of NGRI, Hyderabad. Geochemical analysis revealed the presence of various mineral compositions as listed in Table 1. This was done using ElanDRCII (Perkin Elmer). Later the same marine sediments were analysed in the Mineral Physical Laboratory and the final result indicates the presence of illite (93%) (Figure 3).

Illite is not a specific clay mineral name, but is a general term for the mica type clay minerals. It is commonly used for any nonexpanding clay mineral with a 10 Å *C*-axis spacing (Figure 4).

By definition, all illites have the mica-type structure. The basic structural unit is composed of two silica tetrahedral sheets with a central octahedral sheet. The size of naturally occurring illite particles is small, yet they are larger and thicker than montmorillonite particles and have better-defined edges. Illite is a common product of weathering if potash is present in the environment of alteration. It is a frequent constituent in many soil types, and may form in soils under certain conditions as a consequence of the addition of potash fertilizers. This is possible because illite has the ability to 'fix' potassium. Illite is common in recent sediments and is particularly abundant in deep-sea clays. It probably forms from montmorillonite and other minerals during marine diagenesis. Illite is often found in ancient sediments. It is the dominant clay mineral in shales that have been studied.

The rate of sedimentation is perhaps the highest in the Bay of Bengal region because the gradient of the many rivers run into it. The total number of samples collected was divided into 64. These 64 samples were scanned with the help of DTGS TEC detector. They were further scanned by Fourier transformation infrared spectroscope. The resolution was around 2.000, sample grain 8.0, mirror velocity 0.6329 and aperture 37.00. After all the results were correlated and calibrated, the best match was found to be illite, with 93%. Illites are indicative of mechanical rather than chemical weathering, but are more stable than mica minerals. Illites are characteristic of weathering in temperate climates or in high altitudes in the tropics, and typically reach the ocean via rivers and wind transport. These processes may have brought these sediments to the 85°E Ridge.

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Precambrian mega lineaments across the Indian sub-continent – preliminary evidence from offshore magnetic data

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Marine and airborne magnetic data over south Indian continent including the western and eastern continental margins between latitudes 12°30′N and 10°N were studied and interpreted. The total intensity magnetic anomalies over the south Indian continental block between 10°45′N and 12°30′N exhibit distinct character compared to the adjoining northern and southern blocks. The study revealed the presence of two Precambrian mega lineaments over a stretch of 750–800 km running in east-west direction. They were mapped approximately from the isobath of 1500 m in the western continental margin, across the south Indian Peninsula and through

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the eastern continental margin up to a water depth more than 3000 m. These mega lineaments may be acting as a crustal junction/contact between two major geological provinces, viz. the Southern Granulite Terrain (SGT) and the Dharwar Craton. In addition to these two mega lineaments, major faults have been inferred, which acted as controlling parameters to create a bulge/bite in the coastline off Cuddalore. The continent–ocean boundary/transition on the Eastern Continental Margin of India (ECMI) may be the offshore boundary for these two Precambrian mega lineaments.

Keywords: Magnetic data, mega lineaments shear zones.

AIRBORNE total intensity magnetic data[1] over the Southern Indian shield and the marine total intensity magnetic data of the eastern continental shelf and western continental shelf of India between the latitudes 12°30′N and 10°N have been analysed and interpreted. The marine magnetic data has been collected onboard *R. V. Gaveshani* and *ORV Sagarkanya* by National Institute of Oceanography, Dona Paula[2], Goa and its Regional Centre, Visakhapatnam[3]. The aim of the study is to delineate the major tectonic and structural trends and zones across the Indian subcontinent by analysing the total intensity magnetic data of the land and adjacent offshore regions. The qualitative study of the airborne and marine magnetic data sets revealed significant findings across the south Indian continent. One of the lineaments starts approximately at 1500 m isobath in the western offshore region of south India, runs across the southern peninsular India and passes through the eastern continental shelf of India up to a water depth more than 3000 m. It covers a horizontal distance of approximately 750 km. This lineament runs almost parallel and close to 11° north latitude and can be considered as a mega lineament hitherto unmapped.

