Rama Setu

Including Proceedings of the International Seminar on Scientific and Security aspects of Setusamudram Channel Project held in Chennai on May 12, 2007

NASA Gemini XI Spacecraft (Sept. 12, 1966 - Sept. 15, 1966); NASA Space Shuttle Mission STS 59 (1994) http://history.nasa.gov/SP-168/section3b.htm

S. Kalyanaraman, Editor

Rameswaram Ram Setu Protection Movement, Chennai
(May 2007)

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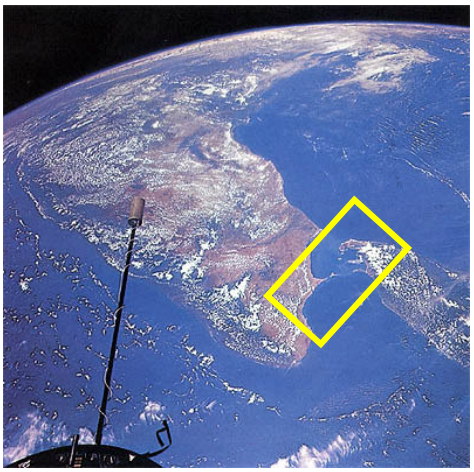
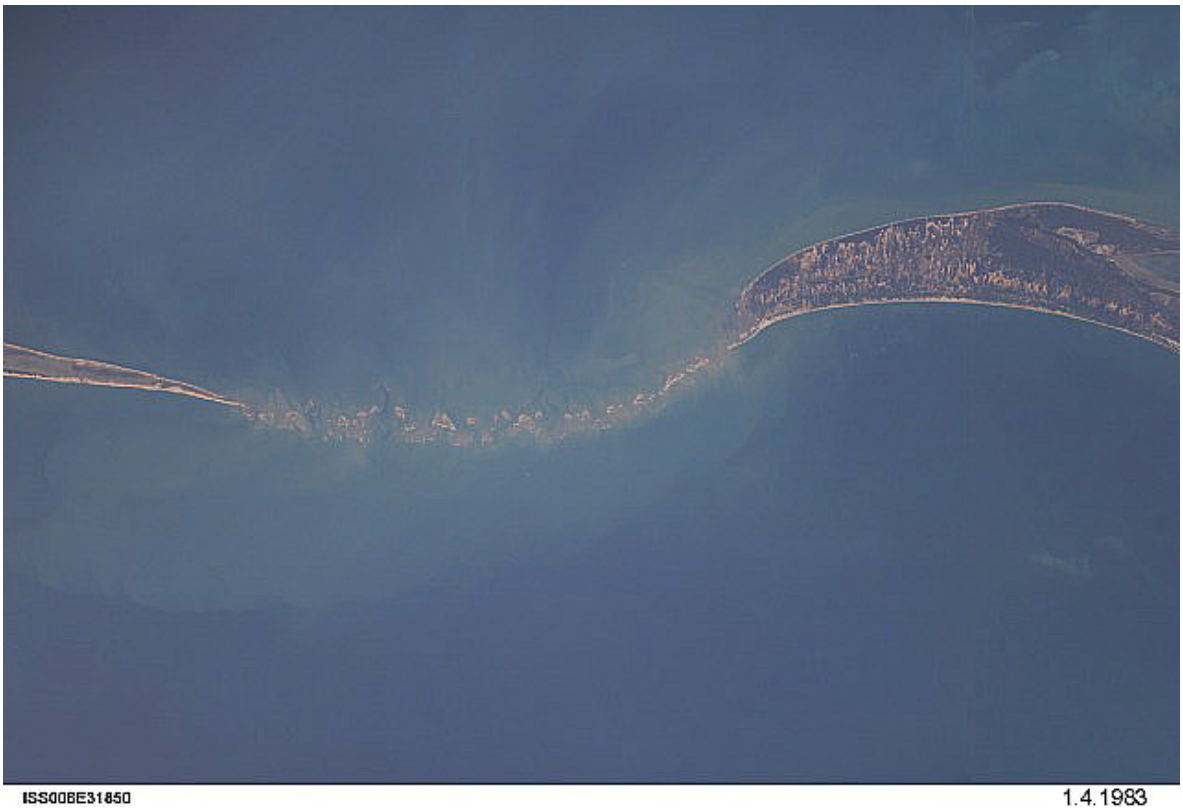
Abbreviations

BCE – Before Common Era
CE – Common Era
ISRO – Indian Space Research Organisation
NASA – National Aeronautics and Space Administration (USA)
NRSA – National Remote Sensing Agency (ISRO)
SSCP – Setusamudram Channel Project

Preface

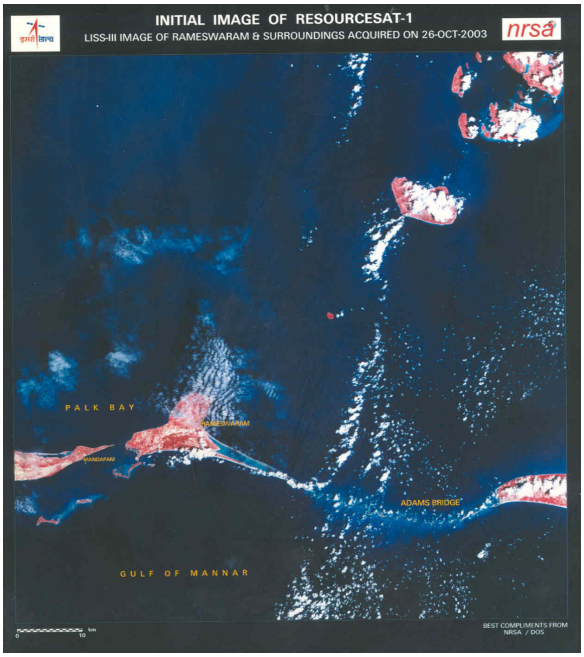


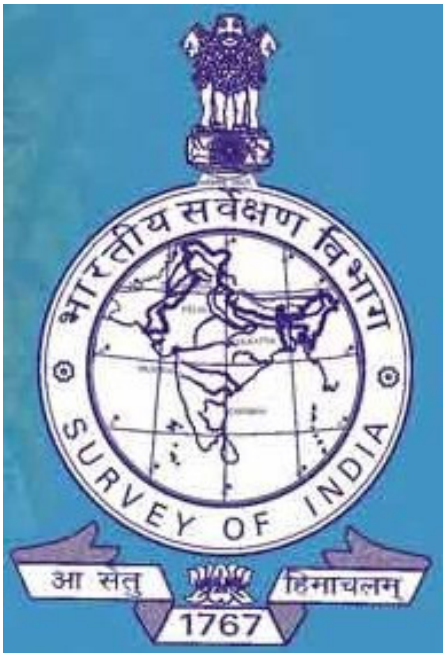
NASA Gemini XI Spacecraft (Sept. 12, 1966 - Sept. 15, 1966); NASA Space Shuttle Mission STS 59 (1994) http://history.nasa.gov/SP-168/section3b.htm Image credits: NASA Johnson Space Center – Earth Sciences and Image Analysis, April 1966 Report of NASA http://history.nasa.gov/SP-168/section3b.htm Exploring space with a camera by NASA "[193] Gemini XI. This photograph from an altitude of 410 miles encompasses all of India, an area of 1250 000 square miles," GEORGE M. LOW, then the Deputy Director, Manned Spacecraft Center, NASA, notes. "Bombay is on the west coast, directly left of the spacecraft's can-shaped antenna New Delhi is just below the horizon near the upper left. Adam's Bridge between India and Ceylon , at the right, is clearly visible. A cloudless region surrounds the entire suBCEontinent. Differences in color, green near the west coast, and brown inland, delineate regions of heavy vegetation and semiarid areas." The picture by NASA is available on the NASA website. http://history.nasa.gov/SP-168/p193a.jpg



Rama Setu as a land-bridge Feb. 23, 2003 International Space Station Expedition 6 (Bridge linking Dhanushkodi and Talaimannar as seen from the Space Station)

Rama Setu as seen on Satellite image (Google Earth, 2 May 2007)





October 26, 2003, ISRO (National Remote Sensing Agency) Resource Satellite 1 http://www.isro.org/pressrelease/ph2.jpg Survey of India logo: Aasetu Himachalam, 1767 http://www.surveyofindia.gov.in/

http://www2.jpl.nasa.gov/srtm/srilanka.htm Shuttle Radar Topography Mission (SRTM) of NASA aboard space shuttle Endeavour launched in February 2000. "Sri Lanka is shaped like a giant teardrop falling from the southern tip of the vast Indian suBCEontinent. It is separated from India by the 50km (31mi) wide Palk Strait, although there is a series of stepping-stone coral islets known as Adam's Bridge that almost form a land bridge between the two countries."

