crystallization from the silicate melt If laurite comes in to contact with immiscible sulphide melt, then it would be present in sulphide melt or if it is formed before silicate melt reached the sulfur saturation, it will be then enclosed in chromite (Merkle, 1992, Canadian Jour Earth Sci, v 29, pp 209-221) The presence of Fe rich Pt may only form as discrete grains before the sulphur saturation has reached Because of smaller grain sizes, the excitation area also results in spurious elements from adjacent grains To draw authentic conclusions, we require large data base and fresh core samples

Acknowledgements PVSR thank DST for the financial support to carry this work The authors thank anonymous reviewer for his constructive comments, which helped to improvise the MS The Director NGRI is thanked for his constant encouragement and support Support staff at UP, S Africa are also acknowledged for the help at thin-section lab, Centre for Microscopy and EPMA

National Geophysical Research Institute Hyderabad - 500 007 P V SUNDER RAJU

Department of Geology University of Pretoria South Africa - 002 R K W MERKLE

WHIRLING (BUCKLING) AND FRACTURING INDIAN PLATE AND IT'S CONSEQUENCES – A REMOTE SENSING APPRAISAL

SM RAMASAMY

Centre for Remote Sensing, School of Geosciences, Bharathidasan University, Tiruchirappalli – 620 023

Email: smrsamy@gmail com

Extended Abstract

Introduction

Consequent to the continental drifting, the Indian plate has moved towards north northeasterly and collided with Eurasian plate, thus resulting into the rise of Mighty Himalayan Mountains along the junction of these two plate boundaries as demonstrated by many earlier Geoscientists But the behaviour of the Indian plate, both during the collision and after that, has not been comprehensively studied and understood as to whether it has remained as an inert plate or suffered any mid plate deformations However, disseminated information has been brought out by many earlier workers on the post trappean arches, deeps, horsts and garbens within the Indian plate Some of such tectonic grains from north to south in the Indian Peninsular are

1 ENE-WSW Luni-Sukri cymatogenic arch in Western India
2 ENE-WSW Amerli arch in northern Saurashtra Peninsula
3 Alternate ENE-WSW horsts and grabens in southern Saurashtra
4 E-W horsts and grabens in Narmada-Tapi region
5 Mangalore (Mulki) – Chennai arch, Palghat deep, etc besides moderate to high mid plate seismicities in different parts of Peninsular India

Under this scenario, detailed interpretations were carried using digitally processed high resolution IRS satellite data and other GIS visualizations of structural, geophysical, geomorphological and hydrological datasets in Mangalore-Cape Comorin-Chennai triangle of the southern part of the Indian plate which lead to the deduction of significant information on the post collision tectonics and the related environmental issues of South India

Deformation of the Southern Part of the Indian Plate

The study has revealed two major E-W trending cymatogenic arches, one along Mangalore-Chennai in the north and the other along Cochin-Ramanathapuram in the south with in between complementary deep along Ponnani-Palghat-Manamelkudi (Fig 1)

The arch regions vividly display conspicuous and unique geological / geomorphological / hydrological anomalies such as

- ENE-WSW Fracture swarms prolifically filled with dolerite dykes along the northern Mangalore–Chennai

Gist of the lecture delivered on 25 July 2007 at the Geological Society of India, Bangalore

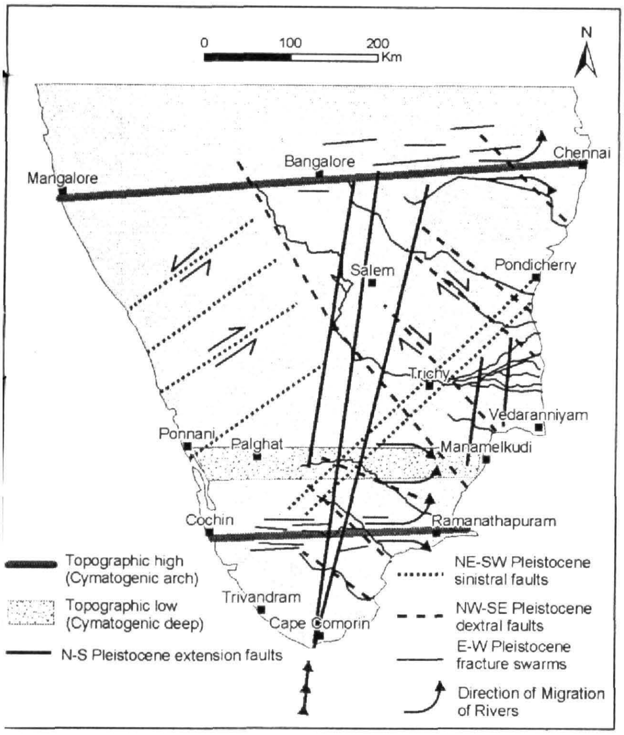

Fig.1. Buckling and fracturing, south India.

