CHAPTER 6

SEISMOTECTONIC ANALYSIS

6.1 Seismotectonic Scenario

The seismotectonic framework of the Andaman Arc System is studied by many that includes Eguchi et al 1979; Mukhopadhyay, 1984, 1988; Dasgupta and Mukhopadhyay, 1993, 1997; Dasgupta et al 2003 and Curray, 2005. Earthquake generation in subduction zones varies from one to another, in terms of their spatial and temporal patterns (Ruff and Kanamori, 1980; Kanamori and McNally, 1982; Byrne et al. 1992; Nanayama et al. 2003). The region of the Andaman and Nicobar islands has experienced several large-magnitude earthquakes in recent history and most of them were thrust earthquakes (Rajendran et al. 2003 and Bilham et al. 2005). The Andaman–Sumatra seismic zone is intense, curvilinear in shape extending from North Andaman to Sumatra. The seismic belt is narrow in the South Andaman and becomes wider northwardly. As far as the Andaman–Sumatra subduction zone is concerned, the southern Sumatra region had generated several large and great earthquakes, but the overall seismicity of the Andaman and Nicobar segments is comparatively low, involving a few large earthquakes and rupture lengths of 200–300 km (Ortiz and Bilham, 2003). No great earthquake (Mw 8) has been reported from the Andaman–Nicobar and Northern Sumatra region, though major events in 1847 (M 7.5), 1868, 1881 (M 7.9) and 1941 (M 7.7) have occurred in the region (Lay et al.2005 and Bilham, et al.2005). The Andaman–Sumatra subduction zone is one of the most prominent tectonic features in the region and has been a source of many major earthquakes (Malik, et al. 2006). At the contact between the two plates, one plate (the Indian and Australian plates in this case) subducts beneath the other plate (the Sunda plate). The contact between the plates is the megathrust (Fig. 6.1), a gently sloping surface that descends from a deep ocean trench for several hundred kilometres into the Earth. Over the centuries between earthquakes, this megathrust remains locked so the relative motion between the two plates expresses itself not as a movement but as a gradually increasing strain or deformation of the Earth’s crust surrounding it. The advance of the subducting Indian and Australian plates causes the overlying Sunda plate to shorten and bow downward in the region above the megathrust, and thus it accumulates energy like a compressed spring (Sieh, 2005). Subduction zone features a locked zone (5-10 to 30-50 km in depth), that is bounded up-dip and down-dip by portions of the fault that deform aseismically (Savage, 1983). The inter-seismic phase is marked by the gradual sinking of the subducting slab, increasing the extensional stresses at depths and leading to shortening of the upper colliding plate that manifest as a uplift. The Sumatra–Andaman earthquake of 26th December 2004 ruptured 1600 km of the Sunda megathrust (Meltzner, et al. 2006), with slip that locally approached or exceeded 20 m (Subarya, et al. 2006 and Chlieh, et al. 2007.) was shallow (~30 km) interplate thrust earthquake occur at the interface of the subducting Indian plate and the overriding Burma plate (Acharya, 2005; Banerjee et al. 2007 and Ghosh and Mishra, 2008;). Focal mechanisms of the aftershocks suggest predominant thrusting in the frontal arc and strike-slip to normal faulting in the back-arc region (Dasgupta et al. 2005). However, paleaogeodetic studies based on coral records suggest that earthquakes of higher magnitude occur in this region every 200-300 years (Natawidjaja et al. 2004; Sieh, 2005).

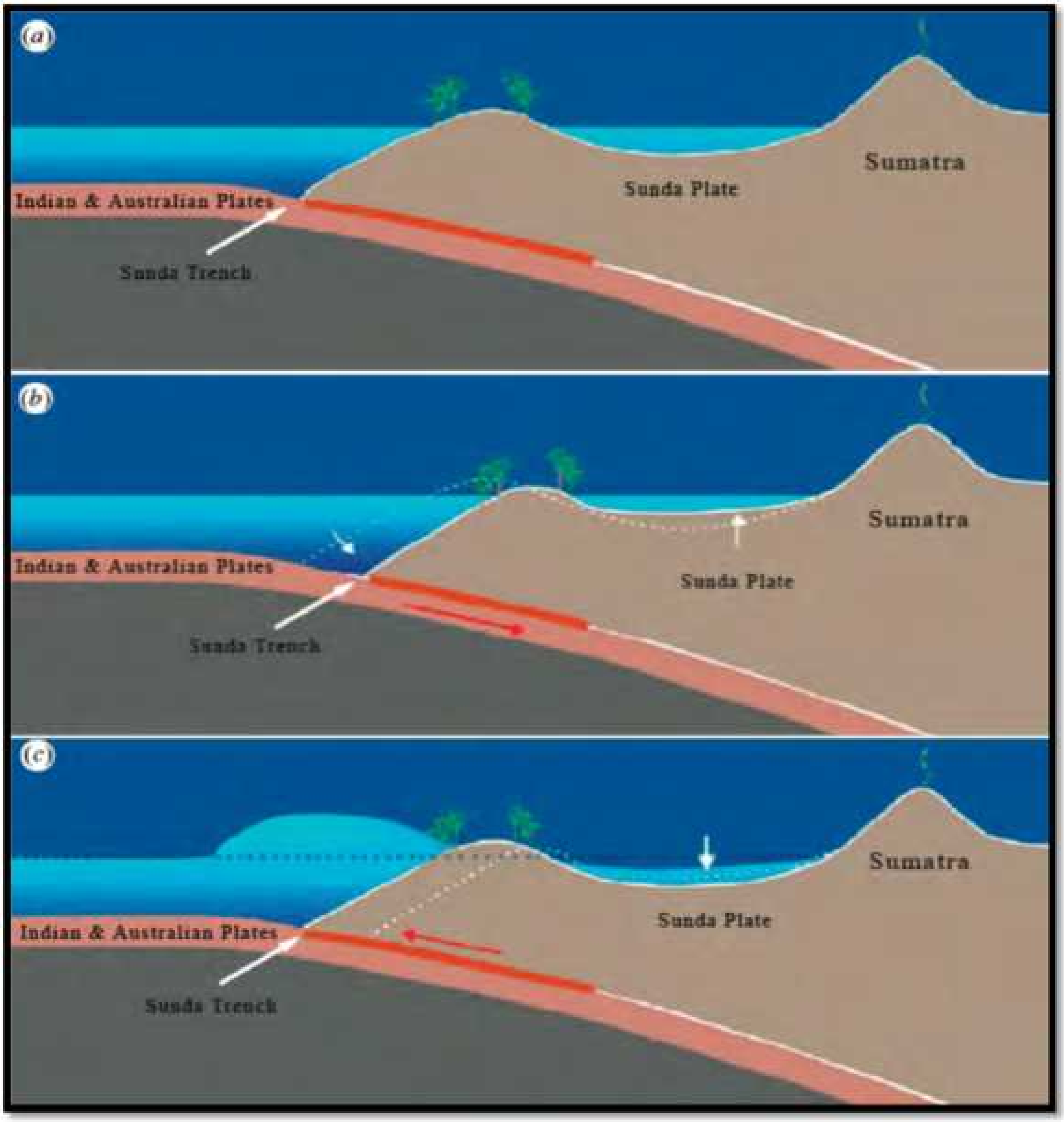


Fig 6.1. Outline Andaman –Sunda plate boundary (Megathrust) (modified after Sieh, 2005) Sumatran shows the accumulation and relief of strains associated with subduction. (a) Relationship of subducting plate (left) to overriding plate (right). The thick red line indicates the locked part of the megathrust between the two plates. (b) Since the megathrust is locked along this shallow portion, the over- riding Block is squeezed and dragged downward in the decades to centuries leading up to a large earthquake. (c) Sudden relief of strains accumulated over centuries results in a large earthquake and uplift of the Islands.

6.2 Focal mechanism solutions

Focal mechanism solutions are simply fault plane solutions for earthquakes indicate the two potential fault planes that may have produced the seismic wave signal associated with the earthquake and the responsible fault whether normal, reverse, strike-slip, or a combination of two of these might have caused the earthquake. These two planes are exactly 90^{o} apart in 3-D space and are mutually orthogonal. Focal mechanism solutions always have two fault curves (a double-couple) as shown in Fig. 6.2.

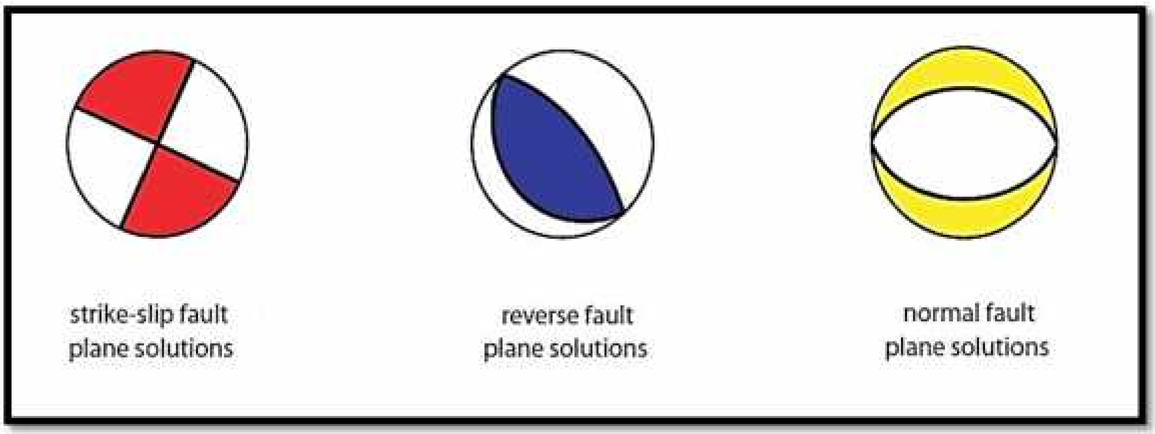


Fig. 6.2 Fault Plane Solution.