The book is based on the proceedings of the International Seminar on Scientific and Security Aspects of Setusamudram Channel Project (SSCP), held on May 12, 2007 at Chennai. Some articles which appeared in scientific journals have also been reproduced/ excerpted, with permission, to make the presentation comprehensive and provide for a continuity of coverage of multi-dimensional aspects which have been ignored or cursorily dealt with in the project design and implementation.

The deliberations are presented in three sections: 1. Scientific-Economic Aspects; 2. Socio-Cultural Aspects; and 3. Security Aspects. Socio-Cultural aspects are included because the Environmental Impact Manual prepared under the Environmental Protection laws of the land, includes a specific requirement related to an evaluation of cultural aspects related the project area. It is surprising that the only reference in all the reports related to the project is a bland statement that there are no archaeological sites along the project alignment. This is a shocking 'evaluation', to say the least.

SSCP is under implementation since 2 July 2005. What started as a Canal recommended by AR Mudaliar Committee (1956) has been transformed into a Channel Passage in the Indian Ocean (Hindumahasagar) constituting de facto International Waters Boundary in the Historic, internal waters between Bharatam and Srilanka.

It has transpired that, deviating from the previous five alignments considered for a 'canal' across the Gulf of Mannar (since the first alignment proposed by AR Mudaliar Committee in 1956 across Mandapam), the character and scope of the project has been radically altered by the chosen alignment cutting a 300-metre wide, 12 m. deep passage across Ramasetu (Ramarpalam) thus attempting to create and maintain a 'channel passage' in the Indian Ocean. The categorical recommendations of AR Mudaliar Committee Report were as follows: [quote] We are convinced that the Adam's Bridge site is unsuitable for the following reasons: First: The shifting Sandbanks in this area present a far more formidable problem – both at the stage of construction and during maintenance – than the sand dunes on the island site. Secondly: The approaches to a channel would be far too open with no possibility of construction of protective works. A channel at this site – even if it can be made and maintained (which is unlikely) – would entail definite navigational hazard. Thirdly: The channel would be bordering on the Setusamudram Medial Line. In these circumstances we have no doubt, whatever that the junction between the two sea should be effectd by a Canal; and the idea of cutting a passage in the sea through Adam's Bridge should be abandoned. [quote]

The arbitrary, fast-track choice of alignment (which is 34 nautical miles longer than a closeby alignment) has created serious apprehensions among the people world-wide since the Ramasetu is an ancient cultural monument.

The objective of the Seminar is to review and evaluate, with participation by experts, the SSCP scientific, technical and management aspects such as:

- imperative of incorporating tsunami protection measures as integral components of the project
- impact on the livelihoods of coastal people of both Bharatam and Srilanka
- marine resources and preservation of fragile biosphere and national marine parks
- rationale for, pro-s and con-s of alternative alignments considered for the canal and the implications denting the Ramasetu on bio-reserves, thorium/titanium type of heavier minerals for the nation's nuclear programme
- international, maritime and geopolitical dimensions of the proposed passage through the ocean including national security aspects related to the guarding of the sea-lanes
- cultural aspects associated with the project area in general, Ramasetu and associated archaeological/cultural sites, in particular.

Rama Setu had saved the coastline during tsunami; stop Setu Project

Ramar bridge (RamaSetu) had saved the coastline during tsunami 2004.
Breaking the bridge with a 300-meter wide channel passage in the Indian Ocean (Hindumahasagar) will suck the next, impending, tsunami directly into the Bharatam coastline. Devastation will be incalculable, particularly in the coastline of southern Bharatam including Tamilnadu and Kerala.

Scientific and other evidences prove that the Rama Setu is an ancient land-bridge. This is a monument of national and international significance and should be declared as a World Heritage Monument.

See: http://ramasetu.blogspot.com/2007/04/bamiyan-and-setu.html

See the following from among the lists of World Heritage Sites of UNESCO:

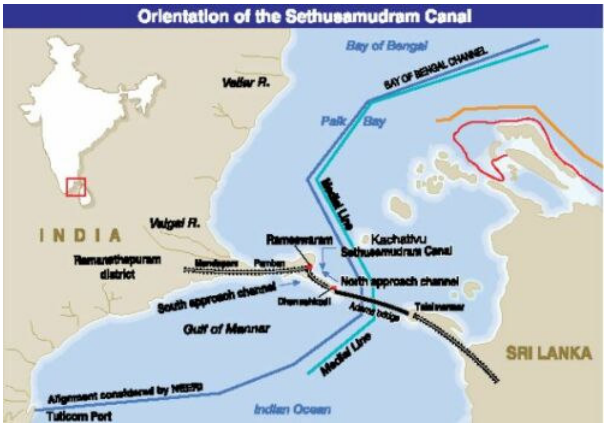
http://whc.unesco.org/en/list/1138 Coiba National Park and its Special Zone of Marine Protection in Panama
http://whc.unesco.org/en/list/653 Tubbataha Reef Marine Park in the Philippines
http://whc.unesco.org/en/list/898 Kvarken Archipelago / High Coast in Sweden/Finland
http://whc.unesco.org/en/list/369 Giant's causeway and Causeway coast in UK
http://whc.unesco.org/en/list/154 Great Barrier Reef in Australia
http://whc.unesco.org/en/list/764 Belize Barrier Reef Reserve System in Belize
http://whc.unesco.org/en/list/80 Mont St. Michel and its bay in France
http://whc.unesco.org/en/list/672 Ha Long Bay in Vietnam
http://whc.unesco.org/en/list/306 Matobo Hills in Zimbabwe

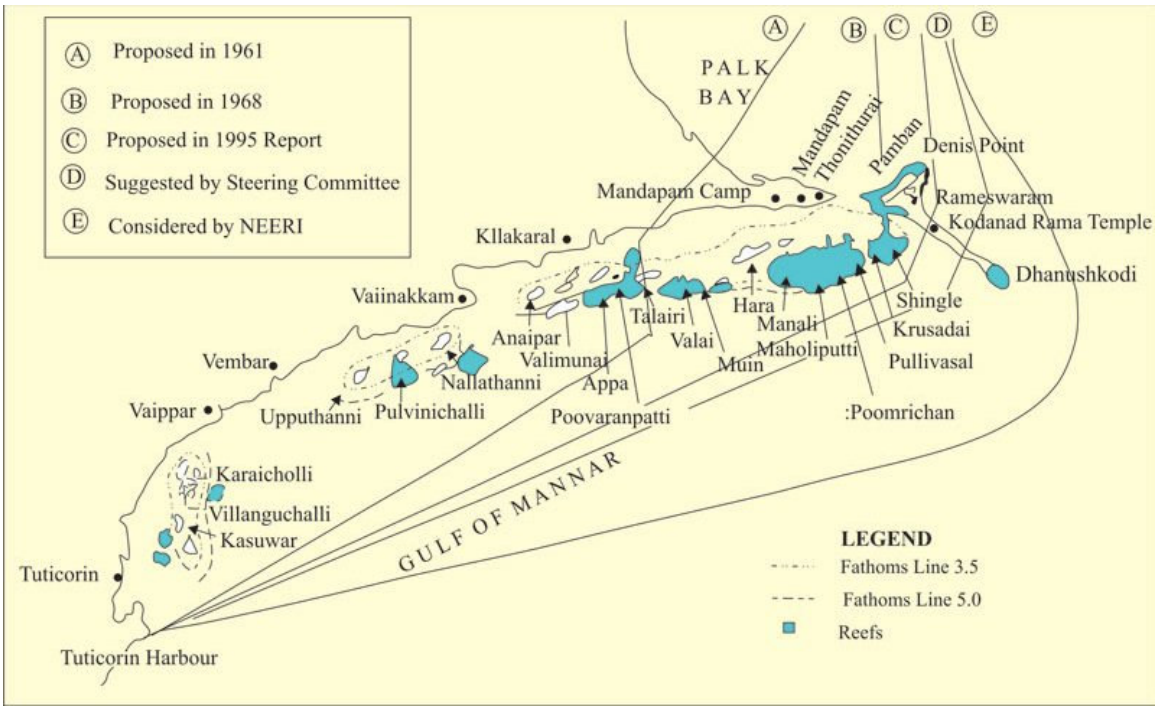
Aren't there good reasons why Rama Setu (or Nala Setu) should be declared as a World Heritage Site? Is it not abhyudayam to cherish and protect ancient monuments? Could anyone support what the Taliban did to the Buddha in Bamiyan? Were the Taliban merely quarrying stone? Surely, there should be some limits to ignominy.

