

**TECTONICALLY INDUCED ENVIRONMENTAL PROBLEMS ON AND OFF PONDICHERRY
COAST, TAMIL NADU, INDIA
- A VISION THROUGH REMOTE SENSING**

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ABSTRACT: The analysis of IRS - 1A satellite imagery has indicated the existence of two NE - SW trending sub parallel faults along which the coast is undergoing land subsidence as revealed by the concavity in the shore line, preferential migration of the river systems and the drainage congestion, absence of beach ridges, occurrence of off shore shoal etc. The study has further indicated chains of tectonically induced environmental problems such as ground water logging, coastal zone flooding, storm surges, harbour sedimentation etc.

1.0 INTRODUCTION:

Coastal zones are dynamically active because of the multivariate tectonic, fluvial, marine and aeolian geomorphic processes, which vary in their dynamism in space of time. In addition, in tectonically active coasts the tectonic movements exert greater influence over various land - ocean interactive processes. The southern part of the Indian Peninsular has all along been thought as stable area in general and the only major tectonic movement advocated was the rise of the west coast and the subsidence of the east coast. But the recent studies conducted (Vaidyanathan (1967), Vemban et.al (1977), Babu (1986), Ramasamy et. al. (1987), Ramakrishnan (1988), Sambasiva Rao (1989), Ramasamy (1989), Narashimhan (1990), Aggarwal & Mitra (1991) and many others) have indicated that differential tectonic movements have been taking place in Southern part of the Indian Peninsular since Jurassics. Greater variations in the land - ocean interactive processes in different segments of the east coast of Tamil nadu was observed (Ramasamy, 1990). Later studies (Ramasamy & Balaji ,1995) show that the India is buckling with a formation of a series of arches & deeps right from Cape Comorin in the south and the foot hills of Himalayas in the north.

The present study is new in this direction and aimed at understanding the on going tectonic movements and its influence over the environment. For the said study the Pondicherry coast of Tamil nadu was taken (Fig. 1). In the said study, the remotely sensed data collected by the IRS - 1A satellite was utilised and certain unique conclusions have been drawn not only on the ongoing tectonic activities but also on the influence of such tectonic movements over the environment of both on and off the Pondicherry coast.

2.0 GEOMORPHIC ANOMALIES:

The interpretation of remotely sensed data show two sub parallel NE-SW trending lineaments / faults extending from Pondicherry in the north east to as far as Kambam valley in the south west to a strike length of 400 kms. These faults are separated by 40 kms (Fig. 1) and this faults bounded zone is a conspicuous concave coast in Pondicherry region. The Mio - Pliocene - sand stone of Neyveli and Jayankondam region show a clear sinistral shift along these two faults which indicate that these two faults are Post - Mio - Pliocene sinistral in nature.

The Gingee and Ponnaiyar rivers have developed conspicuous palaeo channels in the north of their present day courses where as their present flow is south easterly to easterly and these are now meeting the sea in the fault bounded concave coast of Pondicherry region. Especially the Gingee river has taken a phenomenal rotational migration towards the centre of the fault bounded land. The Ponnaiyar river, in addition, exhibits appreciable over printing of drainages in this faults bounded land. A palaeo estuarine delta in Ponnaiyar river in this faults bounded concave coast was observed (Ramasamy,1991). The satellite imagery further clearly show the development of bundles of beach ridges both in the north & south of these two faults where as with in such faults bounded concave coast no beach ridges are observed (Fig. 1 & 2). The digitally processed satellite data (density

sliced IRS band 2/3 data) show an off shore shoal off Pondicherry coast coinciding with these two faults (Fig 1 & 3).