This mega lineament, partly referred to as Palghat–Cauvery Lineament (PCL) on land was marked and shown bounded by lineaments A and B (Figures 1 and 2). Part of this lineament on the south Indian peninsula was studied by several workers[1,4–7]. The area between the two lineaments A and B is characterized by elongated and isolated closures of magnetic anomalies trending approximately in E–W direction. This zone is also associated with high magnitude earthquake epicenter locations (Figure 1), suggesting significant tectonic activity. Some of these major earthquake locations are seen falling on the boundary lineaments A and B. The present study reveals the extension of PCL from the south Indian Peninsula towards its western and eastern offshore regions, which forms one of the mega lineaments. It extends from the land towards western offshore up to a water depth of more than 1500 m and towards eastern offshore beyond the isobath of 3000 m. This mega lineament is delineated as an east–west trending feature in the offshore regions whereas in the central peninsular India it took an oblique shape bulging towards north.

Similarly, towards north of this mega lineament/zone, an east west trending lineament is present, which was earlier marked as Moyar–Bhavani–Attur lineament[7]. In the present study the offshore extension of this lineament was identified and marked in the total intensity magnetic data of the adjoining eastern and western continental margins of India. Due to lack of magnetic data this lineament could not be mapped on the land, but its location has been transferred from the earlier studies[6,7] and shown in Figure 2. This lineament starts at approximately 1500 m isobath in the western offshore region of southern India and runs across the southern peninsular India, passes through the eastern continental shelf of India up to a water depth of more than 3000 m. It covers a distance of approximately 800–750 km. This lineament almost runs parallel and close to 12°N lat., can be viewed as another mega lineament bounded by structural trends C and D in E–W direction cutting across the south Indian continent (Figures 1 and 2).

Along 11° north latitude the sub-surface relief of the magnetic basement appears deep while in the south, the Peninsular segment shows relatively shallow basement suggesting crustal blocks of relative vertical movement[1]. The Dharwar Craton is separated from the Southern Granulite Terrain (SGT) by two prominent shear zones known as the Moyar–Bhavani shear zone and Palghat–Cauvery shear zone, a transition zone marked by gradation in metamorphism from gneisses in the north to charnockite in the south[8]. Perhaps this phenomenon is reflected as an east–west trending tight band of total intensity magnetic contours over the south Indian Peninsula. These two mega lineaments act as major tectonic/structural boundaries of the south Indian continent.

The presence of these mega lineaments on the Peninsular shield as well as on the eastern and western margins of India suggest that, the south Indian land mass and the adjoining offshore regions in the east and west are genetically linked and also indicate that these lineaments may be of Precambrian age[7]. Some of the earlier reported lineaments[9] over the western continental shelf (Figure 2) are well correlating with the presently inferred westward extension of the mega lineaments.

In the present study, by revising the aeromagnetic data over southern Peninsular India, three major faults F1, F2 and F3 were marked and shown in the Figures 1 and 2. The faults F1 and F2 appear to be dislocated at PCL boundary A, suggesting westward shearing along the southern east–west mega lineament. The faults F1, F2 and F3 are associated with some of the earthquake epicentre locations.

South of Cuddalore on the east coast of India, the westward bend/bite of the coastline can be viewed or related to a tectonic movement. The present study revealed that this bend/bite is controlled and bounded by the NE–SW trending fault lineaments F1 and F3 running from the land mass and passes through the eastern continental shelf of India as shown in Figure 2. The faulted region F3 is associated

