Chapter-7

SEDIMENTATION HISTORY AND TECTONICS OF THE SOUTHWEST CONTINENTAL MARGIN OF INDIA
7.1 Introduction

As discussed in the chapter-2, the sedimentary basins of the SWCMI are formed as a result of continental rifting between India and Madagascar during the Late Cretaceous and later modified by Reunion hotspot during the Early Tertiary. Initially the basins received thick volcanics and volcanogenic sediments, derived from Marion and Reunion hotspot volcanism. In the process of development of the basins, sediments of pelagic, hemipelagic and clastic origin are deposited during the Cenozoic time. The 2-6 km thick pelagic carbonate sedimentation of Middle Eocene to Middle Miocene took place during increased sea level and warmer climatic condition prevailed over Indian plate when the plate was in warm latitude belt with very low terrigenous influx (Clift et al., 2001; Molnar, 2004). Post Middle Miocene clastic sedimentation in the basins is associated with accelerated weathering and erosion of the Indian landmass as a result of emergence of the Himalaya during the Middle Miocene and onset of Indian Monsoon (Valdiya, 1999). The shelf and slope sedimentation patterns reveal aggraded sedimentation from the Late Paleocene to Middle Miocene and prograded sedimentation since the Middle Miocene. Based on the litho/chrono stratigraphic correlation of the seismic sequences identified from the MCS reflection profiles, the sedimentation history of the SWCMI is discussed in this chapter. Further the chapter discusses improved understandings, emerged out of the present study, on volcanic nature of the SWCMI, impact of Reunion hotspot, continent to oceanic transition and neotectonic activities along the SWCMI.

7.2 Sedimentation history

Sediment depositional history of the SWCMI is delineated by the correlation of the seismic sequences with litho- and chrono- stratigraphic information of the continental shelf-slope, Laccadive Basin and Laccadive Ridge. Sedimentation along the SWCMI has begun as a result of formation of numerous local and
regional structural grabens along the stretched continental crust of SWCMI due to extensional tectonics during the rifting between India and Madagascar in the Late Cretaceous. These structural grabens became depocentres for the syn-rift and post-rift sediments. Based on seismic sequence analysis and drill well information the sedimentation history of the study area is discussed under two geological domains: i) continental shelf – Laccadive Basin, and ii) Laccadive Ridge.

**Continental shelf – Laccadive Basin**

The Kerala-Konkan Basin (KKB) and Laccadive Basin constitute major depocentres in the continental shelf – Laccadive Basin domain. Sedimentary units deposited in the KKB are highly varying in thickness since they are deposited in coast parallel grabens separated by numerous local basement highs. Late Cretaceous sediments ranging in age from Santonian to Maestrichtian are drilled from deep, narrow sedimentary grabens located in the southern part of the KKB (Rao et al., 2002). Sediment thickness in the Laccadive Basin generally shows gradual decrease from north to south. However, the sediment thickness changes drastically over buried Prathap Ridge and Shelf Margin High. Eight major litho-stratigraphic units deposited since Late Cretaceous have been correlated with the seismic sequences interpreted from the continental shelf – Laccadive Basin depicted in the MCS reflection profiles (Table 4.8).