NASA images clearly establish a land bridge between Dhanushkodi island (Rameshwaram side) and Talaimannar island (Srilanka side). This bridge is composed of a series of islands and shoals (sand accumulations created by ocean currents). Thus, the entire bridge right from the sea-bed to the surface sea level is a bridge formation which has been recognized as a land bridge linking the two regions: Bharatam and Srilanka. To what extent there was manual intervention in connecting the gaps between the shoals and islands during the pre-historic periods as detailed in the ancient texts such as Ramayanam is a matter for detailed marine archaeological and geological evaluation. The reports of submergence of Kumarikandam,

Poompuhar, Dwaraka along the coastline and the formation of the Gulf of Khamba about 10000 years ago (confirmed by scientists of National Institute of Ocean Technology) point to the possibility that the recent historical record of submergence of Dhanushkodi island should provide for a pause and re-evaluation of the impact of the ocean currents and changes in sea-level on the coastline and also on the SSCP. Such a multi-disciplinary archaeological-geological-aquatic environment study should be undertaken respecting the sentiments of the people who has looked upon the bridge as a land-link between Bharatam and Srilanka. The fact that India is described in Government logo as Aasetu himachala paryantam, the fact that the project itself is called Setusamudram canal project (Setu means bridge), confirms the tradition related to the bridge. Hurting the sentiments of the people who revere Sri Rama as a divinity and personification of dharma will be a serious breach of trust and utter disdain for peoples' sentiments. In fact, the SSCP should be reconsidered and the pros-and-cons of reactivating the land bridge between Srilanka and Bharatam should be considered afresh. A bridge may be more beneficial for both countries than a canal. The canal has limited draught and will NOT provide for the movement of large-sized tankers of the carrying capacity of, say, 2 million tones of fuel oils from the Persian Gulf region. The canal may have only a limited use for very small naval vessels. The impact on coast guard to secure the sea-lanes has also to be evaluated. The most serious concern is that this is an experimental project for constructing a canal within the ocean, and will be unprecedented in the history of navigation. Should Bharatam undertake such a high risk project with questionable value to both Bharatam and Srilanka. The authorities should set up a high-level, multi-disciplinary panel including representatives from the people of the region to re-evaluate the project, remembering that the British regime chose NOT to construct this project and instead used the railways to carry bulk commodities from the coal and iron-ore belts to the coastal cities like Chennai, Mumbai and Tuticorin. Even the Tuticorin port projects will get their sulphur-free-coal imported from Australia and the canal will not carry naval vessels carrying such imports and certainly not the fuels imported from the Gulf region.

SSCP channel passage seeks to cut through this bridge. The sudden choice of the medial line as the channel in preference to five alignments recommended earlier is a matter for serious concern, causing apprehensions about the disregard for due process in designing a project of this importance seeking to link west and east coasts of Bharatam through a canal ship-route.





Plan showing various alignments of the Setusamundram Canal and the groups of islands (marine parks) in the Gulf of Mannar (reproduced from NEERI Report, 2004).

NEERI introduced a new alignment which changed the entire nature of the project.

What has been considered as a canal (comparable to Suez or Panama as land-based and hence, controllable canal) since AL Mudaliar Committee Report of 1956, has been transformed by NEERI in 2004 into a passage in the mid-ocean, cutting across the Adam's Bridge. All the previous 5 alignments reviewed in detail DID NOT cut across the Adam's Bridge.

NEERI has failed to take note of the serious consequences noted by Mudaliar Committee (Para 16) of any channel passage through Adam's Bridge.

NEERI has failed to take note of the cultural significance of the Adam's Bridge. It is considered as Setu Teerth (clearly mentioned in the Kurma Purana) and adored in the nation's ancient tradition.

Rama Setu (also called Adam's Bridge) has always been considered a bridge or causeway in ALL previous texts, in ancient texts, in epigraphs, in travelogues, in government documents since the days of the British rule.

There has been NO due diligence before suggesting an alternative sixth alignment which seeks to create a passage in the mid-ocean.

Environment Impact Assessment Manual (Jan. 2001) of Dept. of Forests and Environments stipulates: "Assessment of impact on significant historical, cultural and archaeological sites/places in the area."

No discussion on this topic is found in the NEERI and other reports related to the project.

Respondents' (Union of India) Counter No. 11 states:

"EIA study revealed that in view of the environmental sensitivity along the coastal stretch of Gulf of Mannar harbouring the Marine National Pazrk, an alignment keeping a minimum distance of 6 to 8 kms from Van-Tiu Island in Tuticorin and more than 20 kms from Shingle Island in Adam's Bridge approach area is the most suitable. This alignment at a distance of 4 kms. From the Medial Line at Adam's Bridge and about 3 kms. at other places."

This statement directly runs counter to the arguments advanced in AL Mudaliar Committee (1956) report whose observations related to Adam's Bridge have been scrupulously observed by the various Committees which proposed and recommended alternative alignments, all of which DID NOT pass through the Adam's Bridge. Neither the EIA report, nor the project feasibility reports discuss why the serious objections raised by AL Mudaliar Committee Report were NOT discussed and were NOT answered.

Issues highlighted in this publication, calling for an urgent review and re-evaluation of SSCP are:

Issue 1 The choice of a channel alignment for Setusamudram Channel Project (SSCP) should be done only after a detailed multi-disciplinary evaluation of the impact of tsunami of the type which struck the coastline of Bharatam on Dec. 26, 2004. RamSetu in fact saved the coastline of Bharatam reducing the impact of the last tsunami. If the work is continued on the present alignment is continued, an enormous energy of the next tsunami will be absorbed through this channel and result in the destruction of Kerala and significant parts of Tamilnadu coastline.

> On 8 March 2005, Prime Minister's Office raised 16 objections including the observations of the world-renowned tsunami expert, Prof. Tad S. Murthy of Canada who has been enaged as an expert by the Govt. of Inda to set up a tsunami-warning system in the country. Prof. Murthy is firmly of the opinion that this present alignment will destroy Kerala and most of the coastline of southern Bharatam. These concerns and the impact of a tsunami should be subjected to detailed, multi-disciplinary evaluation before work on a channel is resumed using any one of the other five alternative channels available (including the one recommended by GOI steering committee 1996) which will NOT involve destruction of RamaSetu.

Issue 2 The creation of an artificial boundary between Srilanka and India in the Indian Ocean will adversely impact the livelihood of coastal people, particularly the fishing community, who will be prevented from crossing the channel boundary.

Issue 3 There is also the issue of thorium and other rich mineral deposits close to the RamSetu in Kerala thorium sands. The entire region should be subjected to geological exploration to utilize these mineral resources which will have a profound impact on the country's nuclear program according to the website of Bhabha Atomic Research Centre.

Issue 4 Declaration of Rama Setu as a Protected Monument of national importance. The proposed channel alignment involving the destruction of Ram Setu, hurts the sentiments of millions of people who look upon Ram Setu as Setumandir, a pilgrimage site, a sacred monument, a temple. This age-old Setubandhan, this age-old temple, should be declared as a World Heritage Site, citing textual, epigraphic and scientific evidences of Dept. of Earth Sciences (March 2007) pointing to ancient human activity.

We hope that the issues evidenced scientifically in this publication and the seminar deliberations, will provide a framework for further deliberations and to ensure that no damage is caused to Rama Setu. A Parliamentary Committee should be constituted to re-evaluate the project and to re-align the Canal, as a land-based canal and NOT as a mid-ocean channel passage and to ensure incorporation of adequate tsunami protection measures.

We gratefully acknowledge the contributions made by the following scientists and scholars in making the conduct of the seminar and this publication possible:

Dr. Shikaripura Ranganatha Rao, who inaugurated the seminar, has served the Archaeological Survey of India in various capacities. Dr. Rao has led excavations of many important sites such as Rangpur, Amreli, Bhagatrav, Dwaraka, Hanur, Aihole, Kaveripattinam and others. He is the founder of the Society of Marine Archaeology in India.

Dr. Badrinarayanan, who served with distinction as Geologist in Geological Survey of India was a consultant to National Institute of Ocean Technology.

Captain Hariharan Balakrishnan Retired naval officer with distinguished service in the Indian Navy; is an alumni of National Defence Academy, Khadakvasala and Defence Services Staff College, Wellington; he is an anti-submarine warfare specialist from the former USSR Naval War College, St. Petersburg and has commanded various naval ships during his service including the guided missile frigate,INS Trishul.