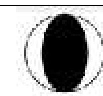
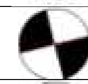
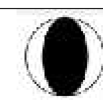
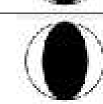
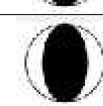
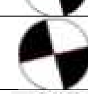
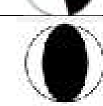
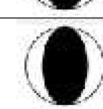
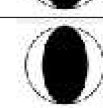
On the left, above (6.2), there are two possible strike-slip fault solutions (a WNW-ESE striking fault and a NNE-SSW striking fault, both vertical). In the center, there are two possible reverse fault solutions (a NW striking fault dipping 80^{o} to the NE and a SE striking fault dipping 20^{o} to the SW). On the right, there are two possible normal fault solutions (an E striking fault dipping 45^{o} S and a W striking fault dipping 45^{o} N). In all cases, the two solutions are 90^{o} apart in space.

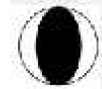
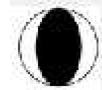
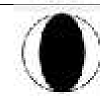
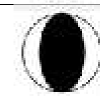
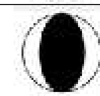
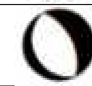
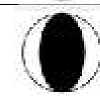
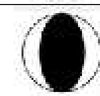
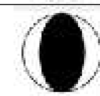
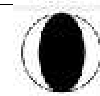
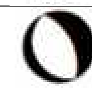
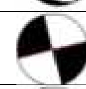
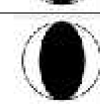
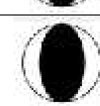
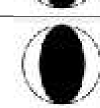
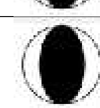
In order to provide the fault plane solution for Andaman Nicobar and Sunda arc, the earthquakes data between 1977 and 2005 were acquired (Table 6.1) from International Centre for Seismology (ICS), UK. Magnitudes of greater than 6.0 were used for the study purpose. A number of 35 earthquakes were collected from 1977 to 2005, plotted and analyzed. Characteristics of seismogenic faults were interpreted from the earthquake data using strike, dip, magnitude, and epicenter of each earthquake.

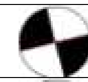
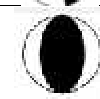
Table 6.1 Block model for fault identification on the basis of angle of dip.

Angle of dip	Fault
$0^o<45^o$	Thrust fault, compressional, reverse fault
45^o to 90^o	Normal fault, tensional fault, gravity fault
$\approx 90^o$	Strikeslip fault, transcurrent fault, lateral fault

Table 6.2 Earthquake fault plane solution.

Year	Lat	Long	Mw	Strike	Dip	Rake	Type of fault	Beach ball
1977	4.23	95.77	6.3	78	19	-140	Thrust fault	
1982	6.81	93.71	6.3	87	69	9	Strikeslip	
1982	6.81	93.71	6.1	1.00	77	172	Strikeslip	
1983	5.72	94.22	6.9	79	50	125	Normal fault	
1983	5.72	94.65	7	207	51	51	Normal fault	
1983	4.75	95.03	6.1	192	43	-17	Thrust fault	
1983	4.60	95	6	182	45	-25	Thrust fault	
1990	7.75	93	6	185	73	180	Strikeslip	
1990	8.14	93.93	6.1	347	86	179	Strikeslip	
1992	9.22	93.50	6	137	58	164	Normal fault	
2004	6.61	92.79	7.2	351	27	121	Thrust fault	
2004	8.58	92.45	6.6	333	38	82	Thrust fault	

2004	8.91	94.11	6.3	272	40	118	Thrust fault	
2004	5.34	94.65	6.1	8	33	131	Thrust fault	
2004	5.21	94.48	6	320	21	97	Thrust fault	
2004	9.10	93.75	6.1	330	46	-122	Thrust fault	
2004	9.12	93.97	6	320	42	-46	Thrust fault	
2004	8.77	93.19	6.2	53	52	-40	Normal fault	
2004	7.11	92.43	6.1	319	44	75	Thrust fault	
2004	7.12	92.53	6	181	37	114	Thrust fault	
2004	6.03	92.80	6	359	39	143	Thrust fault	
2004	6.20	92.913	6	354	44	129	Thrust fault	
2005	4.97	92.22	6.7	111	68	-173	Strikeslip	
2005	5.090	92.30	6.5	105	75	169	Strikeslip	
2005	5.840	92.304	6.5	105	75	169	Strikeslip	
2005	7.15	94.49	6.1	63	77	-13	Strikeslip	
2005	7.336	94.455	6.1	156	18	-175	Thrust fault	
2005	6.26	92.57	6.4	338	26	86	Thrust fault	
2005	6.360	92.78	6.1	322	23	71	Thrust fault	
2005	4.63	94.94	6.0	311	22	88	Thrust fault	
2005	4.63	94.94	6.0	349	27	118	Thrust fault	

2005	7.22	92.40	6.2	112	83	-176	Strikeslip	
2005	7.33	92.85	6.2	202	70	-12	Strikeslip	
2005	6.969	94.602	6	298	18	78	Thrust fault	

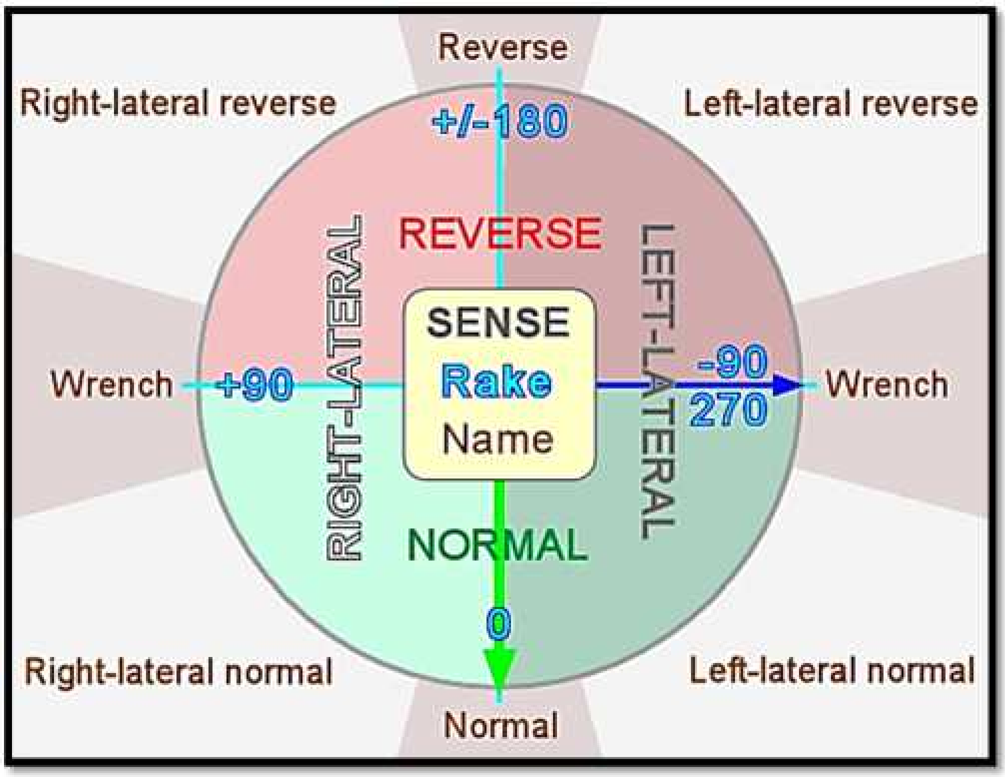


Fig. 6.3 Type of fault based on the rake of the slip vector

Each fault was identified on the basis of angle of dip (Table 6.1) and rake of slip vector (Fig. 6.3). The identified faults and their beach ball diagrams are shown in the Table 6.2.

The azimuth or structural trend of all these earthquakes were plotted by using the Geo-Orient/stereonet 7, in the form of Rose diagram (Figs. 6.4 and 6.5).

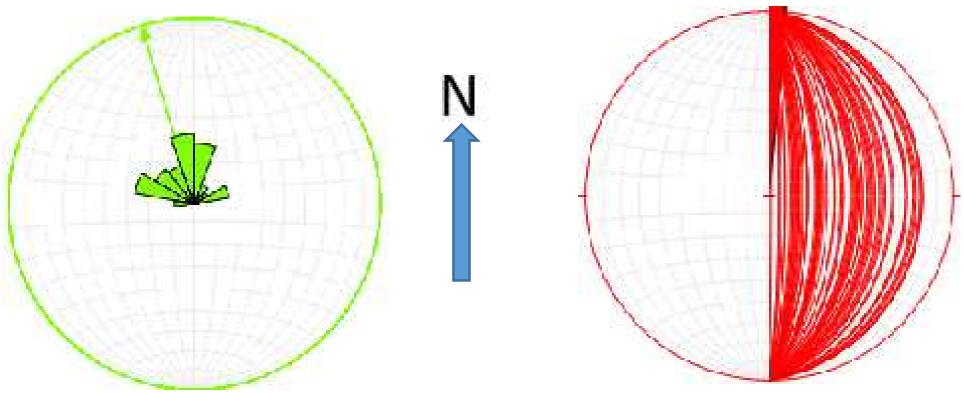


Fig. 6.4 Rose diagram showing the strike of the faults and their prevalence

Fig. 6.5 Dip direction of the faults in stereo net

The Fig. 6.4 shows that the strike of the faults trends in NNE-SSW, NNW-SSE, NE-SW, E-W and NW-SE direction. The principle stresses were identified from the strike, as NNE-SSW, indicating the direction of maximum principal stress (σ1) and the NE-SW, indicates the direction of least principal stress (σ3). All the dips are trending towards Easterly direction (Fig 6.3).

6.3 Earthquake faults

Deep seated Mega thrust, shallow thrust earthquakes, strikeslip faults and detachment faulting earthquakes are associated and accommodated by tectonic dynamism of prominent subduction complex and Andaman spreading center. Analysis of the available focal mechanisms around the Andaman and Nicobar arc shows the variations in tectonic activity along the arc.