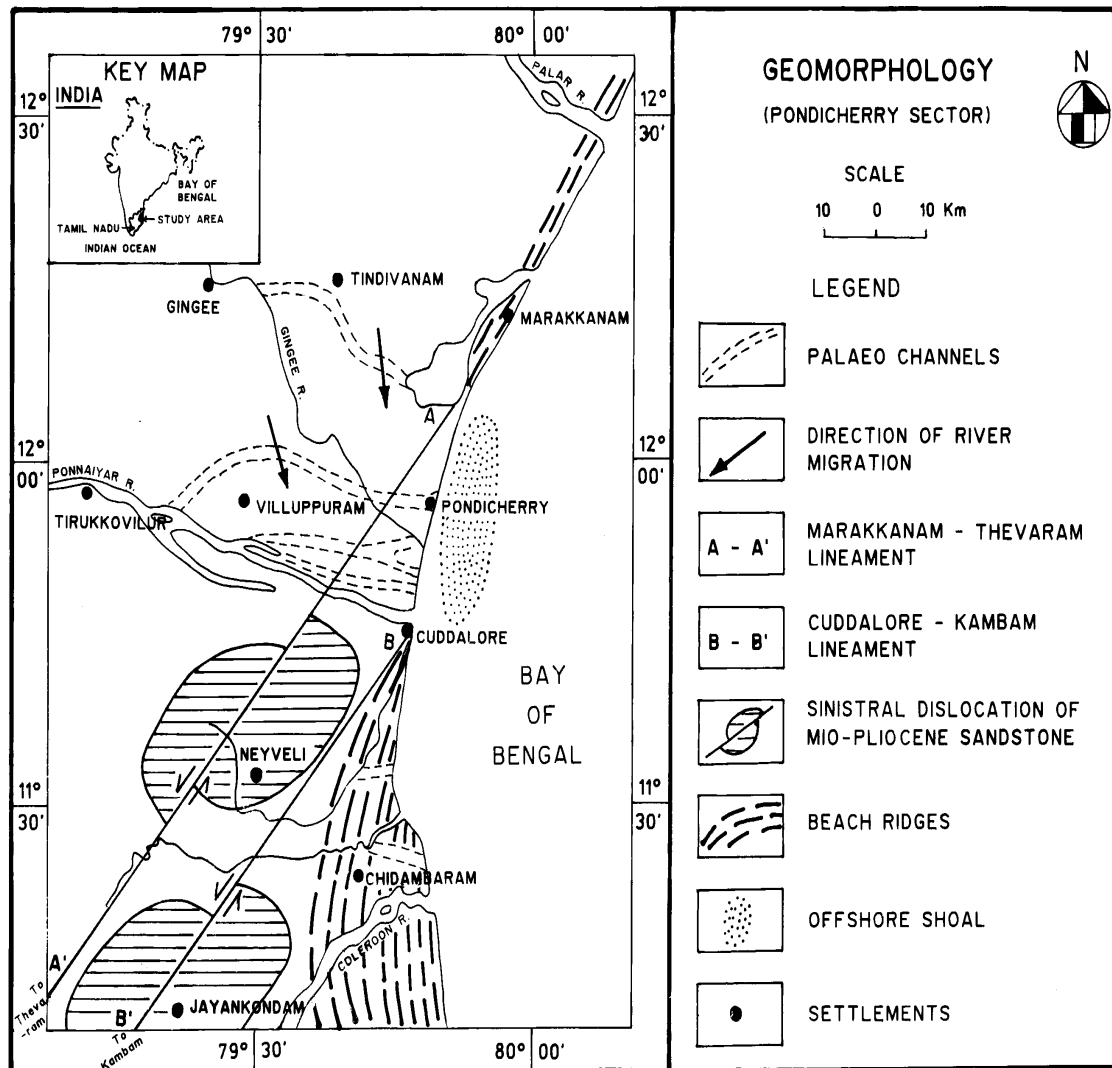


Fig . 1

It was also observed that the emerging coasts are generally convex in shape when compared to the subsiding coasts which are concave (Ramasamy,1990). In this area, conspicuously this faults bounded segment of the coast is concave in Pondicherry (Fig. 1) which indicate probable ongoing land subsidence along these faults. The preferential migration of Gingee river and Ponnaiyar river towards the central part of the faults bounded land (Fig. 1) and the conspicuous absence of the beach ridges further confirms the ongoing land subsidence (Fig. 1 & 2) in Pondicherry coast. The drainage congestion, the over printing of Ponnaiyar & the palaeo estuarine nature of the delta are further confirmation for the ongoing land subsidence along such concave coast. The offshore shoal found off the concave coast of Pondicherry (Fig. 3) further suggests the extension of these faults into the ocean, the availability of trough and the resultant sand accretion. All these clearly indicate that along these two sub parallel faults the land is undergoing a subsidence or grabening in Pondicherry region. On the contrary the sinistral strike slip movements of the Mio - Pliocene sand stone (Fig. 1, 2) indicate that sinistral components of these faults.

3.0 ENVIRONMENTAL PROBLEMS:

The above Remote Sensing derived geomorphic anomalies clearly indicates the ongoing land subsidence in Pondicherry coastal region. Such land subsidence is causing / expected to cause chains of environmental problems.