The lowest seismic sequence H1 is correlated with the Cochin sedimentary formation. The reflection patterns of this sequence indicate that it was deposited in a disturbed, complex and non uniform energy conditions produced by tectonic agitations. The Cochin Formation, which is deposited during Late Cretaceous to Late Paleocene, is interbedded with altered flow basalts to its bottom deposited under a sub-aerial condition. This suggests that towards close of the Late Cretaceous there was an episode of marine regression due to decrease in depth of basin to near sea level. This episode of upliftment of basins and marine regression is associated with the onset of rifting between Seychelles and India. Based on paleo-bathymetry studies, Raju et al. (1999) suggested shallow depths of less than 100 m for sedimentation within KKB during the Late Cretaceous. This event of upliftment was followed by a period of non-deposition and formed Middle Paleocene depositional hiatus (Singh and Lal, 1993).
The sedimentation in the basin resumed during Late Paleocene as a result of marine transgression probably in response to passive subsidence initiated after the rifting at the start of the Late Paleocene (Campanile et al., 2008). As a result, another major sedimentary sequence (correlated with the seismic sequence H2) was deposited. The sequence H2 is seismically characterized by concordant, contorted and hummocky reflection patterns. This suggests the deposition of the sequence from a nearly undisturbed homogenous to a complex high energy condition. This sedimentary sequence, deposited during Late Paleocene to Early Oligocene, comprises Kasargod and Karwar formations (Table 4.8). The Kasargod Formation was deposited during the Late Paleocene to Early Eocene. The formation is separated from the underlying Cochin Formation by an unconformity surface which is identified as H1-top in the seismic profiles. To the end of Early Eocene the Kasargod Formation composed of clay, shale, sandstone, siltstone and lignite-seams shows gradual development of interbedded limestone. A lime rich sedimentation in KKB became conspicuous since Middle Eocene under a shallow marine environment. This lime rich sedimentation above Carbon Compensation Depth (CCD) formed the Karwar Formation. But the sedimentation in the Laccadive Basin was taking place in a deeper marine environment below CCD. Therefore, the carbonates of the Karwar Formation became shaly in the Laccadive Basin to form a carbonate poor shaly formation, termed as Panaji Formation (Figure 3.2). Both the Karwar and Panaji Formations are bounded to the top by a major unconformity surface, particularly in the deep offshore region, formed during the Late Eocene depositional hiatus. This unconformity surface is identified as H2-top in the seismic profile. The carbonaceous nature of the Karwar Formation in the KKB and the presence of an erosional unconformity on top of the formation indicate that the environment of deposition changed from deeper continental shelf to lagoonal. This suggests that the basin has witnessed a major tectonic upliftment at the end of Eocene.

Further subsidence of the basins to a shallow water condition in the Early Oligocene initiated another episode of marine transgression and the deposition of a prominent carbonate sedimentary sequence. This limestone rich sedimentary sequence of Calicut and Quilon formations is correlated with the seismic sequence H3 (Table 4.8) deposited during Early Oligocene to Late Miocene over
the Late Eocene unconformity surface H2-top. The reflection patterns of the seismic sequence suggest that it was deposited in a slow and uniform to highly disturbed energy condition. This sedimentary sequence extends from the onland coastal region to the deep Laccadive Basin (Figure 3.2), and represents a major transgressive period in the sedimentary basins of SWCMI. The Quilon Formation deposited through Late Oligocene to Late Miocene exhibits a period of regional westward tilting of the sedimentary basins that caused an inland marine transgression from the end of Early Miocene to Late Miocene, and development of carbonate banks in elevated areas (Raju et al., 1981; Rao et al., 2002). The development of thick carbonate sequences of Karwar, Calicut and Quilon formations throughout the basins of SWCMI is linked not only to the increased sea level but also a warmer climatic condition from Early Eocene to Late Miocene, when Indian subcontinent was in the warmer latitude belt of the equator. The entire source of sediments during this period consists of abundant pelagic fossil tests, suggesting that much of the peninsula was submerged and characterized by pelagic sedimentation (Raju et al., 1981).