Focal mechanisms of the major earthquakes of magnitude 6.0 and above along the Sumatra - Andaman trench are consistent with the under thrusting along the mega thrust fault. The Andaman and Nicobar provides an ideal tectonic setting for the occurrence of mega thrust earthquakes, strikeslip and normal faulting (Rajendran et al. 2003). Focal mechanism shows consistent thrust mechanism, striking parallel to the trench and deep seated active strikeslip to ocean detachment faulting parallel to Andaman Spreading Centre. Many events at or immediately adjacent to the trench are characterized by both normal and strikeslip faulting. These near-trench shallow normal fault earthquakes may be due to the intra-slab bending stress (Spence, 1987). The near-trench strike-slip mechanisms may be associated with many features on the incoming Indian plate.

The epicenter of the earthquakes that occurred between 1977 and 2005 of magnitude 6 and above were analysed and the subsequent analysis of fault plane solutions were plotted in the regional tectonic map to ascertain which fault is responsible for the earthquake occurrence and their distribution (Fig. 6.6).

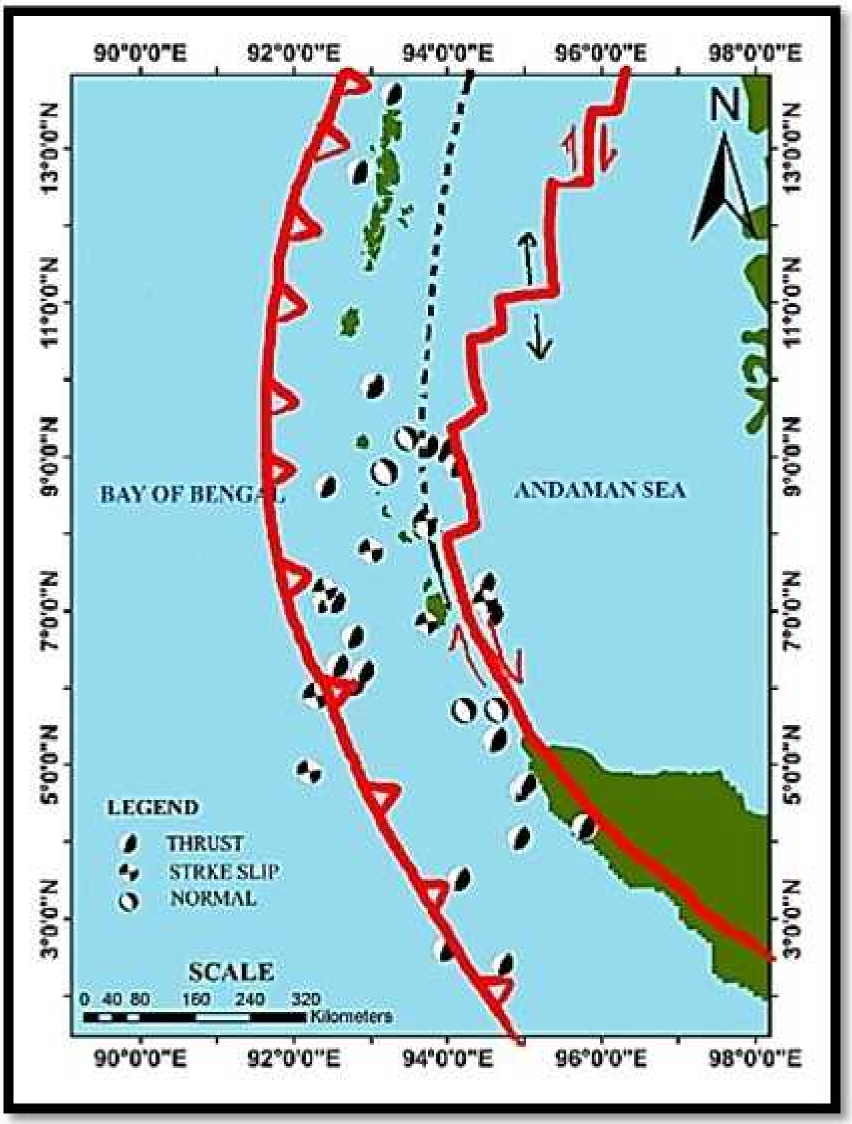


Fig. 6.6 Major tectonic features and fault plane solutions for the earthquakes (Magnitude 6.0 and above) occurred between 1977 and 2005. Thick red line With triangles indicates the Trench (AST), black line indicates West Andaman Fault (WAF) and thick red line indicates Andaman Backarc Spreading Center (ABSC).

Most of the earthquakes occurred along the plate boundary is witnessed by the active subduction zone between the Indian plate and Burmese plate. The distribution of moderate to large earthquakes occurred along thrust faults, strikeslip faults and normal faults (Fig. 6.6)

Most of the earthquakes were dominated by thrust in the vicinity of the subduction zone followed by normal to strikeslip faulting around Simule and Nicobar group of Islands. It is inferred from the focal mechanism solutions that stress and rupture of the faults is related to subduction zone. Some of the earthquakes are related to backarc extension accommodated by Active Backarc spreading. Large fraction of seismic moment release in this region is accommodated by oblique slip mechanisms suggesting the presence of young structures where strain partitioning is not yet developed (Diehl et al, 2013). The normal faulting located west of the plate boundary is inferred from the N-S trending transform faults connecting the Andaman backarc spreading.

Focal mechanisms of the major earthquakes along the Sumatra-Andaman trench are consistent with the under thrusting along the mega thrust fault. The Trench-ward earthquakes shows consistent thrust mechanism, striking parallel to the trench. The present day tectonic processes are controlled by three major fault systems, the most prominent being the subduction thrust, which outcrops in the Sunda trench. The trench parallel to Sumatra Fault runs through the entire length of the island from Banda Aceh to Sunda Strait and accommodates oblique convergence through strikeslip faulting.

Along the arc, the mechanism of the earthquakes are generally thrusting in nature. It basically shows the reverse slippage of the overriding plate over the subducting Indian plate. Off the arc, there are shallow strikeslip events and is representative of the spreading ridge extensional earthquakes. Also, some characteristic normal faulting events are seen along the volcanic arc, representing the stress direction there. These are the present day major tectonic regimes of the Andaman and Nicobar subducting environment. The Sumatra-Andaman trench region shows the compression in NE-SW to N-S direction at the shallower portions.

6.4 'b' Value

The 'b' value is already discussed in section 3.4.1 of Chapter 3. The 'b' Value is inversely related to stress in a qualitative sense. The b- value is used as the key indicator of the degree of seismicity around a region. The cumulative b-value is closely related to dimensionality of the volume. The average regional scale estimates of b-value are usually equal to 1 (Frohlich and Davis, 1993).

The low 'b'values and low seismicity at depth range of 20-30 km may be associated with low degree of heterogeneity, large stress and strain, high deformation speed, large faults (Bayrak et al. 2002) and high rheological strength in the Crust and vice versa (Emad and Heety, 2011). Low 'b' values are often associated with major earthquakes and highly stressed asperities (Wiemer and Wyss, 1997).

High 'b' values are reported from areas having increased geological complexity, indicating the importance of multi-fracture areas. High 'b' values are observed in regions of (a) decreased shear stress; (b) high slip release on earthquake rupture planes; (c) extensional stress; (d) high pore pressure and (e) fault creep (Westerhaus et al. 2002). The 'b' value analysis show that it increases below the depth range of 20-30 km in Africa, Asia, North America and decreases in Australia and Europe.

Variations of 'b' values with durations of months and years are known to precede large shocks in various parts of the world. In Japan, (Imoto, 1991) found that decreases in 'b' values appeared a few years before earthquakes with magnitude 6.0 and greater. He considers the decrease in 'b' values as a promising precursor. Sahu and Saikia, (1994) observed a short-term drop in 'b' value before the occurrence of the August 6, 1988 earthquake (M = 7.3) in the India-Myanmar border region. Many methods can be used for calculating any region's b-value but the maximum likelihood method is the most robust and widely-accepted method for estimating 'b' values (Aki, 1965).

In order to calculate and analyse the 'b' value for the Andaman and Nicobar Islands and its surroundings, were acquired from Indian Meteorological Department, International Centre for Seismology (ICS), Global Centroid Moment Tensor (GCMT) and United States of Geological Survey (USGS) website. The data from 1918 to 2013 were collected and only the magnitudes 5.0 and above were taken for the ‘b’ value estimation. Thus, for the stress analysis, the study area was divided into 5 Blocks based on the latitude and longitude which is shown in Table 6.3.

Table 6.3 Different Blocks of the study area for the ‘b’ Value estimation and stress analysis.

Block	Latitude	Longitude
A	12.1º -14º N	90 º -96 º E
B	10.1º -12º N	90 º -96 º E
C	8.1º -10º N	90 º -96 º E
D	6.1º -8 º N	90 º -96 º E
E	4º -6º N	90 º -96 º E

The number of earthquakes (M>5.0) and the variations in the occurrence in each Block (Year wise) are plotted (Fig. 6.7 to 6.11).

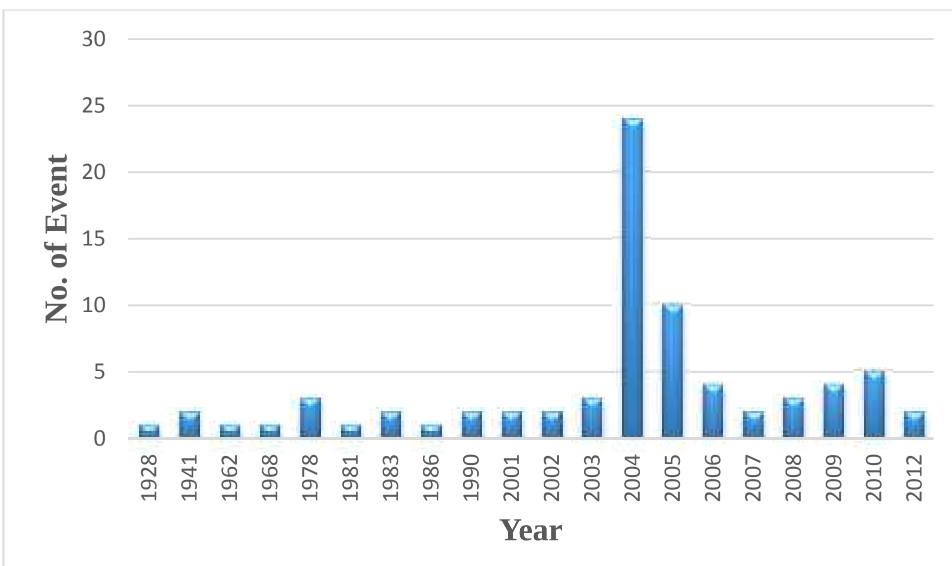


Fig. 6.7 Number of events >M.5.0 in Block A (12.1º -14º N).