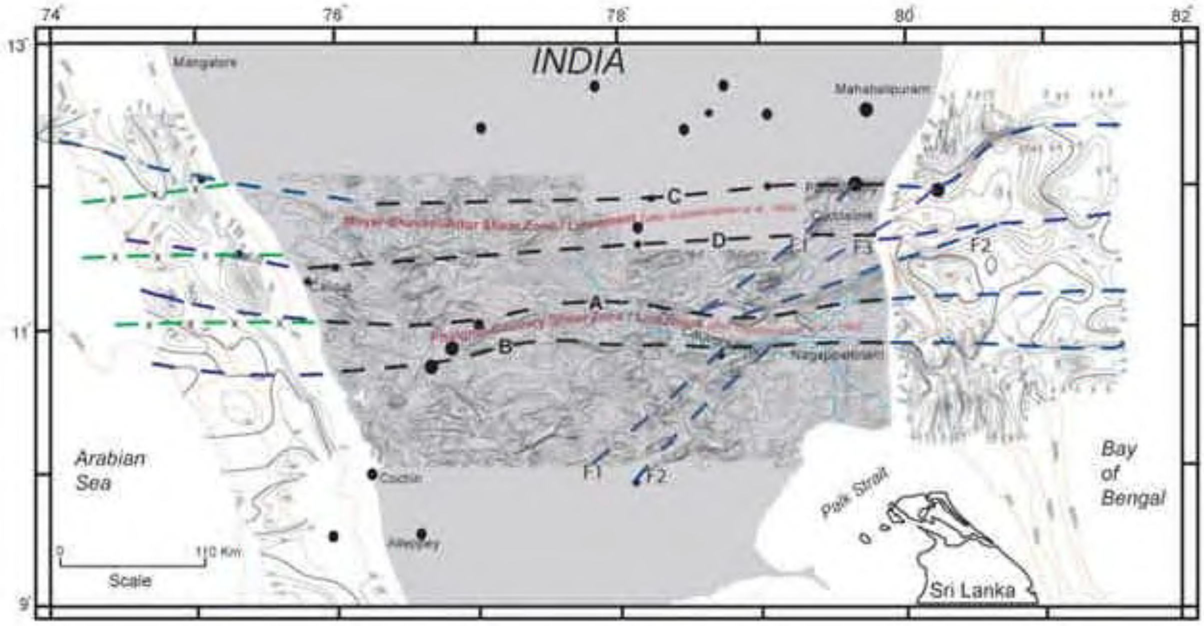

Figure 1. Map showing a part of aeromagnetic data over the south Indian Peninsula[1], shipboard magnetic data over the eastern and western continental margin of India. Solid dashed lines show the inferred tectonic/structural lineaments. Solid circles represent earthquake epicentre locations.

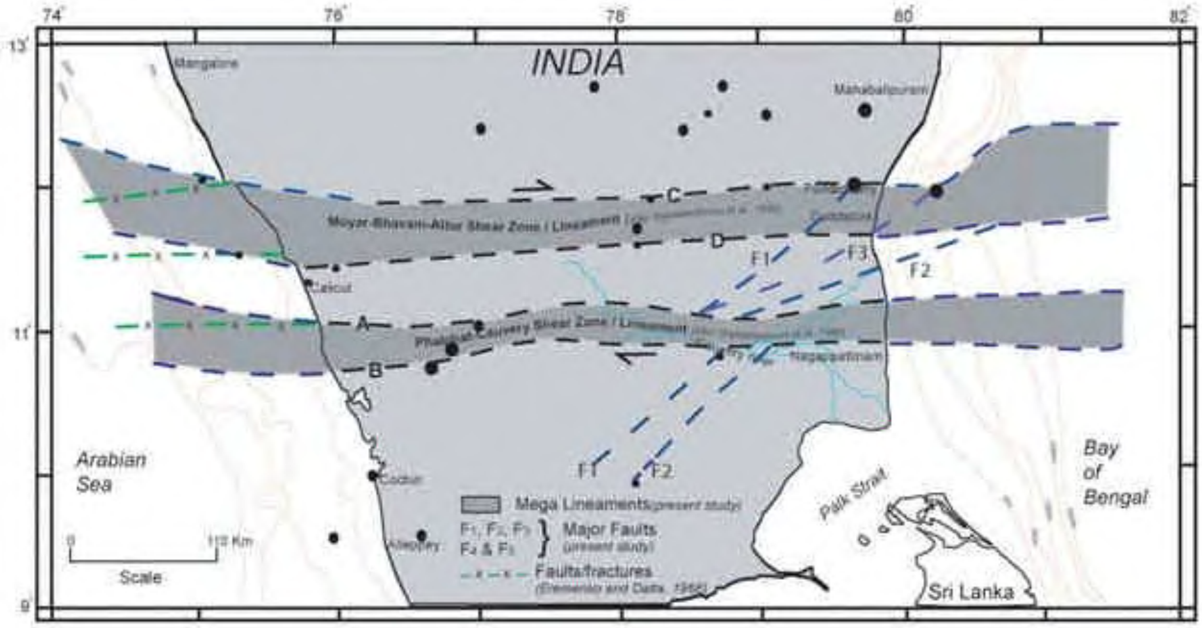

Figure 2. Map showing the Precambrian Mega Lineaments cutting across the South Indian Continent and the extension of major faults from land to eastern offshore (inferred from total intensity magnetic data).

with recently occurred major earthquake of *M* 5.5, on 25 September 2001, off Pondicherry.