The SWCMI experienced a heavy influx of terrigenous sediments derived from the Western Dharwar Craton during the Late Miocene (Singh et al., 1999). This phase of high sedimentation is associated with the formation of numerous fractures and faults, reactivation of existing fault trends and collapse of the parts of continental shelf in response to the tectonic imbalance following the collision of India with Eurasia and upliftment of Himalaya during Middle Miocene (Biswas, 1987; Ghosh and Zutshi, 1989; Subrahmanyam et al., 1995; Clift et al., 2001). As a result, the cessation of carbonate buildup and accumulation of markedly thicker terrigenous sediment deposits in the sedimentary basins were initiated during the Late Miocene. In the MCS reflection profiles the heavy influx of the post Miocene terrigenous sediments into the SWCMI is represented by the significant progradation of the continental shelf. The present shelf break is prograded into the sea for an average distance of about 15 km from the Middle Miocene shelf break. This sequence of terrigenous sediments is correlated with the seismic sequences H4 and H5 which are distinguished as Mangalore and Trichur formations respectively (Figure 3.2 and table 4.8). The general sub parallel to divergent reflection pattern shown by the seismic sequences indicate alternate high and low
energy of deposition associated with the subsidence of the basin. The complex reflection patterns identified locally indicate unstable and disturbed energy conditions during sediment deposition caused by waves, currents, sediment slumping and reactivation of the structural features by neotectonic activities. The sedimentary sequence of the Mangalore Formation, composed mainly of clay and siltstone, was deposited during lower to upper Late Miocene over the unconformity surface H3-top overlying the Quilon Formation. The Mangalore Formation constitutes lower part of the heavy terrigenous sediment sequence deposited along the SWCMI following the major orogenic event of the upliftment of Himalaya in the Middle Miocene. The upper most clastic sedimentary sequence of the Trichur Formation composed of sandy, silty, alluvial and lateritic clay is being depositing since Early Pliocene. It may be mentioned here that the lithological similarity of Mangalore and Trichur formations complicate the proper identification of the seismic boundary between the sequences H4 and H5.

Laccadive Ridge

The lowest seismic sequence L1 identified from the Laccadive Ridge is correlated with the sedimentary sequence deposited during the Late Paleocene (Figure 4.25). This Late Paleocene detrital sedimentary sequence is composed mainly of sandstone and siltstone with glauconitic limestone to the top. This sequence has been deposited on a subsiding seabed within a near shore shallow water environment of less than 100 m water depth (Whitmarsh et al., 1974 and Weser, 1974). The detrital component in the sediment decreased towards the end of the Late Paleocene and started deposition of glauconitic limestone.

In the Early Eocene the seabed began to sink in response to the tectonic events caused by the initial contact between India and Eurasia. As a result, a deep water depositional environment was produced and pelagic sedimentary sequences, mainly composed of chalk, ooze, biogenic silica and limestone, were deposited. These pelagic sedimentary sequences were deposited at a slower and uniform rate during Late Paleocene to Middle Miocene. The biogenic silica, later, began to accumulate as chert within the pelagic sedimentary sequence. This sedimentary sequence is correlated with the seismic sequence L2 deposited during Late
Paleocene to Middle Eocene. The seismic reflection patterns of the sequence suggest disturbed and unstable energy conditions during its deposition. These disturbed and unstable depositional conditions probably indicate the tectonic agitations caused by the initial contact between India and Eurasia.

The supply of biogenic silica became scarce in the sediments by Early Oligocene and carbonate rich chert free pelagic sedimentary sequence was deposited. This sedimentary sequence is correlated with the seismic sequence L3 deposited during Middle Eocene to Middle Miocene. The sub parallel to divergent reflection patterns of the seismic sequence indicate non-uniform environment of deposition due to differential subsidence of the sedimentary basins due to compressional stress developed by the active spreading ridges in the Arabian Basin and the collision of India with Eurasia.

By the advent of Middle Miocene the region began to receive terrigenous sediments derived from the land as a result of tectonic upliftment of Himalaya and development of its fluvial system in the Middle to Late Miocene. This post Middle Miocene terrigenous sedimentation is correlated with two seismic sequences L4 and L5. The Middle Miocene to Early Pliocene sedimentary sequence, correlated with the seismic sequence L4, is characterized by detrital clay and silt with the pelagic sedimentation of nanno and foraminiferal ooze.