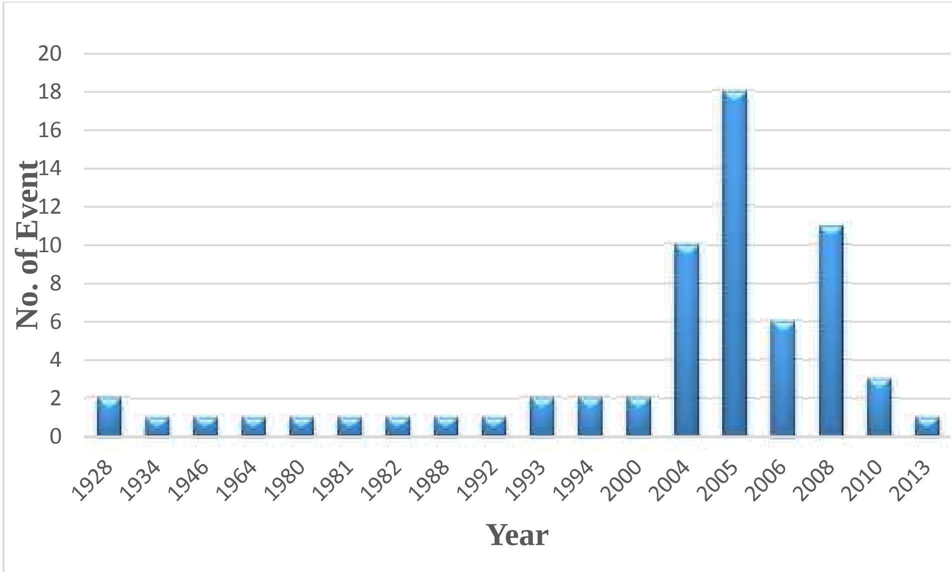


Fig. 6.8 Number of events >M.5.0 in Block B (10.1º -12º N).

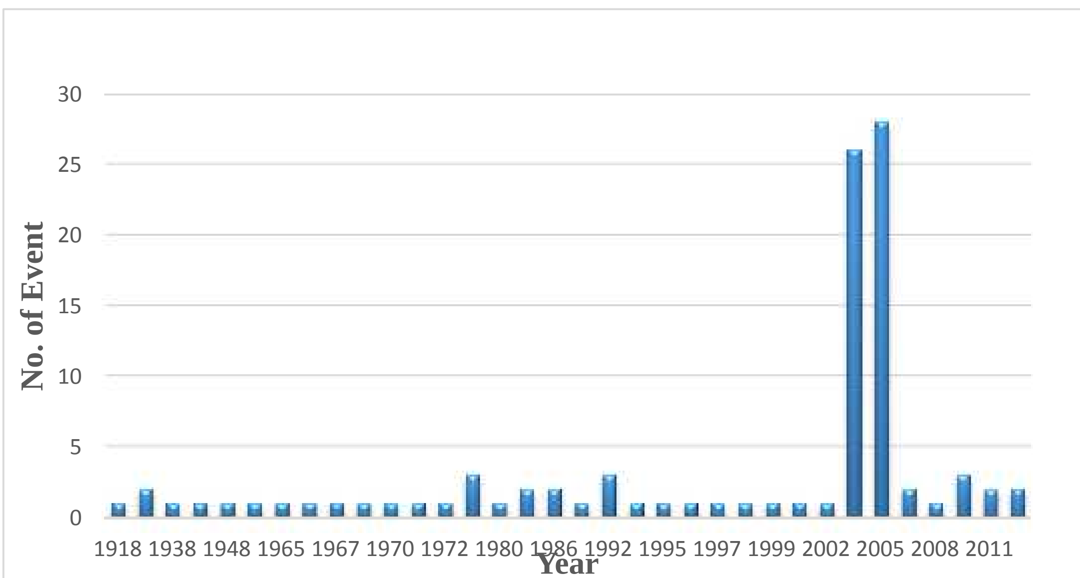


Fig. 6.9 Number of events >M.5.0 in Block C (8.1º -10º N).

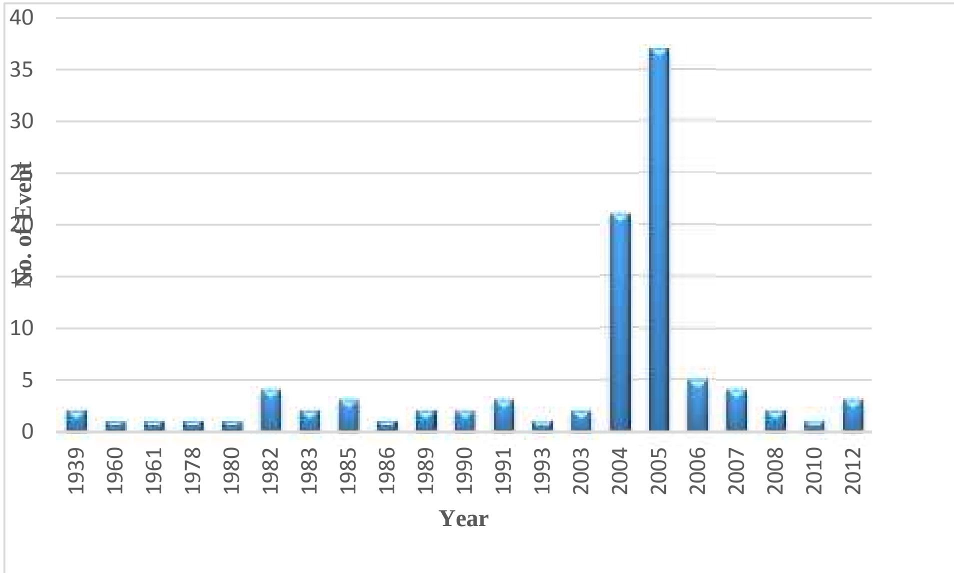


Fig. 6.10 Number of events >M.5.0 in Block D (6.1° -8 ° N).

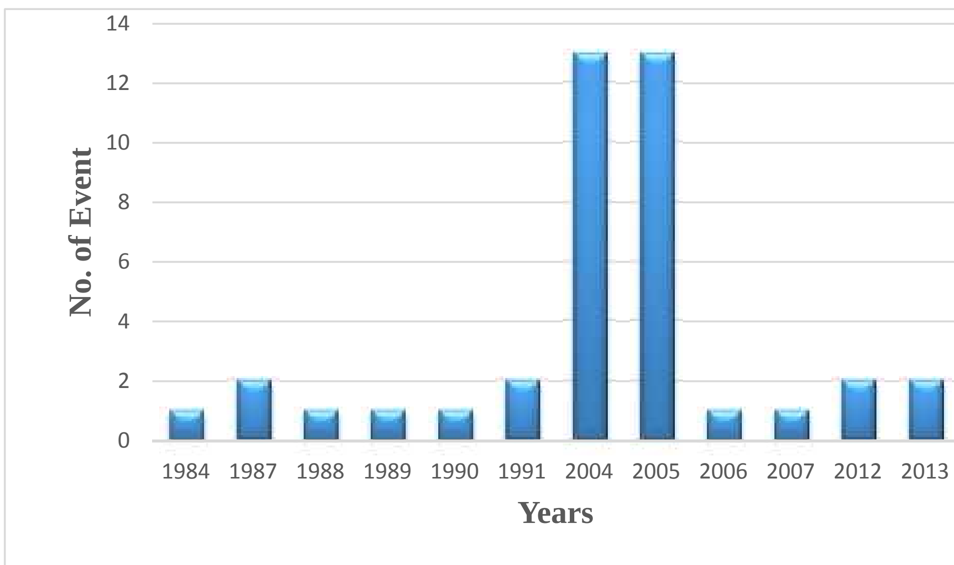


Fig. 6.11 Number of events >M.5.0 in Block E (4° -6° N)

The estimation of a value and 'b' Value is narrated in Section 3.4.1 of Chapter 3. Accordingly the 'a' value and the corresponding 'b' Value were calculated (Tables 6.4 to 6.8) and analysed according to equation 6 (Chapter 3) for Blockwise viz., A, B, C, D and E. The data were then plotted in SRTM satellite imagery of South Andaman Islands.

Table 6.4 Shows 'a' Values and 'b' Values for Block A (12.1º -14º N) for different periods.

Year	'a' Value	'b' Value
1928	6.2	0.983
1941	7.7	1.75
1962	6.1	1
1968	5.5	1.1
1978	5.6	1.08
1981	5.7	1.07
1983	6.1	1
2004	6.2	0.996
2006	6.9	1.051
2007	5.6	1.089
2008	5.8	1.051
2010	6.8	0.956

Table 6.5 Shows 'a' Values and 'b' Values for Block B (10.1º -12º N) for different periods.

Year	'a' Value	'b' Value
1939	5.6	0.987
1960	5.2	1.121
1961	5.2	1.121
1982	5.5	1.06
1983	5.2	1.063
1985	5.2	1.121
1986	5.8	1.005
1989	5.4	1.079
1990	6	0.971
1991	5.9	0.987
1993	5.7	1.022
2004	7	0.937
2005	6.5	0.949
2006	5.8	1.032
2007	5.9	1.005
2010	7.8	0.747
2012	5.5	1.06

Table 6.6 Shows 'a' Values and 'b' Values for Block C (8.1° -10° N) for different periods.

Year	'a' Value	'b' Value
1918	6.2	0.9596
1932	6	1.0267
1938	6.2	0.9596
1941	5.8	1.0258
1965	5.7	1.043
1967	5.7	1.043
1968	5.5	1.081
1970	5.5	1.081
1986	5.6	1.062
1992	5.9	1.008
2004	6.1	1.03
2005	7.2	0.943
2009	6.1	0.975
2012	5.8	1.025

Table 6.7 Shows 'a' Values and 'b' Values for Block D (6.1° -8° N) for different periods.