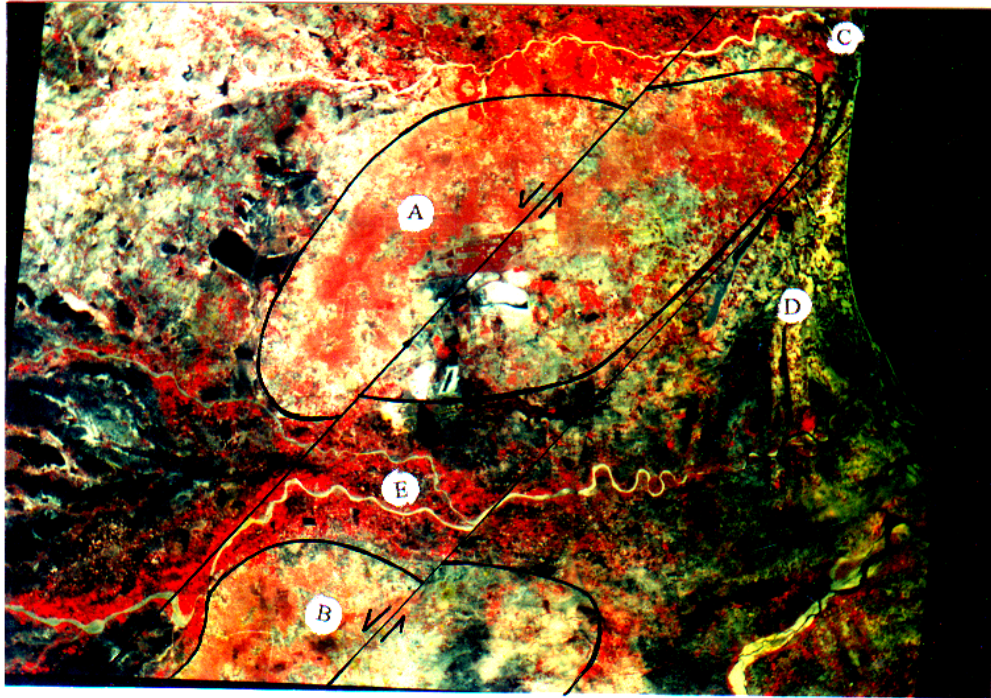


Fig. 2 - IRS 1A Imagery showing morphotectonic anomalies

(A) and (B) Sinistral movements of Mio-Pliocene Sandstone in Neyveli and Janyankondam.

Absence (C) and presence (D) of beach ridges in and away from the graben.

(E) Wider flood plain in Vellar river within the graben.

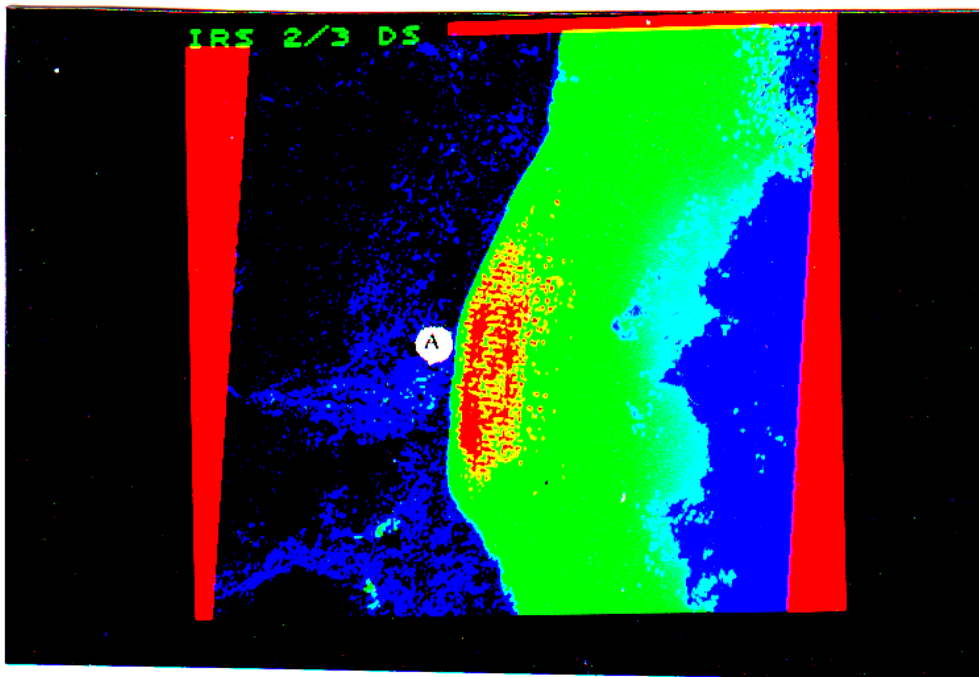


Fig. 3 - IRS 1A Density sliced (band 2/3) imagery showing shoal in the off shore region of Pondicherry (A)