The detrital sediment component increases in the upper sedimentary sequence deposited since Early Pliocene. This sedimentary sequence is correlated with the seismic sequence L5 characterized by parallel to concordant reflection patterns. The seismic reflection patterns shown by both the seismic sequences L4 and L5 suggest more or less uniform environment of deposition since Middle Miocene. The strong upwelling and bottom currents which appear to have begun in the Middle Miocene may have carried the terrigenous materials in suspension to the depositional sites of the Laccadive Ridge and continues to the present day (Whitmarsh et al., 1974).
7.3 Seaward dipping reflectors – evidence for volcanic passive margin

Seismically imaged Seaward Dipping Reflector (SDR) sequences discussed in chapter-6 are one of the most important results of the present study since they are reported for the first time from the SWCMI. SDRs are identified along western flank of the Laccadive Ridge at three locations below sedimentary strata (Figure 6.2). Seaward of their occurrences, the Laccadive Ridge gradually thins and juxtaposed with the Early Tertiary normal oceanic crust of the Arabian Basin. The oldest sediment recovered from the DSDP drill well 219 located (9.02917°N, 72.87783°E) at the crest of the Laccadive Ridge has a dated age of ~58 My. Weser (1974) suggested that Site 219 was much closer to shoreline of India than it is today based on the typical shelf type nearshore shallow water sedimentation (limestone, sandstone and silt). Though, the identified SDRs are away from site 219, it may be interpreted that (i) the SDRs are older than 58 m.y. as they are found below the sedimentary column, and (ii) the SDRs are emplaced under sub-aerial condition. In paleo-geographic reconstructions, it is presumed that the southwest India rifted from the eastern margin of Madagascar during the Late Cretaceous (White and McKenzie, 1989; Storey et al., 1995, 1997; Torsvik et al., 1998; Raval and Veeraswamy, 2003). The rifting was associated with the Marion hotspot volcanism which occurred at Volcan del'Androy, southeast Madagascar and caused widespread eruption of basalts and rhyolites in Madagascar and Fe-Ti-enriched tholeiites in southwest India. Therefore, the occurrence of SDRs along the SWCMI strongly suggest extrusive volcanic episodes under sub-aerial condition during rifting between the eastern Madagascar and Laccadive Ridge which was a part of Indian mainland. It may be noted that volcanic rifted margin segment may be predominantly volcanic without SDRs being imaged in seismic records. Therefore, SDRs can be considered as sufficient condition for volcanic margin classification (Eldholm et al., 1995). SDRs of the present study, indeed, suggest that SWCMI is a volcanic passive margin developed during breakup between Madagascar and Laccadive-India in the Late Cretaceous with COT to the west of the inferred feather edge of the SDR sequences identified along the western flank of the Laccadive Ridge.
7.4 Basement depth anomalies – evidence for thermal uplift

Computation of previously unreported basement depth anomalies in the Arabian Basin (discussed in chapter-5) is another prominent finding of the present study. The depth anomalies in the basin vary from +501 to -905 m (Table 5.2). The anomalous depths to the basement of the basin suggest that subsidence in the basin does not follow the age-depth relationship of normal oceanic crust. The magnitude and regional distribution of basement depth anomalies documented over 63–42 My old oceanic crust of the Arabian Basin are comparable with those obtained from different parts of the world ocean. Depth anomalies have been reported from the Atlantic Ocean (Hayes, 1988; Louden et al., 2004) and the Southeast Indian Ocean (Hayes, 1988). One of the world's largest depth anomalies which is named as 'superswell' by McNutt and Fischer 1987 is reported in the South Pacific Ocean.