Year	'a' Value	'b' Value
1928	8	0.934
1934	6.5	0.986
1946	6.7	0.956
1964	6.3	1.017
1973	5.6	1.44
2004	5.8	1.113
2005	6	1.076
2006	5.9	1.035
2008	6.7	1.044
2010	6.6	0.971

Table 6.8 Shows 'a' Values and 'b' Values for Block E (4º -6º N) for different periods.

Year	'a' Value	'b' Value
1984	5.2	1.1
1987	5.6	1.025
1988	5.8	0.989
1989	5.3	1.83
1990	5	1.148
1991	5.2	1.103
2004	8.6	1.185
2005	6.2	0.941
2006	5.1	1.125
2007	5.4	1.062
2012	5.6	1.034
2013	5.9	0.9895

The 'b' Values corresponding to each Block were plotted in the SRTM satellite imagery of Andaman and Nicobar Island Map using ArcGIS software version 9.3 (Fig. 6.12 to 6.16).

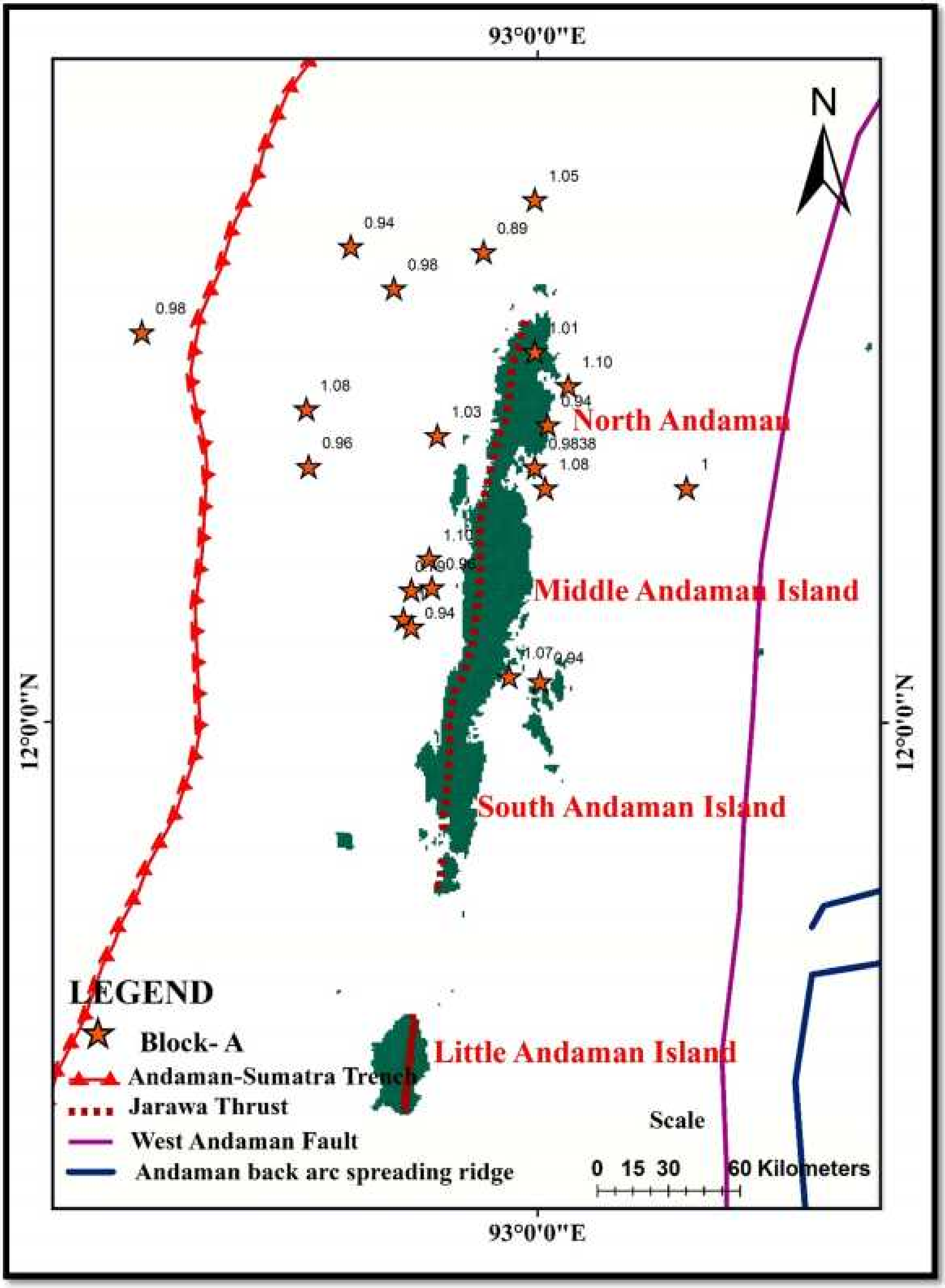


Fig. 6.12 Plotted 'b' Values for Block A.

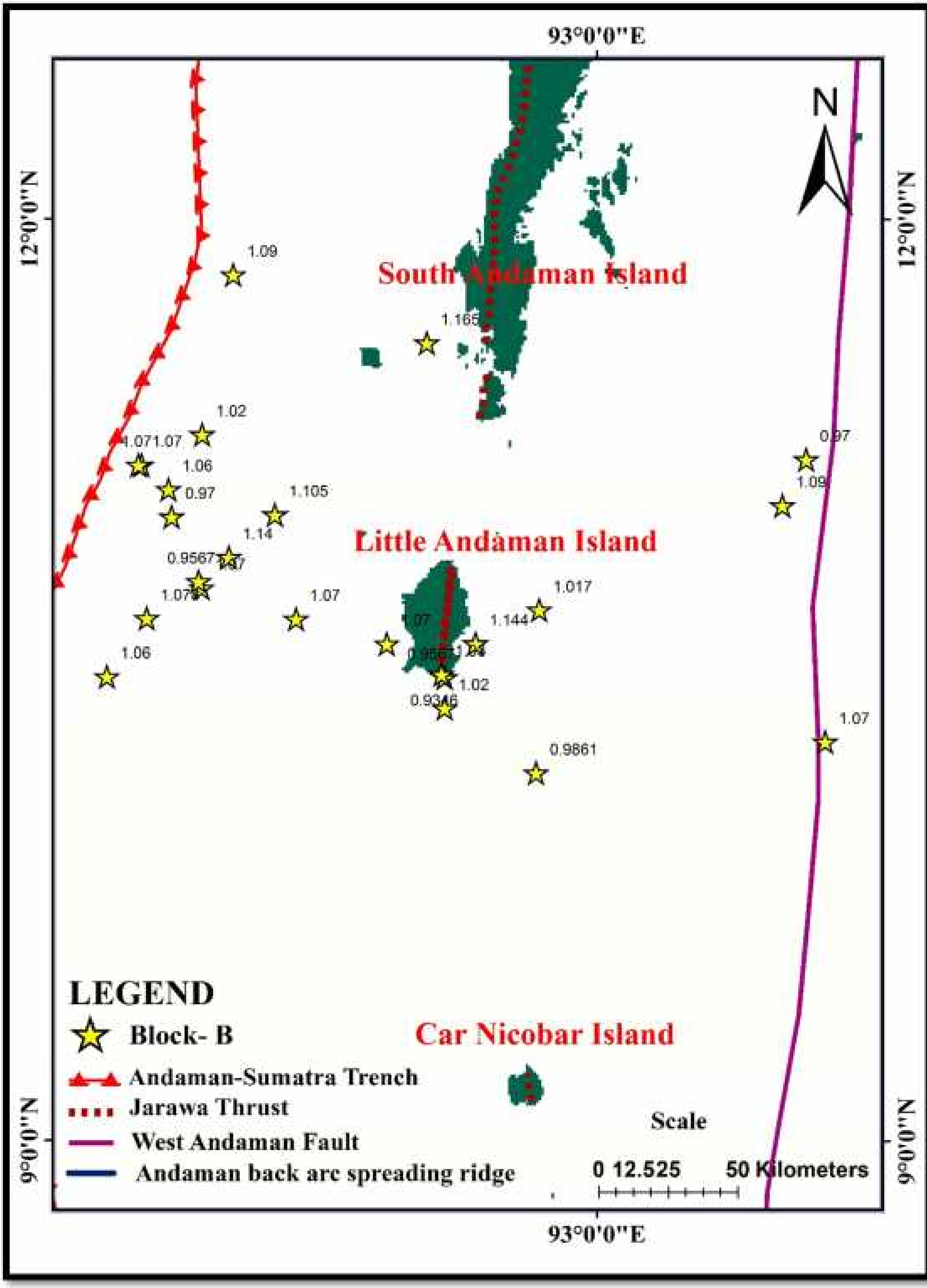


Fig. Fig. 6.13 Plotted 'b' Values for Block B.

