sector which has formed a sliver plate during Eocene between the subduction zone and a complex, right-lateral fault system that extended through the outer-arc ridge offshore from Sumatra, and continued through the Andaman Sea connecting the Sagaing Fault in the north. Jamie Farrell et al. (2009) studied the b-value of the Yellowstone volcano-tectonic system, temporal and spatial occurrence of earthquakes, extensive earthquake swarms and related the b values to active volcanic and tectonic processes. Som et al. (2009) examined Coral microatolls from North Andaman and Little Andaman to understand the relative sea level change due to vertical tectonic deformation above the subduction interface. Alper Gurbuz and Ömer Feyzi Gurer (2008) studied the spatial variations of the Plio-Quaternary tectonic activity and deformation of different fault segments of the North Anatolian Fault Zone (NAFZ) in the eastern Marmara region around Lake Sapanca using geomorphic, morphometric and bathymetric approaches. Christie et al. (2008) collected ground-penetrating radar (GPR) data using 50 MHz 3-D grid and a longer 25 MHz 2-DE line across the active Emigrant Peak Fault in order to image and quantify fault displacement and assess off-fault deformation in an alluvial fan setting. Herfried Madritsch (2008) has done his research in structural evolution and Neotectonics of the Rhine-Bresse Transfer Zone (RBTZ) and the reactivation of pre-existing structures that controls the evolution of RBTZ. Ioannis Tsodoulos et al. (2008) studied four normal fault zones and drainage basin geometry in the easternmost sector of the Gulf of Corinth to document the impact of active tectonics on the landscape evolution. Tectonic geomorphic analysis was also carried out using several parameters such as Transverse Topography Symmetry Factor, Asymmetry Factor, Mountain-front sinuosity Valley floor width to valley height ratios and drainage basin shape to confirm the active tectonics. Marielle Fraefel (2008) has analyzed the geomorphic response to neotectonic activity by combining seismological data along Jura fold-and-thrust belt and the Upper Rhine Graben of Late

Quaternary alluvial terraces in the lower Aare valley, Northern Switzerland. Patidar et al. (2008) have worked to collect the evidence of neotectonic reactivation of the Katrol Hill Fault during late Quaternary through geomorphic investigations and Ground Penetrating Radar (GPR). Allen el al., (2007) have worked on the sedimentation, uplift history and tectonic evolution of the Andaman-Nicobar accretionary prism, South Andaman Island. Javed Malik and Mohanty (2007) have used geomorphological indicators along Northern Himalaya to delineate tectonically influenced landscapes using SRTM data LANDSAT and high resolution CORONA satellite images. Javed Malik et al. (2007) have investigated the Pinjore Garden Fault (PGF) scarp with Ground Penetrating Radar (GPR) and suggested that the GPR technique can be a useful tool in mapping the shallow subsurface geometry and in locating the near surface faults displacing young Quaternary sediments in the Himalayan foothill zone.Parcharidis et al. (2007) have used multi-temporal SAR images and brought out that North-Western coasts of Andaman Islands shows significant marks of uplift and South-Eastern margins of the Island marks of downlift. Philip and Virdi (2007) have done morpho-structural analysis using remotely sensed data along with field investigations on active faults and neotectonic activity in the Panjaur Dun, Northwestern Frontal Himalaya. Sati et al. (2007) worked on geomorphic indicators of neotectonic activity of Alaknanda basin around Srinagar, Uttarakhand and have collected morphological evidences of late Quaternary seismicity such as fluvial terraces, entrenched stream courses, landslide-induced ponding and active and stabilized deposits. Sujit Dasgupta et al. (2007) analyzed the seismicity pattern including b-value in the north Sumatra–Great Nicobar region from 1976 to 2004 and found out that there were a number of significant, intermediate and short-term precursors before the magnitude 7.6 earthquake of 2 November 2002. Alastair McClymont et al. (2006) acquired Three-dimensional (3-D) GPR data to visualize the active fault Alpine Fault at Calf Paddock, New Zealand. Aron Meltzner el al., (2006) worked on Uplift and subsidence associated with 26th December 2004 Aceh- Andaman earthquake and studied the emergence and submergence of coral reefs and microatolls by combining satellite imagery and ground observations. Gahalaut et al. (2006) measured the coseismic displacements at 13 sites using GPS in Andaman–Nicobar Islands before and after the 2004 Sumatra–Andaman earthquake. They found out the Coseismic horizontal ground displacement of 1.5–6.5 m towards the southwest and