Several hypotheses have been forwarded to explain the origin of the basement depth anomalies in the oceans. According to Sleep (1990), the regional domal uplift is a characteristic feature of the presence of mantle plumes. The change from vertical upwelling to horizontal flow along base of the lithosphere induces an upward force on the plate (Menard, 1973), causing a dome-shaped uplift around the centre of upwelling. Compilation of depth anomalies and hotspot locations of the world oceans indicates a strong correlation between depth anomalies and occurrence of hotspots (Crough, 1979). Mostly negative depth anomalies correlate with hotspots such as Iceland, the Azores, Cape Verde and Bermuda in the North Atlantic Ocean. Another possible contributor to oceanic depth anomalies is compositional buoyancy due to basalt extraction (Jordan, 1979; Robinson, 1988). Melting depletes fertile mantle in garnet, and raises the MgO/FeO ratio of the residuum. As a consequence, it becomes less dense (O'Hara, 1975; Boyd and McCallister, 1976; Oxburgh and Parmentier, 1977), and therefore causes upliftment. The thinning hypothesis (Detrick and Crough, 1978) postulates that there is a high mantle heat flux associated with each hotspot. Since the lithosphere is a thermal boundary layer, additional heat in the base of the lithosphere causes the lithospheric thickness to decrease. Since the lithosphere is
colder and, therefore, denser than the asthenosphere, this thinning generates isostatic uplift and the formation of a topographic swell.

The negative basement depth anomalies (shallower than predicted depth) documented in the present study from the eastern part of the Arabian Basin is due to its proximity to the high thermal regime of the former Réunion hotspot. It is suggested that vertical upwelling due to convection, followed by a lateral across-axis flow driven by excess near-field pressure by the hotspot, may have induced an upward force resulting regional swell. Thereafter, the oceanic lithosphere started subsiding, and is presently relatively shallow compared to the depth of the normal oceanic crust predicted by lithospheric thermal model of Stein and Stein (1992), even if the cause of the uplift have ceased to operate in the region. It may be mentioned here that the Arabian Basin was evolved due to a complex pattern of spreading-ridge propagation between magnetic chron 28n (~63 Ma) and 20n (~43 Ma; Dyment, 1998; Chaubey et al., 1998, 2002a). As a result, asymmetric crustal accretion was occurred in the basin over this whole period. Although the origin and change in direction of propagation of the palaeo-propagators in the basin are not well understood, a linkage between the former Reunion hotspot and the spreading-ridge propagation has been postulated in earlier studies (Dyment, 1998; Chaubey et al., 1998). Royer et al. (2002) argued that the former Reunion hotspot may have generated a regional swell which was large enough to affect the bathymetry of the region, which would explain the spreading-ridge propagation 'downhill' along the bathymetry or gravity gradient (Morgan and Sandwell 1994). These views support the postulate (Dyment, 1998; Chaubey et al., 1998) that the nearby former Reunion hotspot influenced the evolution of the oceanic crust of the basins. Therefore, the zone of negative depth anomalies in the study area is caused by vertical upwelling due to convection, followed by a lateral across-axis flow facilitated by the Reunion hotspot. This is further supported by the spatial as well as temporal proximity of the Reunion hotspot to the Early Tertiary seafloor-spreading regime in the eastern part of the Arabian Basin (Whitmarsh, 1974; Morgan, 1981; Shipboard Scientific Party, 1988).

The zone of positive depth anomalies located in the western part of the Arabian Basin indicates excess subsidence of the oceanic crust relative to that predicted...
by lithospheric thermal model and thickening of normal oceanic lithosphere. The excess subsidence of the western part of the Arabian Basin could have caused by the combination of isostatic adjustment due to sediment loading and relatively cold mantle compared to the nearby eastern part of the basin affected by the intense thermal field of the former Reunion hotspot. Lin et al. (2002) proposed that dynamic interaction between relatively cold mantle beneath spreading ridges and the ambient flow renders a transient nature to the subsidence of the seafloor.

7.5 Continent-Ocean Transition

Continent-Ocean Transition (COT), a zone of transition from continental to oceanic crust, is associated with a narrow zone of crustal thinning and significant volume of breakup related magmatic intrusives and extrusives. Whereas Continent-Ocean Boundary (COB) is defined as the line of maximum extent of continental crust material (Maillard et al., 2006) representing change from crystalline continental basement to oceanic basement. In the present study COT is inferred based on crustal structure, igneous intrusive bodies limiting the western extent of the Laccadive Ridge, feather edge of the identified SDRs and characteristic free air gravity anomalies.