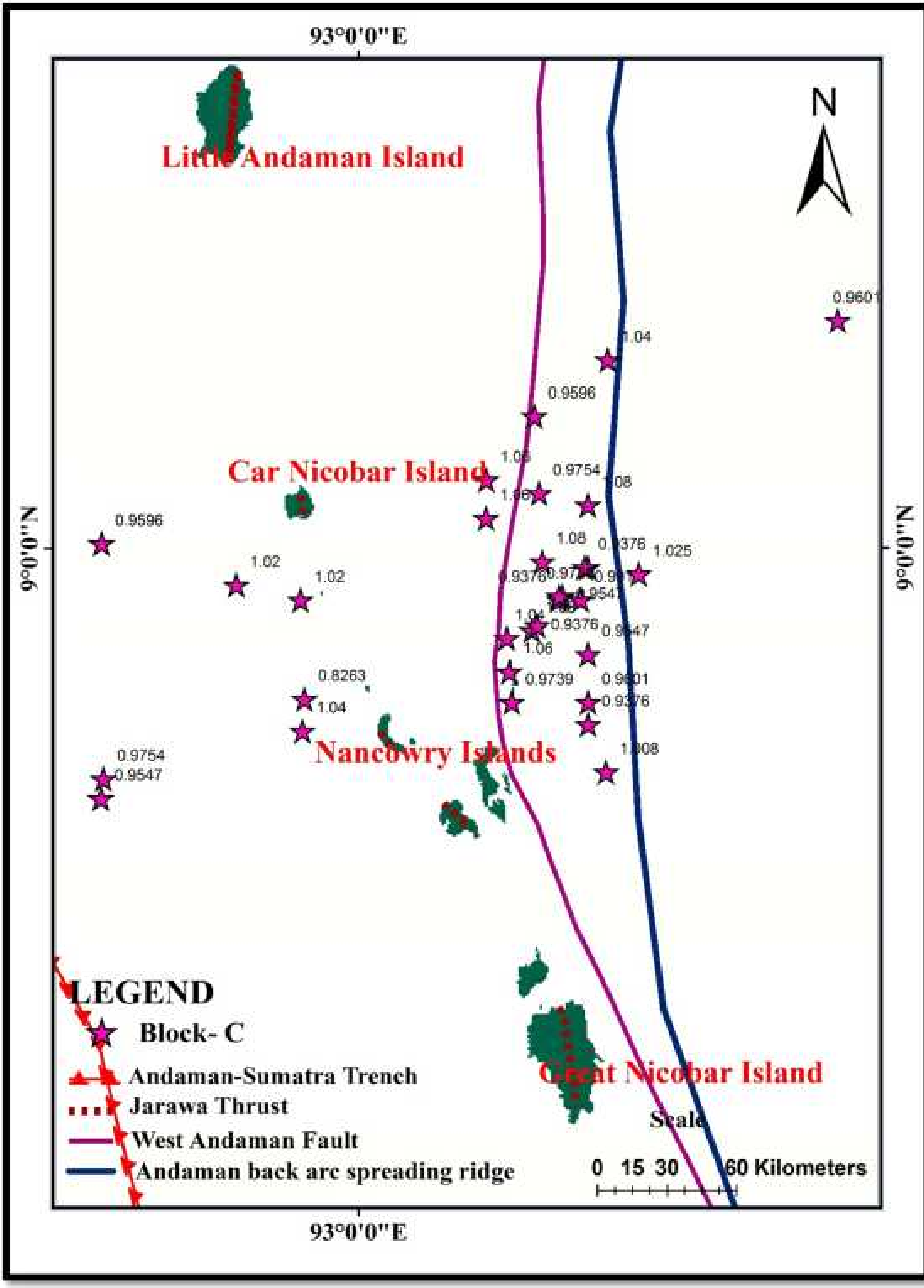


Fig. 6.14 Plotted 'b' Values for Block C.

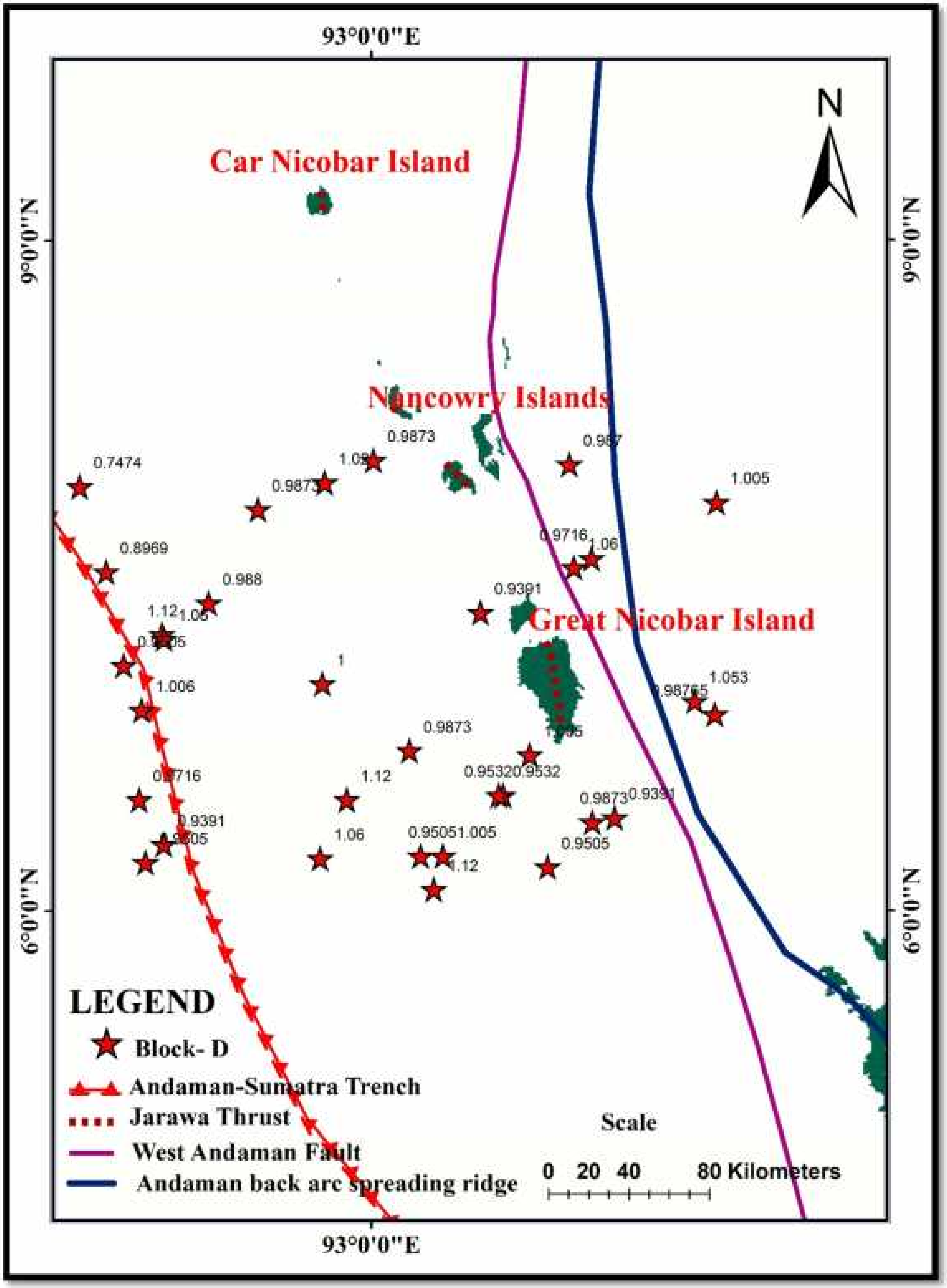


Fig. 6.15 Plotted 'b' Values for Block D.

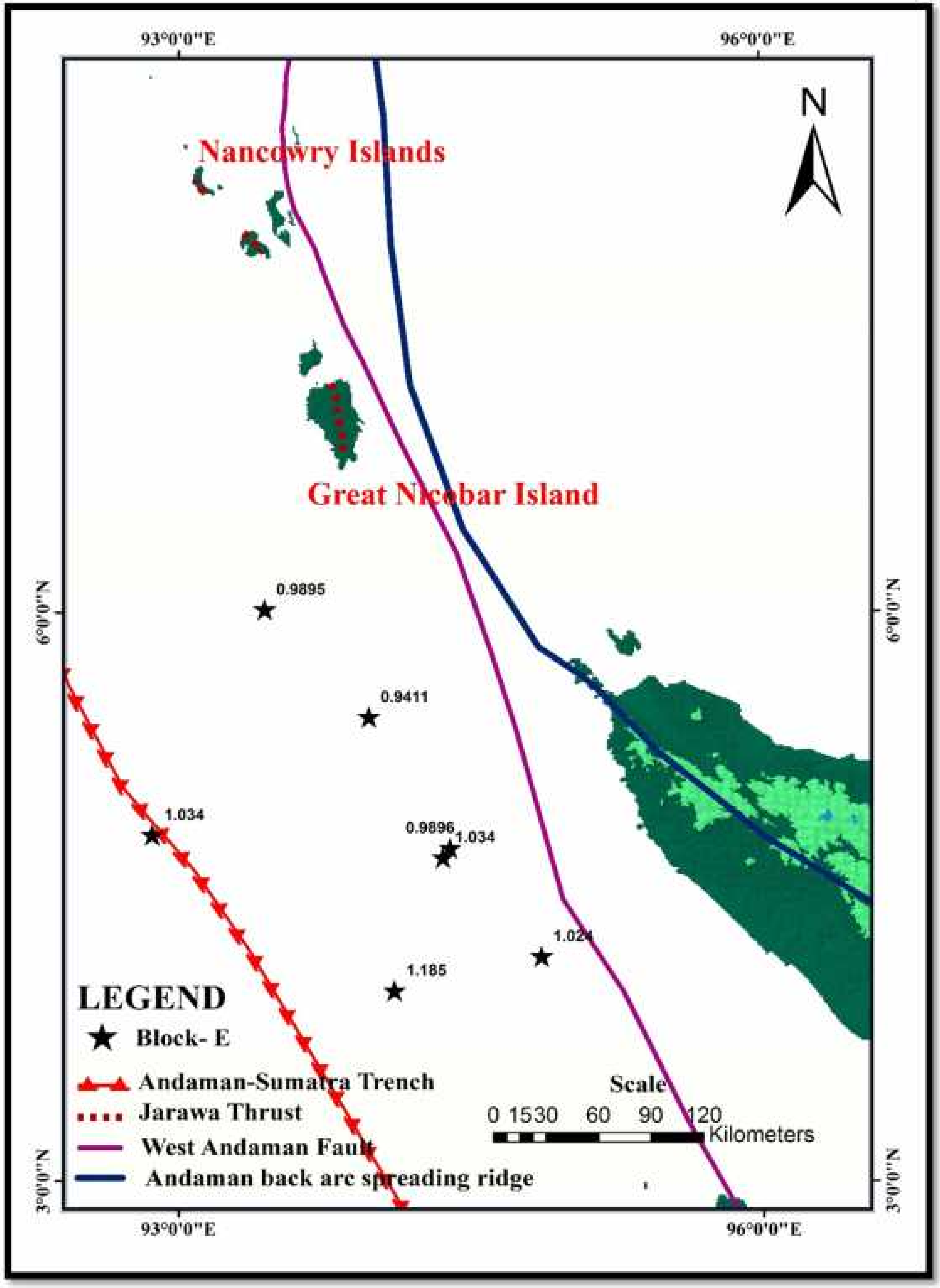


Fig. 6.16 Plotted 'b' Values for Block E.