The south Indian continental block bounded by the faults B and C resembles separate identity compared to the adjoining north and south blocks. The block is characterized by approximately E–W trending magnetic anomalies except few NE–SW trends whereas the adjoining continental blocks are associated with N–S trending anomalies. The present study concludes that the regions between the latitudes 10°N and 12°30′N of the south Indian continent are characterized and controlled by two mega lineations and associated tectonics suggesting that the area is tectonically active.

The presence of continental magnetic anomalies and the oldest mega lineaments of Precambrian origin, up to 3000 m isobath over the ECMI perhaps suggest that the continent–ocean boundary/transition exists beyond this point.

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Three dimensional attenuation structure of the central seismic gap region of Himalaya obtained from inversion of seismic intensity data

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The central gap region of the Himalaya, which lies in the northern part of the Indian subcontinent, is exposed to a great seismic hazard. Due to paucity of existing seismic instrumentation we have less digital data of past earthquakes in this region. With isoseismal data we have used damped least square inversion scheme to get three-dimensional attenuation structure of the region based on *Q* value. The obtained *Q* structure explains the aerial distribution of isoseismals of major earthquakes in the recent past. The studied area covers the Tehri town, which is the locale of one of the biggest earth-fill dams of height 260 m. The surface distribution of *Q* value suggests that the region around Tehri is surrounded by comparatively less attenuating medium and hence is a region of potential seismic hazard. The obtained *Q* structure explains the surface distribution of isoseismals of major earthquakes and provides important inputs for the purpose of seismic hazard zonation.

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Keywords: Central seismic gap, Himalaya, isoseismal, *Q* value, seismic hazard, intensity.

THE Himalayan orogen, which extends over 2500 km from Kashmir in the northwest to Arunachal in northeast India, is believed to be the result of a collision of the Indian and Eurasian plates[1–4]. Four great earthquakes have occurred in this Himalayan belt; however the major intervening part of the plate boundary has not broken in this time interval. Three areas of seismicity gaps have been identified in this Himalayan plate boundary[5]. Among these, the extent of central gap is long and has the potential for sustaining two future great earthquakes[5]. The central gap region of the Himalayas lies in the northern part of the Indian subcontinent and falls under the highest zone V of seismic zoning map of India. This region lies in a seismically hazardous zone and has witnessed two major earthquakes in the last decade, which had killed nearly 2100 people. The seismic hazard in any region can be correlated with the attenuation property of the medium, which is inversely proportional to the quality factor (Q) of the medium. Based on the principle that the ground vibration generated due to an earthquake controls the surface damage, inversion is performed to correlate the intensity data with the subsurface Q structure of the region. The final Q structure shows that this region contains both low as well as high Q localities and the site of the Tehri dam lies in comparatively high Q zone, which indicates its high seismic hazard potential.

For homogeneous earth the intensity contours usually show co-circular pattern with their centre at the epicentre. Irregular patterns of isoseismals are explained by attenuation structures[6,7]. The basic assumption which is used in the inversion scheme is that the seismic intensity is a measure of the peak ground acceleration A, which is associated with the arrival of S-waves released from point source buried in the earth medium, where velocity is constant in the horizontal direction and varies in a vertical direction[8,9]. In the present work the relation applicable for Himalayan earthquakes has been used to convert observed intensity data into peak ground acceleration after carefully testing their applicability for the Himalayan earthquakes[10,11]. It has been seen by several numerical experiments that a quantitatively reliable Q structure and earthquake source strength can be obtained in a region using intensity data[8]. The procedure of inversion is based on the method of Aki and Lee,