Prof. C S P Iyer, Exec. Director, Centre for Marine Analytical Reference and Standards, Regional Research Laboratory, Trivandrum; Senior Scientist, Kerala State Council for Science, Technology and Environment.

S. Kalyanaraman, Ph.D., Director, Sarasvati Research Centre, Former Sr. Executive, Asian Development Bank, Author of 8 volume encyclopaedic work on Sarasvati Civilization, rediscovery and revival of River Sarasvati and involved in the promotion of National Water Grid

Shri D. Kuppuramu, Advocate, Director, Pandyan Grama Bank, State Project Coordinator, Tsunami Relief and Rehabilitation Works, Seva Bharathi Tamilnadu (NGO), State President, Tamilnadu Bharathiya Meenavar Sangam, Ramanathapuram

*Prof. Tad S Murthy, Ottawa. Vice-President, The Tsunami Society, Member, Editorial Board, The International Journal of the Tsunami Society, expert engaged by Govt. of India, Ministry of Science and Technology, to set up a tsunami warning system.

Prof. Madhav Das Nalapat holds the UNESCO Peace Chair and is a professor of geopolitics at the Manipal Academy of Higher Education; one-time resident editor of the *Times of India*

Justice Parvatha Rao, Retd. Judge, Andhra Pradesh High Court.

Shri TV Rengarajan, South India Organizing Secretary, Akhila Bharatiya Itihasa Sankalana Yojana. Retired Principal, Junior College, Coimbatore. Scholar of Tamil and Sanskrit language traditions.

Shri T. Satyamurthy, Former Director of Archaeology, Govt. of Kerala, Senior Superintendent (Retd.), Archaeological Survey of India who has served in ASI in various capacities.

Shri V. Sundaram, IAS (Retd.), Associate Editor, News Today, was the first chairman of Tuticorin Port Trust. He was the one who completed the work on coal jetty, oil jetty and other facilities in connection with the commissioning of Tuticorin Harbour Project. He became its chief on 1April 1979.

* Since Prof. Tad S. Murty will be in Alaska all of May participating with a team on the Pacific tsunami warning system computer modeling and is engaged in editing a manual on storm surges on the globe from tropical and extra-tropical cyclones, he has sent his good wishes for a productive and successful seminar.

We gratefully acknowledge the support and encouragement provided by thousands of people, too many to be named individually and who have given us the strength to launch and carry

forward the Movement with the blessings of Sri Rama, who according to Valmiki, is **vigrahavaan dharmah** (embodiment of dharma).

Rama Setu: an intersection of tradition and progress

This is a historic moment in our history.

This is historic because the word 'setu' evokes immediately a sacred social memory of Sri Rama, under whose command the bridge was built. This tradition is a world wide tradition, a sacred memory in particular in the Indian Ocean Rim states populated by over 2 billion people. The memory of Sri Rama is immortal and will survive this and future generations.

Sri Rama was a person who was divine. Our tradition says that he is divine incarnate. The events and places associated with this social memory related to Sri Rama are indelible and are integral parts of our lives and the lives of future generations. It is our responsibility, our dharma to protect, preserve and cherish a monument associated with Sri Rama at the intersection of land and ocean, at the intersection of civilization and progress.

We are in favour of the Setusamudram channel project which seeks to provide an alternative sea-lane between Tuticorin and other ports of the world. We are gathered here to deliberate on this historic project from a geopolitical perspective and a civilizational perspective. Both perspectives are intertwined in a project which has the potential to create history.

In bharatiya tradition, spiritual and secular intersect. What is setubandha for one is Rama Setu for another. Brige it is, linking abhyudayam and nihs'reyas. Both abhyudayam and nihs'reyas are two sides of dharma which is sanaatana, esha dhammo sanantano.

Bauddham in Lankavatara Sutra tradition notes that the Buddha walked across the bridge to reach Adam's Peak what was called Vishnupaadam. In muslim and Christian traditions, Adam after banishment from heaven reportedly walked across the bridge to reach Adam's Peak, what was called Vishnupaadam. Let us call it Rama Setu because the setu is enshrined in sculptures in Java, Indonesia in the Parambanan temple (Brahmavana).

References to Dharba sayanam where sri rAmA does a saranAgathy to samudra-rAjan to grant him permisson to cross the sea.

SlokA 52,53,54
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52 : prathisayana bhumikA bhooshitha payOdhi puLina ! Jaya ! Jaya !

Hail to Thee O Raghuveera , who beautified the assembly of sands of the beach (at ThirupullANi) through your lying down on them in a bed of sacred grass in observance of Your PraayOpvesam ! Hail to Thee !
****

53: praLaya sikhi parusha visika sikhA soshitAkupAra vAripura ! Jaya ! Jaya !

(Meaning) : Hail to You , O Raghuveera , who evaporated the waters of the ocean with the power of your arrows that resembled the fire which destroys the world at the time of deluge !
****
54 : prabhala ripu kalaha kuthuka chatula kapikula karatala toolitha Hrutha giri nikara sAdhita
sethupatha seemA semanthitha samudhra ! Jaya ! Jaya !

(meaning) :O mighty hero of the scion of Raghus, who created the demarcation of the ocean with your bridge built by the mighty monkeys,who out of their eagerness to reach LankhA to fight their enemies splintered huge mountains and threw them into the ocean as though they were feathery bales of cotton ! Hail to Thee! Hail to Thee ! (Source: Swami Desikan's Raghu veraa Gadhyam (aka) Sri mahAveera Vaibhavam.)

Periya thirumozhi of Thiru Mangai azhwar (Parakala Naayaki) 9.4.5 about dharbas'ayanam/ thirupullani a divya desam 15 kms from Rameshwaram

Listen to the audio.

"PullaaNi Emperumaan poi kettirunde_ne_.. " (I have only heard now of His lies..!) All my relatives come and tell me.."You should have listened to us. You listened to Him. We spoke truth; He has become a liar. ". "Okay. I will now listen to you all. But, only after getting my heart back that had gone behind Him." says Parakala Nayaki. (vallaaLan pin pOna nenjam varumaLavum..) Though all of them talk about me, I am still trusting that "Great liar (of ThirupullaaNi Emperumaan's)'s words and am living with a (faint?) hope.

Thirumaalai by Thondar Adi Podi Azhwar also refers to emperumaan at the Setu.

This social, civilization memory is eternal and will continue to guide us as we embark on projects for abhyudayam. Abhyudayam does not have to be at the expense of cherishing sacred tradition. The bhakti movement of Azhwar like Thiru Mangai Azhwar and Thondar Adi Podi Azhwar will continue to be an inspiration for the youngest nation in the world with over 70% of the population being less than 35 years of age.

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Realign Setusamudram Channel

Aspects of National sovereignty, security and livelihood of coastal people

Download from: http://rapidshare.com/files/26279488/pressmeet17april2007.ppt.html

S. Kalyanaraman, Ph.D.,
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Former Sr. Exec., Asian Development Bank,
kalyan97@gmail.com 17 April 2007

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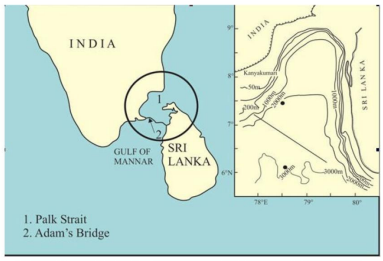

Location map. Inset: bathymetry map of the Gulf of Mannar (reproduced from Murty et al., 1994)

http://www.Setusamudram.in/htmdocs/Articles/cp_rajendran_2.htm

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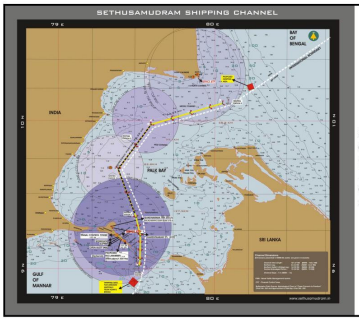


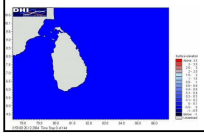
Setusamudram Channel Passage – current alignment

3

4

Computer simulation: Ram Sethu saved coastline from tsunami on Dec. 26, 2004

1. Evidences for Rama Setu
2. Preparedness for next tsunami
3. Impact on coastal life and national sovereignty



Sir AR Mudaliar Committee Report 1956: Choose canal, NOT mid-ocean channel passage

We are convinced that the Adam's Bridge site is unsuitable for the following reasons:

- **Shifting Sandbanks in this area present a far more formidable problem – both at the stage of construction and during maintenance – than the sand dunes on the island site.**
- **Approaches to a channel would be far too open with no possibility of construction of protective works. A channel at this site – even if it can be made and maintained (which is unlikely) – would entail definite navigational hazard.**
- **Channel would be bordering on the Sethusamudram Medial Line.**

In these circumstances we have no doubt, whatever that the junction between the two sea should be effected by a Canal; and the idea of cutting a passage in the sea through Adam's Bridge should be abandoned.