Igneous intrusive bodies with steep scarps are observed along the western flank of the Laccadive Ridge limiting the seaward extent of the ridge. These intrusives are associated with high amplitude free air gravity anomalies. Similar features are reported for basement ridges of many passive margins, e.g. the Gabon-Congo region of west Africa (Belmonte et al., 1965) and Norwegian margins (Talwani and Eldholm, 1972). Talwani and Eldholm (1973) opined that major changes in the basement elevation normally occur at the boundary between oceanic and continental crust. Chaubey et al. (2002b) suggested that the volcanic features at the western edge of the Laccadive Ridge mark boundary of the rifted crust and early rift-emplaced volcanics.

The SDRs are generally used to identify volcanic passive continental margins (Hinz, 1981; Mutter et al., 1982, Eldholm et al., 1995) and to demarcate seaward extent of the rifted continental crust (White et al., 1987). In the present study, the presence of SDRs and its feather edge along the western flank of the Laccadive
Ridge lead to the identification of the edge of the rifted continent, and thereby to demarcate COT along western margin of the ridge. The crustal structure derived from the best-fit 2D gravity models along the five traverses (RE23, RE21, RE19, RE17 and RE15) the SWCMI reveal considerable variation in crustal thickness, and basement elevation across the margin (Figures 6.7, 6.8, 6.9, 6.10 and 6.11). The crustal structure models suggest that continental Laccadive Ridge gradually thins towards offshore and juxtaposed with the oceanic crust of the Arabian Basin, outlining the COT.

The COT along the SWCMI (Figure 7.1) is delineated based on combined interpretation of 2D multi channel seismic and free air gravity anomaly data, as well as crustal structure derived from the gravity modeling. The identification of igneous intrusive bodies along the western flank of the Laccadive Ridge, sharp gradient in the free air gravity anomalies to the west of the ridge, SDRs along the western flank of the ridge with their feather edges towards the Arabian Basin, and oceanic crust of the Arabian Basin provide good indication of the location of COT along western margin of the Laccadive Ridge. The COT is demarcated between the inferred feather edge of the SDR sequences identified along the western flank of the Laccadive Ridge, and the oceanic crust of the Arabian Basin where the Moho is characterized by significant shoaling to an average depth of 10.5 km associated with a prominent free-air gravity low. The COB, is not clearly defined along SWCMI, however, it can be placed within the COT which is confined to a narrow zone of width 30-55 km.

### 7.6 Lower crustal body and rift related magmatism

The Lower Crustal Body (LCB) is a localized zone of anomalous high P-wave velocities (7.2-7.8 km/s) located within the rifted continental margins. The LCB is formed as a result of rift related magmatism within the lower continental crust. Anomalous high velocity (7.2-7.4 km/s) lower crustal bodies have been identified in different geological domains of the western continental margin of India, which were interpreted as underplated lower crust (Pandey et al., 1996; Radha Krishna et al., 2002; Minshul et al., 2008; Collier et al., 2009). The lower crusts with anomalous high P-wave velocities (7.2 to 7.8 km/s) are one of the characteristic
features of the volcanic continental margins. The geophysical expression of the anomalous high velocity/density lower crustal body is complex. Such lower crustal bodies are interpreted as either a magmatic structure or a stretched continental crust loaded with dykes and sills injected during early stage of volcanic margin development.