The 'b' Values of whole Andaman and Nicobar (Block A to Block E) were also plotted in the SRTM satellite imagery of Andaman and Nicobar Islands (Fig 6.17).

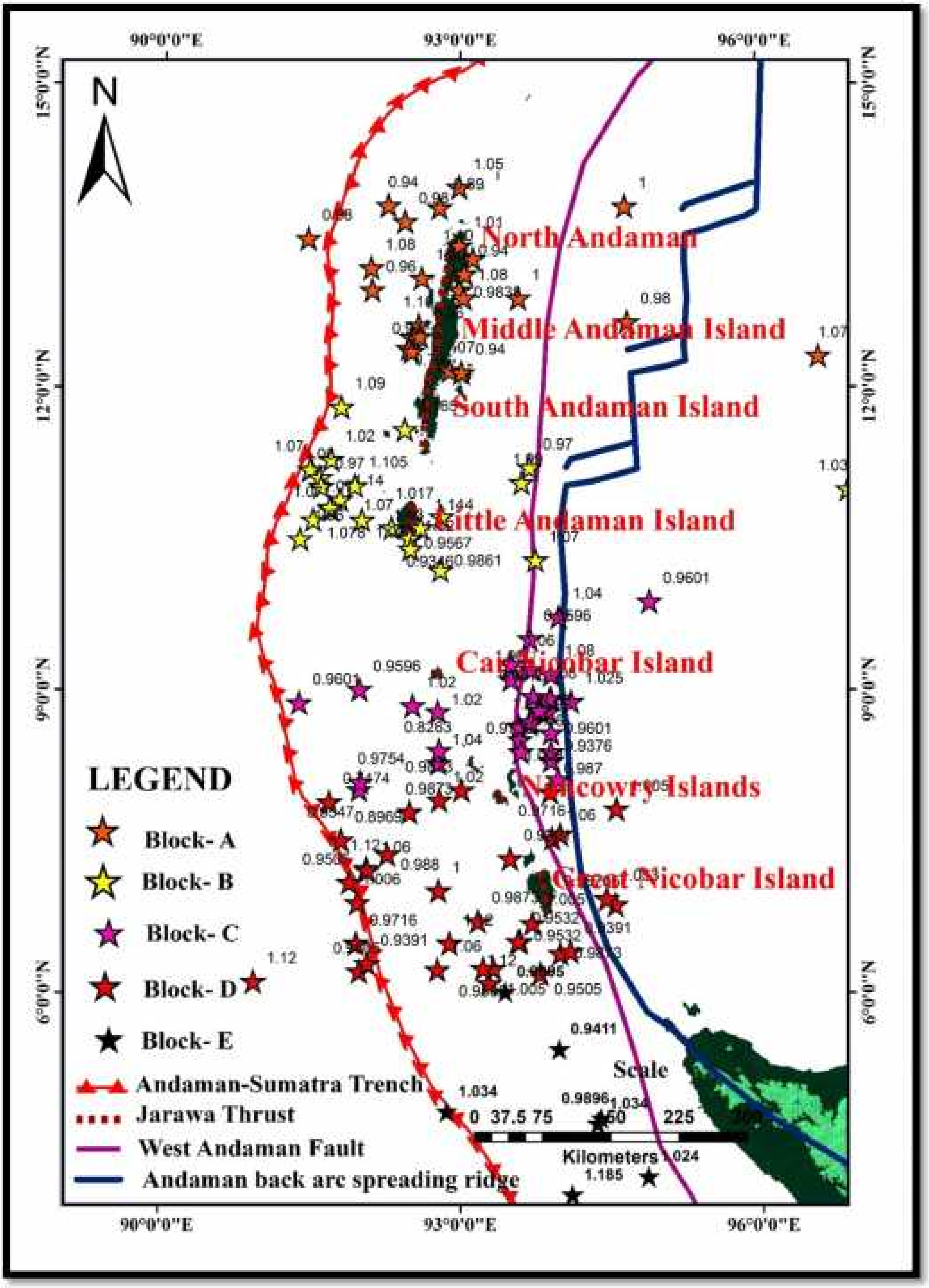


Fig. 6.17 'b' Values of all the Blocks (A to E).

After calculating the ‘b’ Value year wise of each block, the cumulative ‘b’ Value for each Block is estimated (Table 6.10).

Table 6.9 Showing the cumulative ‘b’ Value for each Block.

BLOCK	Cumulative ‘b’ Value
A	0.67
B	0.70
C	0.91
D	0.81
E	0.84

6.5 Stress Analysis

After plotting the ‘b’ Values of each Block in satellite imagery of South Andaman Island (Fig. 6.12 to 6.16), the results were correlated with reference to the regional fault systems of Andaman and Sumatra region (Andaman Trench, Jarawa Thrust, West Andaman Fault and Andaman Back-arc Spreading Centre). Some of the main findings from the analysis are:

- In latitudes between 12.1 ^{o} to 14 ^{o} N (Fig. 6.12, Block A) which covers Middle and North Andaman, the calculated cumulative ‘b’ Value are below 1 and the region is highly susceptible for future seismic activities especially along tectonically active Jarawa thrust and Button thrust as most of the earthquakes epicentre occurred along the Jarawa thrust and/or in the vicinity of active faults with high accumulation of stress resulting in low ‘b’ value 0.67 (Table. 6.9).

- In latitudes between 10.1 ^{o} to 12 ^{o} N (Fig. 6.13, Block B), the calculated cumulative ‘b’ Value is 0.70 and possess high stress (Table. 6.9) around Little Andaman and

South Andaman which will probably experience moderate to large magnitude earthquakes in the future.

- In latitudes between 8.1^{o} to 10^{o} N (Fig. 6.14, Block C) which includes Car Nicobar Island, Teresa Island, Chowra Island, Trinket Island and Kamorta Island, the estimated 'b' Value for this region is 0.91 (Table. 6.9) along the regional faults and this segment C are at risk for the occurrence of moderate earthquakes.

- In latitudes between 6.1^{o} to 8^{o} (Fig. 6.15, Block D) which includes Katchal Island, Nancowry Island and Great Nicobar Islands, the estimated 'b' Value are less than 1 which is 0.81 (Table. 6.9) and the tectonically active features viz Andaman Trench, Jarawa Thrust and Andaman Backarc Spreading Centre provide an ideal tectonic settings for the occurrence of future seismicity.

- In latitudes between 4^{o}-6^{o} N (Fig. 6.16, Block E) covering Northern Sumatra, the calculated 'b' Value is 0.84 (Table. 6.9) which are parallel to the strike of West Andaman Fault (WAF) suggesting accumulation of potential stress and the probability of future earthquakes by rupturing the fault segment accompanied by stress release.

- The estimated cumulative 'b' Value of Block A and Block B (North Andaman Islands, Middle Andaman, South Andaman Island and Little Andaman Islands) show exceptionally low 'b' Value (0.67 and 0.70 respectively) which is suggesting that Andaman regions possess high stress are more vulnerable for future seismicity along tectonically active faults.

6.7 Analysis of Seismogenic Faults

After calculating the b- value for all the Blocks, the regional faults such as Andaman Trench, Jarawa Thrust, West Andaman Fault (WAF) and Andaman Backarc Spreading Centre (ABSC) were analysed to identify the active nature of the regional faults through the spatial distribution of earthquake magnitude 5.0 and above. For this, the epicenter data were classified into three i.e. Mw 5.0 – Mw 6.0, Mw 6.1 – Mw7.0 and Mw >7. These data were plotted and correlated with the regional faults map of the Andaman and Nicobar Islands (Fig. 6.18). If the epicenter data of particular magnitude falls on the fault or in the vicinity of the fault, the severity of the fault system can be understood based on the classification of the magnitude and accordingly, this analysis was carried out for all the Blocks.