arch and the dyke barren fracture sets in the southern Cochin-Ramanathapuram arch

- Extensive soil erosion, heavy siltation of deltaic lakes located along the eastern proximity of these arches and significant sediment dumping into ocean even by small streams flowing these arches
- Preferential northerly and southerly migrations of the rivers away from the axial portions of the these arches (Northerly migration of river Pennar found to the north and the southerly migration of river Palar found to the south of Mangalore-Chennai arch and northerly migration of river Vaigai located to the north and the southerly migration of river Tambraparani seen to the south of Cochin-Ramanathapuram arch)
- Conspicuous convexities with restricted marine regressions on either ends of these arches along Mangalore and Cochin in the west coast and Chennai and Ramanathapuram in the east coast
- Shrinkage, siltation and defunct of backwaters
- Perceptible groundwater fall in the axial portions of these arches, etc.

On the contrary, the complementary cymatogenic deep along Ponnani–Palghat–Manamelkudi reveals contrasting geomorphic and hydrological anomalies viz:

- Preferential migration of river systems from the boundaries towards the axial portion of the deep (northerly migration of Pudukottai Vellar and southerly migration of Ambuliar rivers)
- Rise of groundwater level, moisture blanketing and soil salinity in different parts of the deep
- Conspicuous concavity, thin to nil beach ridges, accelerated tidal activities, substantial growth of mangroves, etc. along Manamelkudi coast, etc.

Similarly, the Remote Sensing based interpretations done using IRS satellite and SRTM (Shuttle Radar Topographic Mission) data reveal a spectrum of lineaments/faults in three major azimuthal frequencies viz: N-S, NE-SW and NW-SE. Amongst these, the N-S faults show varied evidences for block faulting, hinge faulting and tectonic wedging as evidenced from the compressed meanders and eyed drainages in river Cauvery in Mysore - Sivasamudram area, acute deflection of Cauvery in Hognekkal – Erode area, Eyed drainages in Palar near Chengalpattu, Compressed meanders in river Vellar near Sethianthoppe, northerly migration of river Cauvery in its deltaic regime and progradation of land in Tiruthuraipoondi - Vedaranniyam area to the tune of 55 km in the last 5000 years or so, drainage anomalies in Vaigai, etc.

In the same way, the NE-SW faults seem to be active sinistral faults as shown by varied drainage anomalies in the land part with conspicuous "S" shaped compressed meanders and sinistral shifting of the shoreline all along the west coast of Kerala and Karnataka as well as along the chains of islands in Laccadives and Maldives occurring to the west of Kerala coast in Arabian sea.

In contrast, the NW-SE faults, in addition to controlling most of the Bay of Bengal bound rivers in Tamil Nadu, show compressed meanders with "Z" shapes along their intersections with rivers / streams, truncation of beach ridges and the en-echelon shifting of Precambrian Quartzites by a system of sub parallel dextral faults in Madurai area.

Such active tectonic scenario with E-W arches and an intervening deep and N-S extensional, NE-SW sinistral, NW-SE dextral faults and E-W release fractures suggests that the Indian plate is undergoing a phenomenon of whirling / buckling and fracturing in the area due to the still prevalent post collision compressive force oriented along the acute bisector of the above NE-SW sinistral and NW-SE dextral faults and the N-S extensional faults in northerly to north northeasterly direction which only has originally caused the drifting and the collision of the Indian plate with Eurasian plate.