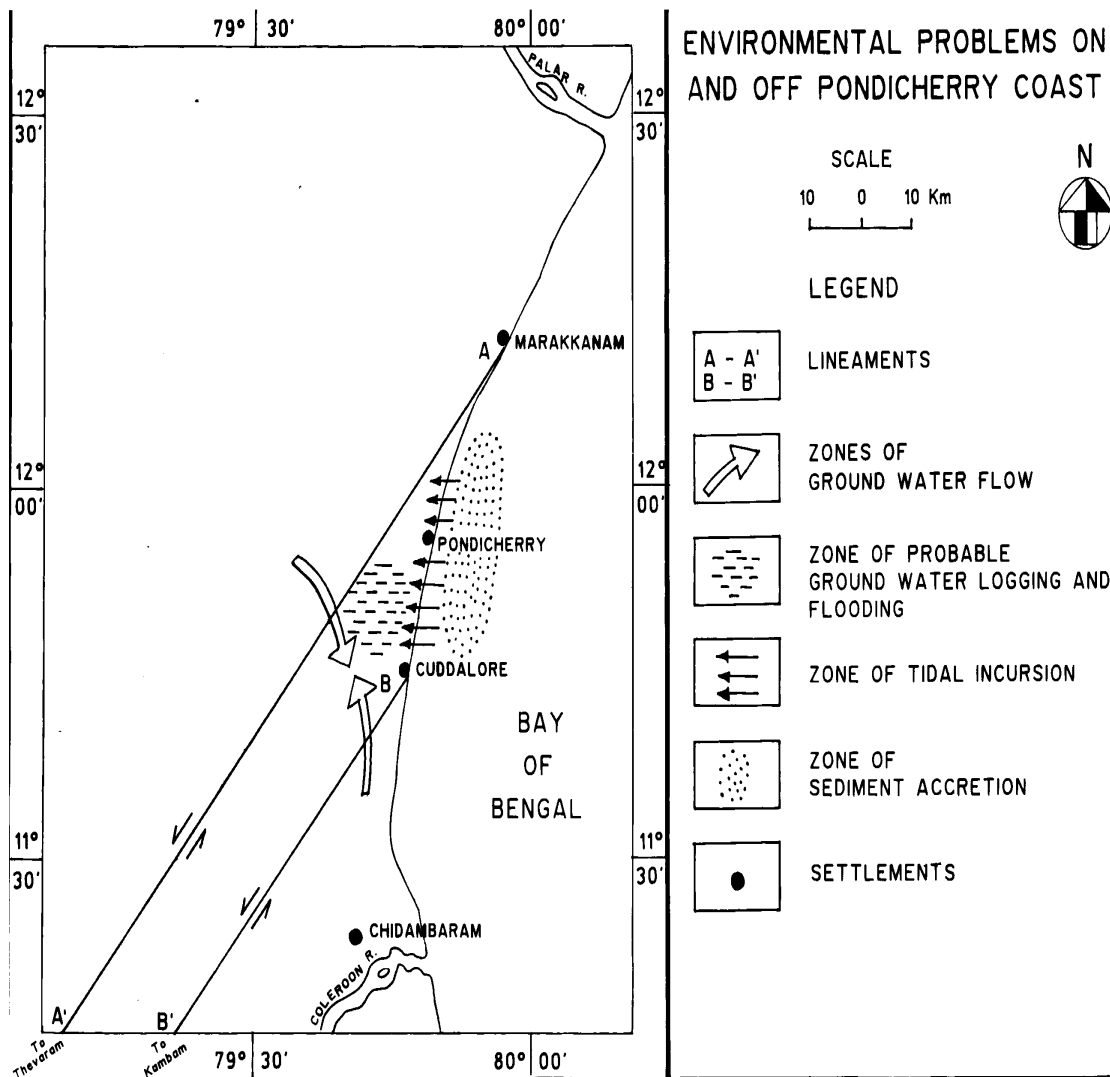


Fig . 4

3.1 Groundwater Flow:

The convergent flow in ground water in areas of land subsidence & land grabening in parts of Tamil Nadu has been observed (Ramasamy & Karthikeyan,1998). In this graben too the convergent flow can occur which will raise the groundwater level and which can further cause groundwater logging and inturn quality deterioration in ground water (Fig. 4)

3.2 Flooding:

Already Ponnaiyar river is showing over printing within the graben which indicates that because of the subsidence induced base level erosion, such drainage congestion is occurring which in turn will cause flooding.

3.3 Tidal Incursion:

Number of tidal inlets are found in the concave Pondicherry coast. This indicates that this area is also prone for storm surge which can also increase the phenomenon of flooding in the area

3.4 Coastal Sedimentation & Shore line Changes:

The digitally processed satellite data (Fig. 3) shows the occurrence of off shore shoal / sand body. This indicates that development of any harbour in this area must have preparedness for the removal of harbour sedimentation.

For that matter construction of harbour must be avoided as the sedimentation will be a big problem in the concave Pondicherry coast.

In addition, such shoal can also grow as a big land which may ultimately give a straighter configuration to such concave coast. As a result in another hundreds of years coast may be 5 - 10 kms east of present Pondicherry coastal city.

3.5 Conclusion:

Thus the Remote Sensing study has not only indicated the capability of remote sensing in the detection of tectonic movements but also in detecting chains of environmental problems in such tectonically induced coast.

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