6

1

Consequences of Sethusamudram Channel

- Bharatam's sovereignty and integrity undermined by declaring these as international waters under US pressure
- Tsunami assessment was not done
  - Removal of the proven Tsunami protector in Rama Sethu
  - Opens up serious potential damage of entire Kerala and Tamilnadu coast when next tsunami hits (per T.Murthy, leading Tsunami expert and advisor to GOI)
  - Thorium deposits in Kerala (Aluva, Chavara), Tamilnadu (Manavalakurichi) that support nuclear power source for India will be desiccated
  - Tsunami protection measures NOT incorporated in the project
- Ancient heritage monument with attested evidences (textual and scientific); Damage to Rama Setu a violation of Ancient Monuments and Archaeological Sites and Remains Act, 1958 (A monument which has remained in existence for over 100 years)

Dhanushkodi to Talaimannar

Pamban cantilever bridge

NASA image: Adam's bridge

Suggestio falsi, suppressio veri: Ambika Soni

New Delhi, Mar 06, 2007: Government on Tuesday said there are no archaeological studies that reveal the existence of a Ram Setu bridge between India and Sri Lanka. However, a NASA satellite picture has shown the existence of a stretch of land bridge in the Palk Strait between the countries, Minister of Tourism and Culture Ambika Soni said in a written reply to the Rajya Sabha today. She informed the house that as there are no archaeological studies to confirm the fact, the government was not planning to take any preservation initiative in this direction. ttp://zeenews.com/articles.asp?aid=358346&sid=NAT

9

Evidence from NASA websites

A news report date-lined Rameswaram, 15 April 2007 in the New Indian Express (page 7) noted "... Baalu said the government and the Sethusamudram project officials had written to NASA on the Adam's Bridge, but there has been no reply from NASA."

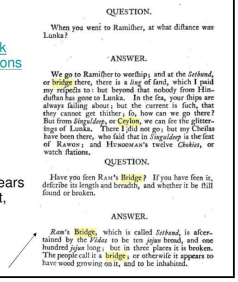
Item 1: February 2000 Report of NASA http://www2.jpl.nasa.gov/srtm/srilanka.htm Shuttle Radar Topography Mission (SRTM) of NASA aboard space shuttle Endeavour launched in February 2000. "Sri Lanka is shaped like a giant teardrop falling from the southern tip of the vast Indian subcontinent. It is separated from India by the 50km (31mi) wide Palk Strait, although there is a series of stepping-stone coral islets known as Adam's Bridge that almost form a land bridge between the two countries."

Item 2: April 1966 Report of NASA http://history.nasa.gov/SP-168/section3b.htm Exploring space with a camera by NASA "[193] Gemini XI. This photograph from an altitude of 410 miles encompasses all of India, an area of 1250 000 square miles," GEORGE M. LOW, then the Deputy Director, Manned Spacecraft Center, NASA, notes. "Bombay is on the west coast, directly left of the spacecraft's can-shaped antenna New Delhi is just below the horizon near the upper left. Adam's Bridge between India and Ceylon , at the right, is clearly visible. A cloudless region surrounds the entire subcontinent. Differences in color, green near the west coast, and brown inland, delineate regions of heavy vegetation and semiarid areas." The picture by NASA is available on the NASA website. http://history.nasa.gov/SP-168/p193a.jpg

11

Research report

Asiatic Society, 1799, Asiatick Researches: Or, Transactions of the Society Instituted in Bengal, P. 52 refers to the bridge called Setband (alt. spelling, setuband like Allahband; setu-bandha), broken in 3 places. It also notes "The people call it a bridge; or otherwise it appears to have wood growing on it, and to be inhabited."



QUESTION.

When you went to Ramiher, at what diſtance was Lunka?

ANSWER.

We go to Ramiher to worſhip, and at the *Setband*, or bridge there, there is a *leag* of land, which I paid my reſpects to: but beyond that nobody from Hindoſtan has gone to Lanka. In the ſea, your ſhips are always ſailing about; but the current is ſuch, that they cannot get thither; ſo, how can we go there? But from *Singuldeep*, or Ceylon, we can ſee the glitterings of Lunka. There I did not go; but my Chellas have been there, who ſaid that in *Singuldeep* is the ſeat of RAWON; and HUNOOMAN's twelve *Chobies*, or watch ſtations.

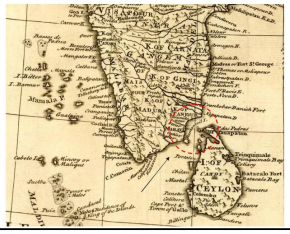
QUESTION.

Have you ſeen RAM's Bridge? If you have ſeen it, deſcribe its length and breadth, and whether it be ſtill found or broken.

ANSWER.

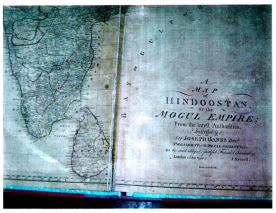
Ram's Bridge, which is called *Setband*, is aſcertained by the *Vidas* to be ten *jojun* broad, and one hundred *jojun* long; but in three places it is broken. The people call it a bridge; or otherwiſe it appears to have wood growing on it, and to be inhabited.

Malabar Bowen map (1747) drawn by Netherlands shows Ramarcoil I (that is, Rama temple).



12

Map drawn by Joseph Parks, Australian Botanical explorer (1788) shows Ramar Bridge (Map in Sarasvati Mahal Lib., Thanjavur)



Map of 1804, by James Rennel, First Surveyor General of India, renamed Ramar Bridge as Adam's bridge

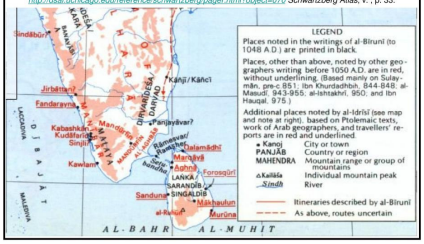
13

Religious and cultural sites, 8th-12th centuries

http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=071 *Schwartzberg Atlas*, p. 34.

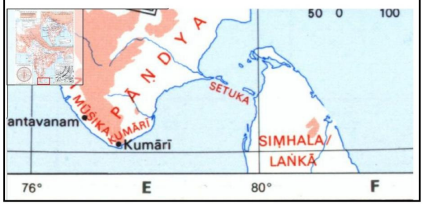
Islamic expansion and changing Western views of South Asia, 7th-12th centuries

http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=070 *Schwartzberg Atlas*, v. , p. 33.



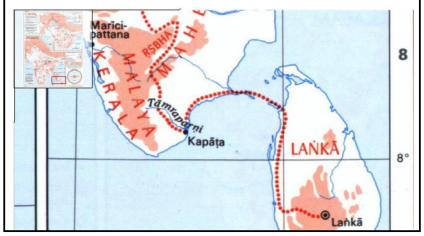
Puranic India (Bharata)

http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=064 *Schwartzberg Atlas*, v. , p. 27.



India of the Vedas and the Epics

http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=050 *Schwartzberg Atlas*, v. , p. 13.



Madras Presidency Administration Report, 1903 and a Travelogue, 1744 refer to the bridge

Glossary entry: Adam. …"Called the bridge of Rama… It really joined Ceylon to India until 1480, when a breach was made through rocks during a storm. A subsequent storm enlarged this and foot traffic then ceased…Partly above and partly below water; but when covered has now here above three or four feet of water…"

Source: **Manual of the Administration of the Madras Presidency** (C.D. Maclean (1930). New Delhi, AES, 3 Vols. - 2440 p.. **Contents: Vol. 1:** Chapters 1-9 Containing: The Principal Articles of the Manual Arranged so as to Conform to the Order of Subjects in the Yearly Presidency Administration Report. **Vol. 2:** Appendices Containing: Articles and Statements, Supplementary of the Articles in Vol. 1 Arranged Under General Heads. **Vol. 3:** Glossary of the Madras Presidency: A Classification of Terminology, a Gazetteer and Economic Dictionary of the Province and Other Information, the Whole Arranged Alphabetically and Indexed.