Deformation of the Western Part of the Indian Plate

The Remote Sensing based studies carried out in parts

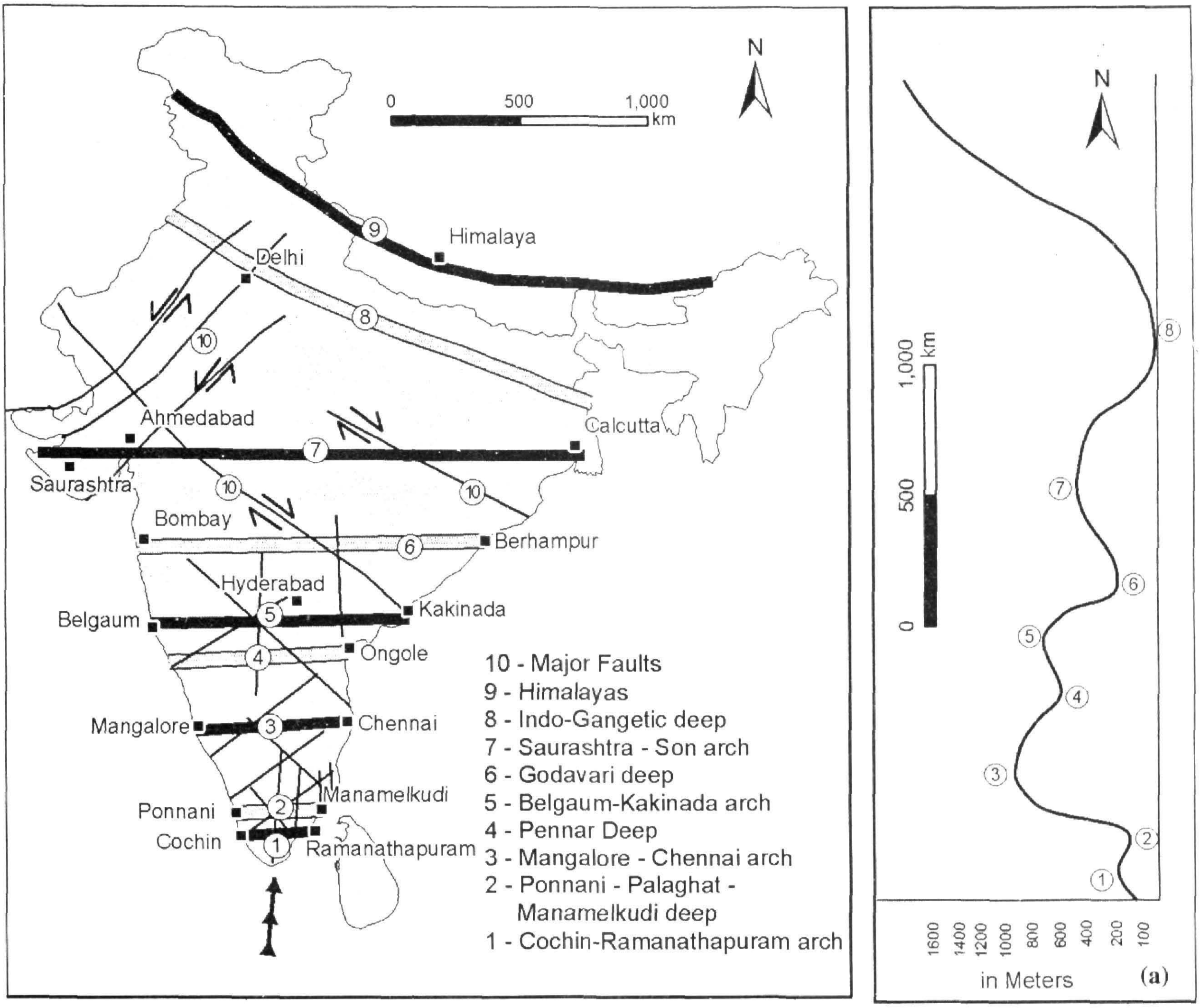

Fig.2. Post collision tectonic cartoon of Indian plate.

of Western India too lead to the detection of active tectonic grains with E-W trending alternate arches and deeps in Saurashtra, clockwise rotational / northerly migration of river Saraswati due to the Luni-Sukri cymatogenic arching found to its south, the northerly migration of Yamuna and the southerly migration of river Chambal suggesting the ongoing tectonic upliftment of the entrapped Upper Bhander Sandstone of Dholpur area, westerly migration of Ganges and the easterly migration of Yamuna indicating the ongoing subsidence of the entrapped land along NNW-SSE trending subparallel faults in the area east of Delhi, etc.

