open marine environment, and was not conducive for nautiloid living.

The individual groups within the Bagh taxa appear to be of high density but are less diverse. Ammonites previously believed to be taxonomically diverse, are now found to be almost monotypic represented mainly by *Placenticeras*[19]. The functional morphological study of this genus as well as sedimentary facies analysis indicate that they lived in very shallow waters[24,25] and their monopolization of the Bagh basin as an opportunist species implies prevalence of physico-chemical stresses.

The only nautiloid specimen found, is a steinkern. Associated ammonites also show varying states of preservation. The horizon, where the specimen is recorded, is a condensed zone marked by hardground at several levels[26]. Associated ammonites are often seen to be bored and internal moulds are even encrusted with epizoan oysters implying reworking. The eutrephoceratid specimen is a septate internal mould whose camerae are infilled with a matrix similar to the host sediment. Since the infilled material retains the shape of nautiloid, we suggest that sediments were cemented prior to diagenetic dissolution of aragonitic shell. But matrix was partly lithified when the shell dissolved as evident from a slight deformity of the specimen. The absence of body chamber in the present specimen, we believe, is due to mechanical destruction prior to burial[27]. This also explains why infilling material is sediment and not calcitic spar which commonly occupy camerae of Bagh ammonites. Water with dissolved carbonates enters the cephalopod phragmocone through siphuncle. *Eutrephoceras*, characterized by siphuncle, is a deep-water form and preferred to live in the continental shelf[21].

In conclusion, we attempt to establish that rarity of nautiloids in the Bagh basin may be ascribed to the deep inland nature of the sea which differed physicochemically from the open oceanic environment. The only eutrephoceratid recorded, was perhaps posthumously transported from the open marine environment in a manner similar to the fate of a dead shell of extant *Nautilus*. The shell was later mechanically damaged, lost its body chamber and was finally buried within the Bagh sediment.

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Structural provinces of India based on gravity trends

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Gravity trend is defined as the axis of an elongated high or a low. Trends drawn from the Bouguer gravity anomaly map of India reveal that the Indian shield is a mosaic of about twelve crustal blocks that are either sutured or separated along the rift valleys. These blocks corroborate well with those identified earlier from geological evidences and provide a geophysical support to geological inferences.

GRAVITY trend is defined as the axis of an elongated gravity high or low. These trends represent deep structural features such as the axis of a major fold or an elongated intrusion in the metamorphic or the crystalline part of the crust. In sedimentary regions, the trends in the sediments are usually parallel to the trends in the underlying crust. Rifts could be identified from gravity trends as elongated linear belts. The study of gravity trend patterns helps to identify geologic terranes[1,2] – crustal blocks with different geological and tectonic history from the adjoining blocks.

Gravity trends drawn from the Bouguer gravity anomaly map of India[3] are shown in Figure 1. The most prominent feature of Figure 1 is the belt of linear trend pattern in ENE direction that extends from west to east across the subcontinent along the Narmada and Son rivers. Oblique to this major trend pattern are the linear belts along Godavari, Mahanadi and Damodar river valleys which appear to have been branched out from the Narmada–Son trend pattern. These belts of linear trends might suggest the pattern of ancient rifting of the Indian shield and subdivide the Indian crust into various geological/tectonic provinces. Twelve crustal blocks listed in Table 1 have been delineated from the gravity trends by using the following criteria:

- a crustal block contains internally consistent set of sub-parallel trends;
- boundaries of crustal blocks separate discordant trend patterns;
- the amplitudes and pattern of anomaly may change from one block to the other.

Following the above criteria, twelve crustal blocks have been identified from Figure 1. These crustal blocks have characteristic geologic features that distinguish one from the other and they can be called as 'terranes' and individual geologic and structural characteristics of these terranes have been described[4,5].