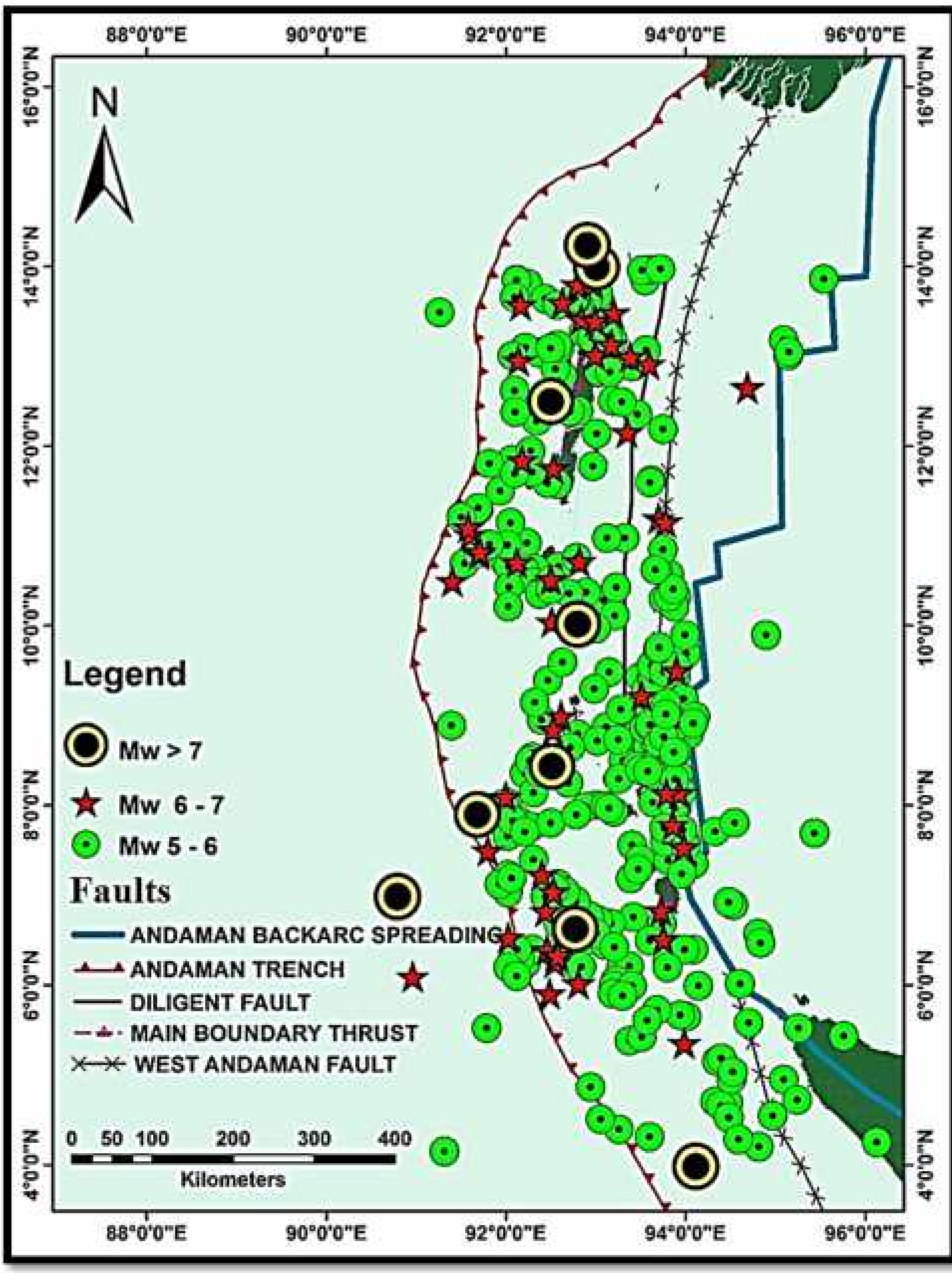


Fig. 6.18 Showing the distribution of Earthquakes of magnitude Mw >5 of Andaman and Nicobar Islands and its surroundings.

6.7.1 BLOCK - A

The Block A Segment which include North Andaman, Middle Andaman and Northern part of South Andaman Islands that interlinks with number of major fault systems such as Andaman Trench, Jarawa Thrust, West Andaman Fault (WAF) and Andaman Back-arc Spreading Centre (ABSC). 79 earthquakes Mw above 5 were analysed to identify the active tectonics of regional faults.

1) Out of the 79 earthquakes between 1928 and 2012 that were analysed, 25 earthquakes magnitude Mw 5 and above fall along the Trench. Out of the 25 earthquakes, 22 earthquakes between Mw 5.0 – Mw 6.0, 2 earthquakes between Mw 6.1 – Mw 7.0 and 1 earthquake Mw > 7.0 fall in the Trench region.

2) Jarawa thrust have ruptured in the form of 26 earthquakes between 1928 and 2012. Out of which, 16 earthquakes between Mw 5.0 – Mw 6.0, 8 earthquakes between Mw 6.1 to Mw 7.0 and 2 earthquakes of Mw > 7 have occurred in the Jarawa thrust. These earthquakes uplifted this region during successive earthquakes.

3) West Andaman Fault (WAF) recorded a total of 17 earthquakes between Mw 5.0 – Mw 6.0, Five earthquakes occurred between Mw 6.1 – Mw 7.0 and none of the earthquakes (Mw > 7) have occurred in this region between 1928 and 2012.

4) Whereas Andaman Backarc Spreading Centre (ABSC) have recorded 6 earthquakes of Mw 5.0 – 6.0 and 1 earthquake in the magnitude range between Mw 6.1 – 7.0. But, none of the earthquakes (magnitude above 7) have been witnessed in this region between 1928 and 2012.

6.7.2 BLOCK - B

The Block B segment which includes South Andaman Islands and Little Andaman Island that interlinks a number of major fault systems such as Andaman Trench, Jarawa Thrust, West Andaman Fault and Andaman Backarc Spreading Centre, where a total number of 63 earthquakes of magnitude above 5.0 are analysed to bring out the active tectonics of the faults in this Block B.

1) Along the Andaman-Sunda Trench region, 34 earthquakes occurred between 1928 and 2013 have been analysed. Out of which, 28 earthquakes have occurred in the magnitude range between Mw 5.0 – 6.0 and 6 earthquakes betweem Mw 6.1 – 7.0 have occurred. But, none of the earthquake of magnitude above 7 have been witnessed in the Trench region.

2) Jarawa Thrust traversing through this Block B have experienced 27 earthquakes of Magnitude above 5.0. Out of which, 19 earthquakes between magnitude range Mw 5.0 – 6.0, 7 earthquakes between Mw 6.1 – 7.0 and 1 earthquake of magnitude above 7 have ruptured this fault during 1928 to 2013.

3) The West Andaman Fault of this segment have witnessed a total number of 19 earthquakes of magnitude above 5.0. Out of which, 17 earthquakes have occurred between Mw 5.0 – 6.0 and 2 earthquakes occurred between magnitude Mw 6.1 – 7. But, none of the earthquakes of magnitude above 7 have occurred in the vicinity of this fault between 1928 and 2013.

4) None of the earthquakes magnitude above 5.0 have occurred in the vicinity of Andaman Backarc Spreading Centre of this segment B.

6.7.3 BLOCK – C

The Block C Segment which includes Car Nicobar Island, Teresa Island, Chawra Island, Trinket Island and Kamorta Island that interlinks a number of major fault systems such as Andaman Trench, Jarawa Thrust, West Andaman Fault (WAF) and Andaman Back-arc Spreading Centre (ABSC). In total, 94 earthquakes of magnitude (Mw) above 5 were analyzed to identify the active tectonics of faults in this block.

1) Andaman Trench region in this block have experienced a total number of 17 earthquakes. Out of which, 15 earthquakes of Mw 5.0 – 6.0 and 2 earthquakes of Mw 6.1 – 7.0 have occurred. But, none of the earthquakes of magnitude above 7 have been witnessed in the Trench region between 1918 and 2012.

2) Jarawa Thrust of this Block have experienced 15 earthquakes of Magnitude above 5.0, in which 12 earthquakes of Mw 5.0 – 6.0, 2 earthquakes of Mw 6.1 – 7.0 and 1 earthquake of magnitude above 7 have ruptured this thrust fault between 1918 and 2012.

3) The West Andaman Fault of this segment have witnessed 39 earthquakes of magnitude above 5.0, in which 37 earthquakes of Mw 5.0 – 6.0 and 2 earthquakes of Mw 6.1 – 7.0 have occurred in this fault. But, none of the earthquakes of magnitude >7 has been witnessed in the vicinity of this fault between 1918 and 2012.

4) The Andaman back- arc Spreading Centre (ABSC) recorded 23 earthquakes. Out of which, 21 earthquakes of Mw 5.0 – 6.0 and 2 earthquakes of Mw 6.1 – 7.0 have occurred in the ABSC. But, none of the earthquakes magnitude >7 has been witnessed in this region between 1918 and 2012.

6.7.4 BLOCK –D

The Block D Segment which includes Katchal Island, Nancowry Island and Great Nicobar Islands that interlinks number of major fault systems such as Andaman Trench, Jarawa Thrust, West Andaman Fault (WAF) and Andaman Back-arc Spreading Centre (ABSC). Totally, 104 earthquakes of Mw above 5 were analyzed to identify the active tectonics of faults in this block.

1) Along the Andaman Trench region, 65 earthquakes have been analysed. Out of which, 51 earthquakes of Mw 5.0 – 6.0, 11 earthquakes of Mw 6.1 – 7.0 and 3 earthquakes of Mw above 7 have occurred in the Trench region between 1939 and 2012.

2) Jarawa Thrust of this Block have experienced 20 earthquakes of magnitude above 5.0. Out of which, 18 earthquakes of Mw 5.0 – 6.0 and 2 earthquakes of Mw 6.1 – 7.0 have ruptured this fault. But, none of the earthquakes above 7 magnitude have occurred between 1939 and 2012.

3) The West Andaman Fault of this segment have witnessed 12 earthquakes of magnitude above 5.0. Out of which, 10 earthquakes of Mw 5.0 – 6.0 and 2 earthquakes of Mw 6.1 – 7.0 have experienced in this region. But, none of the earthquakes of magnitude above 7 have occurred in the vicinity of this fault between 1939 and 2012.

4) The Andaman back- arc Spreading Centre (ABSC) have witnessed 7 earthquakes of Mw 5.0 – 6.0. But, none of the earthquakes magnitude above 6.1 have been occurred in this region between 1939 and 2012.

6.7.5 BLOCK –E

The Block E segment which includes South Andaman Islands and Little Andaman Island that interlinks a number of major fault systems such as Andaman Trench, Jarawa Thrust, West Andaman Fault and Andaman Back-arc Spreading Centre. In total, 41 earthquakes of magnitude above 5.0 are analyzed to bring out the active tectonics of the faults in this block.

1) Along the Trench region in this block, 16 earthquakes have been analysed. Out of which, 14 earthquakes of Mw 5.0 – 6.0, 1 earthquake of Mw 6.1 – 7.0 and 1 earthquake of Mw above 7 have occurred in this Trench region between 1984 and 2013.

2) The Jarawa Thrust of this Block have experienced 18 earthquakes of Magnitude above 5.0, in which 17 earthquakes of Mw 5.0 – 6.0 and 1 earthquake of Mw 6.1 – 7.0 have ruptured this fault. But, none of the earthquakes of magnitude above 7 have occurred along this fault between 1984 and 2013.

3) Along the West Andaman Fault, none of the earthquakes of magnitude greater than 5.0 have occurred between 1984 and 2013.

4) Similarly, along Andaman Back-arc Spreading Centre, 6 earthquakes have occurred in the magnitude 5.0 – 6.0. But, none of the earthquakes of magnitude above 6.0 has been witnessed along this fault between 1984 and 2013.

   Maximum earthquake have occurred in the Andaman Trench region followed by Jarawa Thrust, West Andaman fault and ABSC.