Travelogue

A book by Alexander Hamilton, 1744, *A New Account of the East Indies*: Giving an Exact and Copious Description of the Situation, P. 338 describes his **visit to 'zeloan'** (alt. spelling for Ceylon) **by walking on the bridge.**

18

Setu in texts (The word 'setu' in Tamil, Sanskrit and almost all bharatiya languages means 'bridge')

- Valmiki describes the construction of Sethu in detai (85 shlokas).

hastimaatraan mahaakaayaaH paaSaaNaamshca mahaabalaaH parvataamshca samutpaaTya yantraiH parivahanti *ca Valmiki Ramayana* 2-22-58
Vaanara having huge bodies, with mighty strength uprooted elephant-sized rocks and mountains and transported them by mechanical contrivances (yantraih).

- Vedavyasa refers to Nalasetu

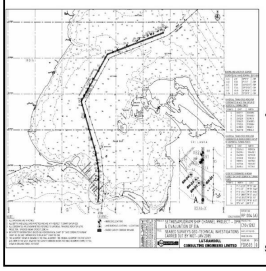
nalasetur iti khyāto yo 'dyāpi **prathito bhuvi** rāmasyājñāṃ puraskṛtya dhāryate girisaṃnibhaḥ *MBh.* 3.267.45
.... which even today, popular on earth as Nala's bridge, mountain-like, is sustained out of respect for [Lord] Rama's command. (Nala was son of Vis'wakarma) Kalidasa's Raghuvams'a (sarga 13): Rama, while returning from SriLanka in pushpaka vimaana: "Behold, Sita, My Sethu of mountains dividing this frothy ocean is like the milky way dividing the sky into two parts"

Kaavya in Prakrit by King Pravarasena II (550-600 CE) called "Setu bandha or Ravanavaho."; "Dasamuha Vadha" (Setubandha Kavya) by the King Damodara Sen (5th Century).

- Skanda Purana (III.1.2.1-114), Vishnu Purana (IV.4.40-49), Agni Purana (V-XI), Brahma Purana (138.1-40) refer to the **construction of Rama Setu**. Skanda Purana (VI.101.1-44) describes the installation of threee Shiva linga at the end, middle and beginning of Rama Setu and **making the same bridge submerged and thereby creating Setu-Teerth**. This is also related in Kurma Purana (21.10-61). Garuda Purana (1.81.1-22) lists sacred places including Setubandh and Rameswar. Narada Purana (Uttara Bhag 76.1-20) extols the greatness of Rama-Setu.

19

Bore-hole locations



Geomorphology

- Consequences of dredging and opening of Rama Setu: Likely destruction of fragile coral islands by sediments and turbulent tides of Bay of Bengal entering the tranquil Gulf of Mannar
- Alternatives: Realign canal towards Pamban; like Panama Canal, locks could be provided both in the Palk bay side and Gulf of Mannar side so that such calamities could be prevented.

Source: Dr. S. Badrinarayanan

20

Geological, archaeological evidence: Dept. of Earth Sciences (March 2007)

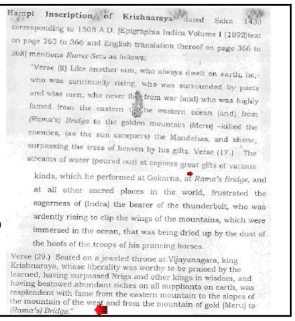
Since the calcareous sand stones and Corals are less dense than normal hard rock and quite compact, probably these were used by the ancients to form a connecting link to Sri Lanka, on the higher elevations of the Adams bridge ridge and this is analogous to modern day causeway.

- Around Rameswaram, there are raised Teri formations that supported a rich assemblage of mesolithic – microlithic tools indicating the presence of strong human habitation and activity in these areas as early as 8000 to 9000 years B.P and as recent as 4000 years B.P. On Sri Lanka side there are indications of human habitation extending to late Pleistocene (about 13,000 B.P) based on bone and fossils of human and animal form.
- All these point to a flourishing human activity on both sides of Adams Bridge and probably when the sea levels were just right the link between India and Sri Lanka could have been established.

21

Setu in Epigraphs

Hampi inscription of Krishnaraya Saka 1430 (1508 CE) in Epigraphica Indica refers to Rama Setu



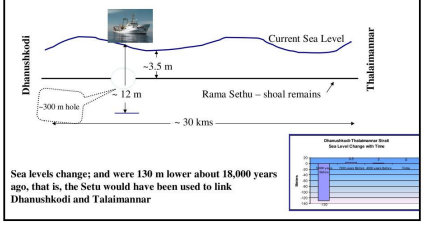
Hampi Inscription of Krishnaraya dated Saka 1430 corresponding to 1508 A.D. [Epigraphia Indica Volume I (1892)text on page 363 to 366 and English translation thereof on page 366 to 368] mentions *Rama-Setu* as follows:

"Verse (8) Like another sun, who always dwelt on earth, he, who was continually rising, who was surrounded by poets and wise men, who never fled from war (and) who was highly famed from the eastern [to the western, ocean (and) from *(Rama's) Bridge* to the golden mountain (Meru) -killed the enemies, (as the sun conquers) the Maidebas, and shone, surpassing the trees of heaven by his gifts. Verse (17.) The streams of water (poured out) at copious great gifts of various kinds, which he performed at Gokarna, at *Rama's Bridge*, and at all other sacred places in the world, frustrated the eagerness of [Indra] the bearer of the thunderbolt, who was ardently rising to clip the wings of the mountains, which were immersed in the ocean, that was being dried up by the dust of the hoofs of the troops of his prancing horses.

Verse (29.) Seated on a jewelled throne at Vijayanagara, king Krishnaraya, whose liberality was worthy to be praised by the learned, having surpassed Nriga and other kings in wisdom, and having bestowed abundant riches on all suppliants on earth, was resplendent with fame from the eastern mountain to the slopes of the mountain of the west and from the mountain of gold (Meru) to *[Rama's] Bridge*."

New Shipping Canal route damages Rama Setu

Status: 12 April 2007: About 1.4 % dredging done in the Rama Sethu area (35.05 kms.)



Sea levels change; and were 130 m lower about 18,000 years ago, that is, the Setu would have been used to link Dhanushkodi and Talaimannar

Impact on the livelihood of coastal people

U. Arulanandam, President, Singaravelar Fishermen's Forum : the project is being implemented to enforce the international boundary line in the waters.

Once the canal is a reality, it will become an unofficial boundary line on the sea between India and Sri Lanka.

The channell would seal fishermen's entry into Srilanka waters where fish thrive.

http://www.hinduonnet.com/fline/fl2201/stories/20050114005902400.htm

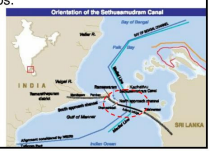
24

From ancient times, the Gulf of Mannar, Palk Bay have been treated as Historic Waters (Internal Waters of Bharatam-Srilanka).

An arbitrary international boundary has been drawn and called the Sethusamudram Canal without any evaluation and without studying the impact of tsunami of Dec. 26, 2004.

US Navy Operational Directive of 23 June 2005 refused recognition of the Historic Waters claim. USA asserted its authority by sending its naval ships.

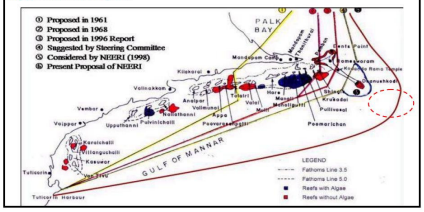
- Geopolitics:
  USA : Diego garcia, Trincomalee, Straits of Malacca
  China: Gwadar, Haumtota, Sitwe



Serious consequences of Route 6, suddenly chosen

Route 6, cutting through Rama Setu, ignores other expert committee-recommended options

http://sethusamudram.gov.i n



8,500 year-old S'ankha industry, Gulf of Mannar

Seven shell bangles from burial of an elderly woman, Harappa; worn on the left arm; three on the upper arm and four on the forearm; 6.3 X 5.7 cm to 8x9 cm marine shell, *Turbinella pyrum* (After Fig. 7.43, Kenoyer, 1998) Harappa museum. H87-635 to 637; 676 to 679.

Wide bangle made from a single conch shell and carved with a chevron motif, Harappa; marine shell, *Turbinella pyrum* (After Fig. 7.44, Kenoyer, 1998) National Museum, Karachi. 54.3554, HM 13828.

27

Fast track Sethusamudram Channel Project (SSCP):

1. US Navy operational directive, 23 June 2005:
2. Chairman TCPT replies to PMO 30 June 2005 ;
3. Inauguration of SSCP 2 July 2005.

- Waters of Palk Bay between coast and boundary with Sri Lanka claimed as internal waters; waters of Gulf of Mannar between coast and maritime boundary claimed as historic waters.