The relative age of gravity trend areas can be inferred from where the trends on one side of the common boundary are parallel to it and on the other side are oblique to it. The oblique trends are likely to antedate

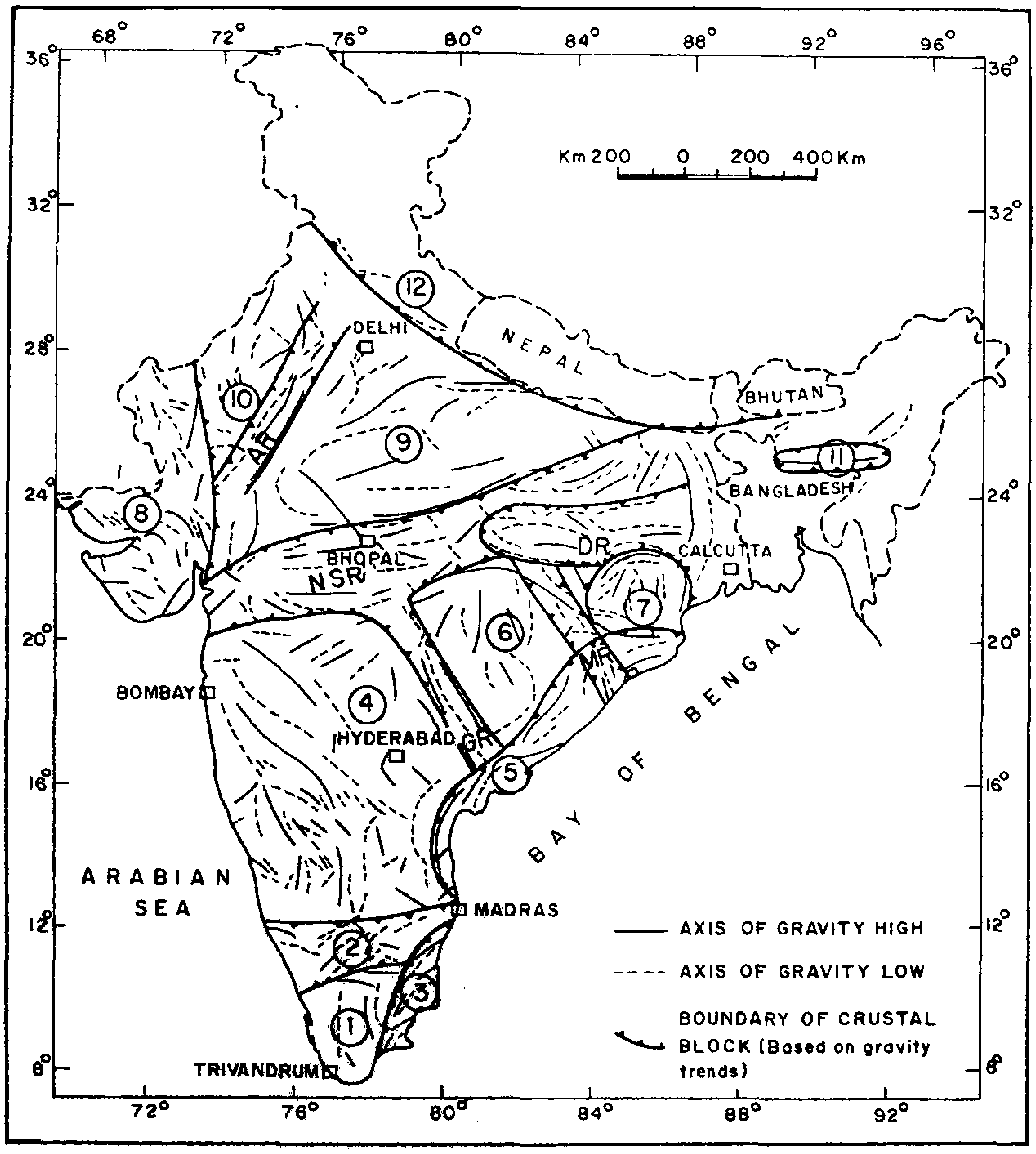

Figure 1. Gravity trend map of India and the twelve crustal blocks delineated from the trends. NSR, Narmada–Son rift zone; DR, Damodar rift; MR, Mahanadi rift; AR, Aravalli rift(?); GR, Godavari rift.