Post Collision Tectonics of the Indian Plate (Fig.2)

Assembling all, a comprehensive cartoon has been visualized on the post collision tectonics of the Indian plate with a series of E-W arches and deeps (1-9, Fig.2), N-S block faults, NE-SW sinistral faults and NW-SE dextral faults. For visualizing the arches and deeps in the entire Indian Peninsular, the topographic N-S profile deduced from SRTM data (Fig.2A), convexities and concavities of the coasts, the restricted marine regression within such convex coastal segments and the preferential migration of the river systems away from the axial portion of arches, etc. were considered, besides the E-W trending horsts and grabens and cymatogenic arches and deeps inferred by the earlier workers.

Consequences of Post Collision Tectonics

Such tectonic phenomenon seems to have significant control over various natural and environmental disasters as seen in parts of Tamil Nadu viz: seismicities along NE-SW sinistral faults; landslides in Nilgiri Mountains; flooding in zones of tectonic subsidence and drainage anomalies like compressed meanders, eyed drainages and deflected drainages, diversion of tsunami surge along convex and it's convergence and accelerated inundation along the concave coasts, occurrence of groundwater table as alternate E-W trending ridges and valleys in general and groundwater fall, aquifer squeezing and leakage into ocean along the convex coasts related to cymatogenic arching in particular, backwater shrinkage, siltation and total defunct and withdrawal of creeks in convex coasts/arches, accelerated tidal activities and mangroves in concave/ subsiding coasts, etc

Conclusion

Thus the study has brought out packages of newer information on the post collision tectonics and its direct bearing over various natural and environmental disasters which all warrant deeper studies in the context of rapidly emerging natural disaster scenario and the phenomenon of climate change

SELECTIVE TSUNAMI ATTACKS ALONG SW COAST OF INDIA – HOW & WHY? AND THE ROLE OF TSUNAMI WARNING SYSTEM IN THE SUB-CONTINENT

A C DINESH, N MARAN, A R NAMBIAR, E UNNIKRISHNAN and C JAYAPRAKASH
Marine Wing, Geological Survey of India, Mangalore
Email: acdinesh@rediffmail com

Extended Abstract

The 26th December 2004 Sumatra tsunami was most devastating in terms of loss of lives, properties and spread In India, east coast was hit by the primary waves without being modified by diffraction/reflection But very unexpectedly, the waves were undergone diffraction and/or reflection and inundated several parts in the southwest coast of India Unlike western part of Bay of Bengal, the eastern part of Arabian Sea is traversed by ridges like - Lakshadweep Ridge, Pratap Ridge, Comorin Ridge etc These ridges have played a major role in modifying the waves The bathymetric data collected onboard GSI vessels support this view Our data on timings of maximum inundation at different places along SW coast are matching with that of N P Kurien et al (2006) From these timings it is evident that the waves have not progressed much towards north from Kanyakumari (beyond Kolachel) Sector wise detailed bathymetry off Chetuwa, Kochi, Ambalapuzha, Alleppey, Kayamkulam inlet show gentle slope towards west Increasing slope was noticed near shore at Kollam and further south The first attack at SW coast was along Kanyakumari-Kolachel stretch This can be explained by the diffraction of waves at Galle(Srilanka) and /or along Comorin Ridge The selective inundations at other places at different timings are attributed to reflection of waves from Lakshadweep Ridge and diffraction/reflection from other ridges on its east and also the very late arrival of waves at few places like Edavanakkad, Anthkaranazhi, Ponnai etc could be possibly due to wave oscillation between the steep Lakshadweep Ridge and Quilon Plateau and adjoining ridge areas

Tsunami Warning System (TWS) is a system with two equally important components- a network of sensors which detect a tsunami and its velocity and a communication network to reach the message to the people at risk India is setting up its TWS in Bay of Bengal and Arabian Sea The Pacific Ocean Tsunami Warning Centre is operational since 1946 which serves as a tsunami warning centre not only for USA but also for 25 member countries situated around Pacific Since earthquake and tsunami are frequent hazards in this area, the detection and dissemination networks have constantly been evolved through decades, where as, tsunami is a rare phenomenon in the Indian sub-continent which is one way a blessing to the people at risk and a curse for the warning system Since tsunami occurs in this part over very long time intervals, like the present generation just before 26th December, 2004, the future generation also will be

Gist of the lecture delivered on 31 January 2007 at the Geological Society of India, Bangalore