  This claim is not recognized by the United States. U.S. conducted operational assertions in 1993 and 1994, to Gulf of Mannar claim in 1999. (jiska laat uski bhains or tadi eduttavan tandal kaaran) Aug 76 Act No. 80 Enables government to declare waters as historic. Jun 79 Law No. 41

- United Nations Conference on the Law of the Sea (1958), Convnention of the Territorial Sea and Contiguous Zone recognizes HISTORIC Waters
- Agreement between Sri Lanka and India on the Maritime Boundary between the two Countries in the Gulf of Mannar and the Bay of Bengal and Related Matters 23 March 1976 on Historic waters

28

Importance of Thorium for Bharat

- From BARC website: Thorium deposits - ~ 3,60,000 tonnes
- The currently known Indian thorium reserves amount to 358,000 GWe-yr of electrical energy and can easily meet the energy requirements during the next century and beyond.
- India's vast thorium deposits permit design and operation of U-233 fuelled breeder reactors.
- These U-233/Th-232 based breeder reactors are under development and would serve as the mainstay of the final thorium utilization stage of the Indian nuclear programme.

29

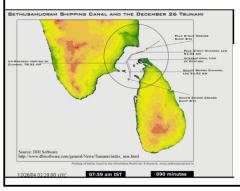
http://www.barc.ernet.in/webpages/about/ssn1.html

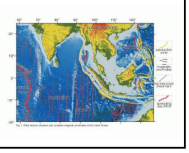
Thorium/titanium placer deposits due to churning action of ocean currents

30

Next tsunami through channel route will destroy Kerala and Tamilnadu coastline: tsunami energy will funnel through as Ram Setu barrier is dented. This serious consequence should be evaluated by a multi-disciplinary team as recommended by Rameswaram Judge.

Be prepared for a probable next tsunami. Geoscientific investigations on the active convergence zone between the east Eurasian and Indo-Australian Plates along Indonesia (GINCO I) FSSONNE cruise SO-137 Fault-lines and earthquake zones
http://www.bgr.de/b322/grafik/ginco_fig1_k.png





Tsunami effect: 2,60,000 lives lost

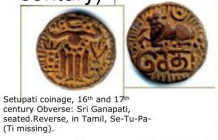
Destruction of Aceh island, damage in beaches north of Chennai and Nagapattinam
Sea-bed has risen by about 200 m.
2/3 of the aquatic life and corals devastated in the Biosphere Reserve/Marine National Parks

Prof. Tad S. Murthy's views

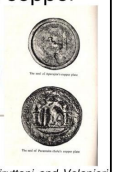
- Prof. Tad S Murthy is a tsunami expert who advised Govt. of India on tsunami warning system and edited Tsunami journal for over 20 years
- Prof. Tad S Murthy's objections were cited in PMO's letter of Jan. 2005
- He said: **Change the mouth of the alignment (Bay of Bengal) norwestwards to avoid destruction of Kerala by next tsunami**
- "The Sethusamudram canal has many characteristics similar to the Alberni canal, and this is the reason I am concerned. In the March 28, 1964, Alaska earthquake tsunami, outside of Alaska the largest tsunami amplitude was at the head of the Alberni canal well inland and not at the open coast as everyone expected. Later, I explained this was due to (a phenomenon known as) quarter wave resonance amplification," Murty explained."
- From Personal Communication, Feb. 2007: "I requested him (Raghupathy) to consider slightly re-orienting the entrance of the Sethu canal on the Bay of Bengal side, so that in future tsunami events, tsunami energy will not be preferentially funnelled into the Sethu canal. Shri Raghupathy assured me that he will look into this matter. When a senior IAS officer like Shri Raghupathy says something, I beleive him and I have no further concerns on this matter."
- http://www.elaw.in/issue/sethu.htm

- Incorporate Tsunami protection measures; tsunami protection wall, Japan
- Save the livelihood of coastal people who safeguard the coral and algae reefs
- Preserve the status of Historic Waters
- S'ankha (turbinella pyrum), like Sri Rama is an abiding metaphor of Bharatiya Civilization

Ancient Setu coins of Jaffna, 13th century and Parantaka Chola copper plate (10th century)



Setupati coinage, 16th and 17th century Obverse: Sri Ganapati, seated.Reverse, in Tamil, Se-Tu-Pa- (Ti missing).



(Nagaswamy R. 1979. *Thiruttani and Velanjeri Copper Plates*. State Dept. Of Archaeology, Tamilnadu. Madras. See: L'Hernault F. 1978. *L'Iconographie de Subrahmanya au Tamilnad*, Institut Francais d' Indologie. Pondichery, p.111, ph. 63.) The copper plates indicate that Aparajitavarman went to Setutirtha.

References

- NASA, Google Earth photgraphs and other information
- http://hinduthought.googlepages.com
- http://hinduthought.googlepages.com/krishnaiyer13april2007.jpg
- http://docs.google.com/Doc?id=ajhwbkz2nktv_642dbmt75
- Dept. of Earth Sciences, Govt. of India (March 2007) http://hinduthought.googlepages.com)
- Ancient Monuments and Archaeological Sites and Remains Act, 1958 cited at http://asi.nic.in/asi_monuments.asp
- http://sethusamudram.gov.in
- Other references from google search on Rama Sethu, Adams Bridge, Sethusamudram Project

Rama Setu: tradition and progress with compassion

D. Kuppuramu
Advocate, State President, Tamilnadu Bharatiya Meenavar Sangam,
Ramanathapuram

Ever since it was announced that Rama Setu will be destroyed to implement the Setusamudram Channel Project, strong opposition has been expressed by the Movement on behalf of Hindu organizations.

In the year 2006, on Ramanavami day, a nation-wide signature campaign was launched to express peoples' support for our pleas. Our opposition was expressed through a petition signed by 35 lakh people which was presented personally to His Excellency President Dr. Abdul Kalam.

On 10 December 2006 when we learnt that dredging work is likely to begin in the Rama Setu area, myself and Pujya Swami Omkarananda Maharaj of Theni filed a civil petition in the Ramanathapuram Court on 15 December 2006 seeking injunction against the ongoing work.

After attending the court session on 12 January 2007 I returned home and finished my lunch. As I came into the hall, my mother asked me: "My dear son, what happened to the Rama Setu case?"

"They are claiming that Rama Setu does NOT exist," I sat down in a chair responding to my mother.

"Who says there is no Rama Setu?" thundered my mother , sitting up in her chair. The sheer majesty of her stance made me realize that Mother Paraashakti herself was asking this question and I saw Bharata Mata in my mother's presence.

"That is what the Government advocate is saying, mother, that Rama Setu does not exist; they say that there is no scientific evidence," I responded.

"Who is saying that Rama Setu or Setu Tirtha does not exist?" so saying, my mother raised up from her chair quivering with anger and standing majestically, she started speaking in a resolute tone.

"The existence of Rama Setu is real. The existence of Rama Tirtham is real. You are the living testimony to this. Your very birth is the evidence," she said.

She continued: "After my marriage, two children were still born. I did not have a child for 10 years. People said that I will not have a child. Later, our elders told me that I should go to Dhanushkodi for teerthastnaana and perform puja, 'you will have a child' they said. I told this to my close friend. Myself and your father went with my friend to Dhanushkodi on a teerthayaatra and made a sankalpam at the Rama Setu. Within a year after we performed this teerthasnaanam you were born as my son. This is why, you are the evidence for the reality of Rama Setu and Setu Teertham. I will say this to anyone. I will depose before any court. Take me to your court, I will tell the judges there" so saying in a magisterial voice, she stood in front of me.

My mother who had appeared to me like Mother Paraashakti and as Mother Bharata Maata now appeared to me in the form of fierce Bhadrakaali in rudrataandavam. I folded both my hands, stood up in reverence.

"When is the next hearing? I am coming the court," she asserted. "Next month on 2 February 2007", I said. "Remind me. I will come to the court", she said again. Without my reminding her, she was ready to come to the court on 2 February 2007. She came to the court. Even though there was no provision in the court proceedings to cross-examine her, I took her with me to the court to satisfy her intense yearning.

She expressed her anguish at the behavior of some people denying the existence of Rama Setu and shared that anguish with my colleage advocates and friends assembled in front of the court. This incident affected me intensely. All mothers of our nation have feelings similar to the feelings of my mother. If this information reaches them, they will find a solution to the issue.

It is amazing indeed that Rama Bhakti, Rama Setu, Rama Teertham, are so deeply founded in our society. Maybe, we may not know the names of our ancestors of the previous four or five past generations. When this is the situation, mothers remember Rama who lived many yugas before our times and narrate to their children the events of his life and the places related to his life. The society has transmitted this from generation to generation. Because it is satyam, it is standing firm even today. What foolishness it is to search for scientific evidences for such a Rama, such a Rama Setu, such a Rama Teertha?