coseismic vertical displacement, mostly subsidence, of 0.5–2.8 m occurred along the Andaman–Nicobar Islands with maximum displacements in the Nicobar Islands. Javed Malik et al. (2006) have studied the past seismicity and 26th December earthquake to bring out the coseismic land-level changes and Tsunami effects on Landscape Changes in the Andaman and Nicobar Islands after the 2004 Great Sumatra Earthquake. Philip and Virdi (2006) demonstrates the significance of morpho-structural analysis using remotely sensed data (multi temporal satellite data of IRS-ID-LISS-III and PAN) along with selected field investigations to delineate trace of active faults along Himalayan Frontal Thrust (HFT) near Singhauli, Haryana. Richard Thomas Walker (2006) has carried out a remote sensing study of active folding and faulting in southern Kerman province, S.E. Ayten Koç (2005) has done research on the geometry, deformation mechanism and kinematics of the Surgu Fault Zone (SFZ) using Landsat TM and ASTER imagery combined with SRTM, stereo-aerial photographs and various image processing and enhancement techniques. Curray (2005) worked on tectonics history of the Andaman Sea region and explained about the formation of sliver plate by the effect of the oblique convergence between the subduction zone and a complex right-lateral fault system. Kamesh Raju (2005) studied the three-phase tectonic evolution of the Andaman backarc basin based on the multibeam swath bathymetry, magnetic and seismological data. Ota Kulhanek (2005) has given seminar on b-value by the Gutenberg-Richter (G-R) magnitude-frequency relationship (MFR) and explained the techniques utilized in b-value determination. Sridevi Jade et al. (2005) worked on Co-seismic and post-seismic displacement in Andaman and Nicobar Islands from GPS measurements and calculated the displacement of four sites from Diglipur to Car Nicobar. Vikrant Jain and Sinha (2005) have worked on the response of active tectonics on the alluvial Baghmati river, Himalayan foreland basin and identified fluvial anomalies such as compressed meanders, knick point in longitudinal profiles, channel incision, anomalous sinuosity variations through satellite imagery, DEM and field observation. Tapan Pal et al. (2003) have worked on geodynamic evolution of outer and forearc belt and discussed about the tectonostratigraphic units of an accretionary prism in an outer-arc setting and turbidities of a forearc setting. They explained how the different fault system helped in the development of outer-arc, forearc and sediment deformation. Danny Hilman Natawidjaja (2002) utilized coral microatolls which records magnitude of vertical deformation

associated with earthquakes (paleoseismic data) from west Sumatra to document evidence for deformation of underlying subduction interface. Keller and Pinter (2002) used geomorphic landforms and quaternary deposits in tectonic studies that capture immense amount of information from the last few thousands and extend to about two million years. Szekely et al. (2002) have worked on neotectonic movement and their geomorphic response as reflected in surface parameters and stress patterns in the Eastern Alps. They have used Digital Elevation Model (DEM) to characterize the major domains of tectono-geomorphic units and they tried to interpret the vertical motion pattern based on precise leveling data and horizontal motion from fault plane solution or recent seismic events. Chow et al. (2001) used Ground Penetrating radar (GPR) and high-resolution shallow seismic reflection to delineate the subsurface pattern and paleoseismic facies which revealed unconformities, reverse faults, fault related fold indicated paleoseismic activity of the active Chihshang Fault, a segment of the Longitudinal Valley Fault of eastern Taiwan. Franck Audemard et al. (1999) studied neotectonic and paleoseismicity on Urumaco Fault of northern Falcon basin, northern Venezuela. They have studied the kinematic and present stress tensor and the seismogenic potential of the fault. Arlegui and Soriano (1998) suggested a methodology for selecting best band combination for visual interpretation Landsat-5 imagery for geological purposes and concluded that lineament identification is generally based on morphological rather than tonal contrasts. María Teresa Ramírez-Herrera (1998) assessed the spatial variation of Quaternary deformation and tectonic activity of the faults of Acambay Graben of Maxican Volcanic Belt using tectonic geomorphic indices such as mountain front sinuosity, facets, longitudinal profiles, river cross-valley relief ratios and drainage basin shape. Qari (1991) tested the utility of the Landsat TM for lithological and structural studies. The scene was analyzed using various image processing techniques which include PCA, DS and edge enhancements for mapping different lithologies and structures. Satyajit Biswas et al. (1988) worked on seismicity and b-value and focal depth distribution of earthquakes in the Andaman-Nicobar Island region from 1900-1982. Hayden (1986) defined geomorphology as “the application of mathematics and statistical techniques to the study of landforms, their description and the processes by which they are created and changed” and attributed that the quantitative measurement and analysis of landforms and topography are the fundamental factors of

morphometry. Bull (1984) accounted that the Tectonic geomorphology focuses on the contrast between topography and geomorphic features generated by tectonic processes and the erosion factors caused by surface processes that tend to wear them down. Uyeda and Kanamori (1979) explained Backarc opening and model of subduction. The high oblique convergence of India and Asia during Cenozoic resulted in the formation of silver plate during Eocene and the clockwise rotation of Sunda subduction zone during Cenozoic by a succession of extensional episodes. Gutenberg and Richter (1942) have worked on earthquake magnitude, earthquake intensity, energy and acceleration and has given formula to calculate magnitude.