Table 1. Structural blocks identified from gravity trends and their trend directions

Block number	Name of the block	Major trend direction	Major rock type/ structure
1	Southern granulite terrain	N–S	Granulites
2	Palghat–Cauvery shear zone	ENE	Shear zone
3	Coastal Tamil Nadu (Cauvery) terrane	ENE	Sediment cover
4	Dharwar craton and a part of the Deccan volcanics	NNW, NW–SE	Schist belts, Closepet granite, granite-gneiss
5	Eastern Ghats	NNE, NE–SW	Khondalites, alkaline magmatism
6	Bhandara craton	N–S, NNW	Granite-gneiss
7	Singhbhum craton	N–S, ENE	Ultramafic suites with granite intrusives
8	West Rajasthan block	NNW	Sediments and trap cover
9	Bundelkhand craton	ENE	Reworked gneisses and granitic rocks
10	North Aravalli craton	N–S	Rhyolitic rocks, granites, migmatites
11	Shillong plateau	E–W	Granites, gneisses, and metamorphics
12	Himalayan fold belt	NW to NE	

the formation of the boundary while those parallel to the boundary are likely to post-date it[1]. The following relative ages of the gravity trend areas are found by applying these rules to the gravity trend patterns shown in Figure 1. In the south Indian shield, the areas with the oldest trends are inferred to be the blocks 1 (the southern granulite terrain) and 4 (the Dharwar craton). Adjacent blocks 2, 3, and 5 appear to have younger trends. Amongst these three, the block 2 appears to be older than blocks 3 and 5. The blocks 4 (Dharwar craton), 6 (Bhandara craton) and 7 (Singbhum craton) are separated from each other by the Godavari and the Mahanadi rifts respectively. Gravity trend patterns suggest that the Bhandara and the Singbhum cratons might be older than the Eastern Ghats (block 5). In the northern part, the Bundelkhand block (block 9) appears to be older than the west Rajasthan block (block 8) and the Himalayan fold belt (block 12).

The study of gravity trend patterns helped to identify twelve structural provinces (terranes) and their relative ages in the Indian shield. The terranes identified in the present study are almost identical to those identified from geological studies by Radhakrishna[5], thereby providing a geophysical support to the geological findings.

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Effect of abrupt salinity changes on survival of *Artemia parthenogenetica*

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A sudden decrease in salinity from 130 to 20 ppt resulted in the death of 96% adults, 78% subadults and 30% nauplii of *Artemia parthenogenetica*. Thus the tolerance level of the nauplius to changing salinity was greater than other stages.

DUE to precipitation and flooding, *Artemia* populations flourishing in the saltpans are subjected to wide and abrupt changes in salinity[1–4]. von Hentig[5] made a detailed study on survival of *A. salina* nauplius exposed to different salinity–temperature combinations. An equally detailed study was also undertaken on the hatching efficiency of cryptobiotic cysts[6] as a function of salinity. We report here survival of selected life stages of *A. parthenogenetica*, which were exposed to abrupt changes in salinity.

Populations containing nauplius, subadult, and adult stages of *A. parthenogenetica* were collected from saltpans at Kelambakkam, Madras, South India. They were quickly transported to the laboratory, where each of the selected stages (50 each) were separated and abruptly exposed to different salinities (20–130 ppt) in beakers (1000 ml). They were fed on rice bran twice a day and the water in the beakers was changed once a day. Five replicates were maintained for each stage at the tested salinities. The 130 ppt salinity was considered as the control and the duration of the experiment was restricted to five days.

The adults were most susceptible to sudden salinity changes, when they were transferred from 130 to any lower salinity down to 20 ppt (Figure 1); the mortality was also high, as much as 96%. The subadults were also severely affected, suffering a mortality of 78% compared to nauplii (30%). Hence the nauplius was the most tolerant stage to sudden salinity changes.

A sudden decrease of 10 ppt (130–120 ppt) in salinity resulted in less than 10% mortality in adults and