2D crustal models across SWCMI suggest occurrence of LCB characterized by high density material beneath the Laccadive Ridge. The thick high-density (3.0 g/cm$^3$) lower crustal body below the ridge might have formed due to magmatic intrusions by the Marion hotspot during initial stage of rifting between Madagascar and Laccadive-India, and later by the Reunion hotspot when the Indian Plate
moved over the hotspot during its northward motion. However, Dev et al. (2007) have opined that the Marion hotspot might have played a limited role in the development of SWCMI. Nevertheless, the results of the present study (SDRs, LCB, crustal structure) suggest that the SWCMI could be described as a volcanic rifted margin whose early development have been affected by Marion hotspot magmatism in the south, unlike wide spread magmatism by the Reunion hotspot in the north.

7.7 Neotectonic activities

Differential displacements of the interpreted seismic sequences are identified in the MCS reflection profiles. These displacements are depicted as slumping of the sedimentary blocks along the continental shelf/slope, and faulting of the sedimentary layers. The slumping of upper most sedimentary sequence H5 is identified along the continental slope depicted in the seismic reflection profiles RE23 and RE17 (Figure 4.4 and Figure 4.15) suggesting recent tectonic activity.

Near vertical faults, penetrating through the entire sedimentary column overlying the Prathap Ridge are interpreted in the MCS profiles RE17 and RE15 (Figure 4.14 and Figure 4.17). The upper sediment layers are heavily folded and disrupted between the faults. The result suggests recent reactivation of the existing basement highs of the Prathap Ridge resulting into the intense faulting.

Interpretation of seismic sequences on the flat topped shelf margin high and adjacent region (Figure 4.17 and Figure 4.18) suggests upliftment due to re-activation of the high after the deposition of the upper most sedimentary sequence H5. The basement highs and/or igneous bodies associated with thinned and uplifted sedimentary column over its crust are identified in the Laccadive Basin and at the foot of the continental slope (Figures 4.3, 4.5, 4.14, 4.15 and 4.21). The upliftment and thinning of the sediment column suggests recently intruded or uplifted igneous bodies and/or basement highs. The reactivation of the horst-graben structures over the Laccadive Ridge are indicated by the fault bounded up-thrown and down-thrown tilted sedimentary blocks (Figure 4.3 and Figure 4.6). The faulted, folded, tilted and slumped blocks of the post Middle Miocene
sedimentary sequences and recently intruded or uplifted igneous intrusive bodies suggest neotectonic activities along the SWCMI.

The reactivation of Precambrian structural trends in the Indian subcontinent is attributed to: i) tectonic imbalance produced by the collision of India with Eurasia and upliftment of Himalaya during Middle Miocene (Ghosh and Zutshi, 1989; Biswas, 1987; Subrahmanyam et al., 1995, Clift et al., 2001), and ii) the compressional stress development due to spreading ridge push in the Indian Ocean and resistive forces at the Himalayan collision zone (Gowd et al., 1992 and Gowd et al., 1996). The reactivations of Precambrian fault trends caused the neotectonic activities and slumping along the western continental margin of India (Raha et al., 1983; Chandrasekhar, 1985; Nair and Subramanyan, 1989; Ramasamy, 1989; Chauhan and Almeida, 1993; Subrahmanyam et al., 1993b; Subrahmanyam, 1998; Widdowson and Mitchell, 1999; Hanumantha Rao et al., 2002; Rao et al., 2002). The ENE-WSW trending transform faults of the Carlsberg Ridge and the structural lineaments of the Indian Ocean floor are known to be tectonically active. Nair and Subramanyan (1989) suggested that the ENE-WSW lineaments identified in the SWCMI constitute the youngest set since it abuts all other lineaments and are known to be responsible for neotectonism observed in the region. Earth tremor loci in the adjacent continental region of SWCMI reported from the recent past are aligned in ENE-WSW direction (Sharma and Varghese, 1979). Therefore, it could be surmised that the tectonic imbalance formed along the WCMI due to continued collision between India and Eurasia, upliftment of Himalaya, and the stress build up in the tectonically active zones of the Carlsberg Ridge and its transform faults are responsible for the reactivation of the Precambrian lineaments that caused neotectonic activities in the SWCMI.