The presiding judge of the Ramanathapuram Sub-court, Hon'ble Judge A. Muhammad Abtaqir said in his judgement: "Ancient monuments should be protected." The issue is subjudice.

As we enquire further, we find that fisherfolk who venture in to the ocean to collect algae (kadal paasi), take extraordinary caution and care to ensure that no portion of the Rama Setu is broken. If by mistake, any damage is caused to any rock on the Rama Setu, they consider it a divine error and fear that something untoward may happen in their family. This care, compassion and caution is observed by all fisherfolk irrespective of their religious affiliations. People of all faiths exercise this caution and care.

Fisherfolk who live in poverty, about 3500 of them, including 2000 fisherwomen, are engaged in the tasks of collecting algae. In a year about 75,300 tonnes of algae are collected. There are 147 varieties of algae and aquatic flora here.

The earth of Rameswaram is considered sacred because Rama installed the Sivalinga made of the earth of Rameswaram, which was worshipped by Sita. Beyond religious concerns, the earth is looked upon with reverence. Even today, there is no cultivation of the soil using a tractor or a plough. People tend and ready their farms using only shovels.

The politicians of Tamilnadu are no exception to such practices. They do not retain their flamboyant, grandiose politics in the island of Rameswaram. If politicians come to the earth of Rameswaram thinking arrogantly that they are superior people, they lose their political offices. They are convinced that they will lose their political power, the regime collapses, elections are lost, personal lives are impaired. Politicians do accept the traditions of the people who note that in Rameswaran, the Isvara of Rama

is supreme. Rama who worshipped this supreme divinity is supreme. Those who have scoffed at these traditions have been destroyed. There are many evidences for this. "Those who consider the earth of Rameswaram as sacred live and flourish in the world. Those who trod on the earth with disdain and arrogance have fallen."

In a spiritual quest, Setubandha Rameswaram is as sacred as the Gulf of Mannar and Palk Bay are the world's serene and pure waters of the ocean.

This is why, there are unique species of s'ankha (turbinella pyrum). There are about 3600 rare aquatic species in this marine biosphere. Recognizing this, the region was declared as the Marine Biosphere Reserve of South and Southeast Asia with protected National Marine Parks, spending several hundreds of crores of rupees to conserve the heritage.

The Gulf of Mannar Protected Marine Biosphere is 10,500 sq. kms. in extent. Out of this, 560 sq.kms. of the ocean is declared as a National Park. This National Park is an aquatically rich region, on 21 small Coral reef islands between Rameswaram and Tuttukkudi (Tuticorin). Along the coastline, there are 125 fisherfolk villages. The population is 1,60,000 and there are about 9000 fishing boats.

This conservation and protection is to protect the coral reefs and aquatic resources for economic exploitation, with ecological conservation and to provide livelihood to the coastal people. Is it not a wonder of wonders that such a government which isspending several crores of rupees for conserving the ecology of the fragile ecozone, should now be spending several thousand crores of rupees to destroy and demolish Rama Setu, this gigantic coral reef, despite scientific evidences for human activity on both sides of the reef, without safeguarding the coastline, protecting the livelihood of fisherfolk, without respecting the traditions and sentiments of people closely intertwined with their culture? What type of justice is this? How can this be accepted?

The Palk Straits and Gulf of Mannar are the breeding grounds of aquatic resources. It is through this region, the aquatic wealth of Bay of Bengal and of Indian Ocean are generated. These resources include the 'Oil sardine' which yield significant income to the fisherfolk. Because of this, the fisherfolk of northern portions of Tamilnadu coast, and of Andhra coast benefit. What will happen to this aquatic wealth if Rama Setu is desiccated? What will be the fate of the lives of fisherfolk and coastal people of Tamilnadu, Andhra and Orissa?

Without detailed multi-disciplinary evaluation of the impact of the December 2004 tsunami which impacted north Tamilnadu, Kanyakumari and Kerala coastal villages, the impact on mineral resources and resultant changes in the economic and social conditions of the coastal people, the hazards posed by the Setusamudram Project and carrying on with the project by claims are sought to be made that the project is continued because it was designed by the previous government. Claims are also made that the project is continued because it is a 150-year old project. It has to be completed by 2008 and hence the work is progressing. So saying, without systematic enquiry and investigation, working in haste, will the progress lead to uncertainties in the lives of coastal people of Kerala and Tamilnadu?

Why is the Dhanushkodi Setu teertha sacred?

Sri Rama reportedly installed three s'ivalinga in this teertha.

From a scientific, oceanographic perspective, there is an ocean stream circulating the earth which has accumulated life-force and attains its purest state in this place where a confluence of three ocean currents occurs. At the brahma muhurta, say between 4 and 6 AM, the waters are considered sacred and most beneficial to the aquatic living organisms. Given the close proximity to the algae (photoplyktons), these waters have the sacredness attributed to them as life-giving waters and hence, the tradition among mothers desirous of children performing teertha snaana puja at this tirtha.

At this teertha when sankalpam and tarpanam is performed for ancestors and pitr-s, they are remembered and invoked to bless the present and future generations. We are all children of our forefathers and our socio-cultural history is bound to the tradition that our ancestors have bequeathed to us.

சேது சமுத்திரம் திட்டத்திற்காக ராமர்பாலத்தை உடைக்கும் திட்டப்பாதையை அறிவித்த நாளில் இருந்து இந்து இயக்கங்கள் சார்பில் கடும் எதிர்ப்பை தெரிவித்து வந்துள்ளது.

கடைசியாக சென்ற 2006ம் ஆண்டு "இராமநவமி" அன்று நாடு முழுவதும் நமது கோரிக்கையை வலியுறுத்தி கையெழுத்து இயக்கம் நடத்தப்பட்டது. 35 லட்சம் பேரிடம் கையெழுத்து பெறப்பட்டு கடந்த 27.09.2006 அன்று மேதகு.ஜனாதிபதி. டாக்டர். அப்துல் கலாம் அவர்களிடம் நேரடியாகச் சென்று சமர்ப்பித்து நமது எதிர்ப்பைத் தெரிவித்தோம்.

ஆனால் கடந்த 10.12.2006 அன்று அந்தப் பகுதியின் திட்டப்பணி துவங்குகிறது என்று அறிந்தவுடன் நானும், தேனி பூஜ்ய.சுவாமி. ஓம்காரானந்தா மஹராஜ் அவர்களும் 15.12.2006 அன்று பணிகளுக்கு தடை கோரி இராமநாதபுரம் சப்கோர்ட்டில் ஒரு சிவில் வழக்கை தாக்கல் செய்தோம்.

12.01.2007ல் வழக்கில் ஆஜராகிவிட்டு வீட்டில் மதிய உணவை முடித்துக் கொண்டு கையை அலம்பிவிட்டு துண்டால் கையைத் துடைத்துக்கொண்டு எனது வீட்டின் ஹாலுக்கு வந்தேன்.

"என்னப்பா ராமர் பாலம் கேஸ் என்னாச்சு?" என்று எனது தாயார் என்னிடம் கேட்டார்கள்.

"ராமர் பாலமே இல்லை என்று சொல்கிறாகள்" என்று சொல்லிக்கொண்டே நான் நாற்காலியில் அமர்ந்தேன்.

"யார் சொன்னது ராமர்பாலம் இல்லை என்று?" என்று கேட்டுக்கொண்டே சோபாவில் நிமிர்ந்து உட்கார்ந்தார்கள் என் தாயார். அந்த குரலிலே இருந்த அழுத்தம் அவர்கள் நிமிர்ந்து உக்கார்ந்தன் கம்பீரம்

இதுவெல்லாம் அன்னை பராசக்தியே இந்தக் கேள்வியை கேட்பதாக நான் உணார்ந்தேன். பாரதமாதாவாகவே எனது தாயார் எனக்கு காட்சி தந்தார்கள்.

“அதாம்மா கோர்ட்டில் அரசு வக்கீல் சொல்கிறார். ராமர்பாலம் இல்லை என்று - அதற்கு விஞ்ஞானபூர்வமான ஆதாரம் இல்லையாம் “ என்றேன் நான்.

“எவனடா சொல்வது ராமர்பாலம் இல்லை, ராமர் தீர்த்தம் இல்லை என்று கூறிக்கொண்டே சொபாவில் இருந்து கோபத்தோடு எழுந்தார்கள். கம்பீரமாக நின்று கொண்டு கோபக்குறியோடு பேச ஆரம்பித்தார்கள்.

“ராமர் பாலம் இருப்பது, ராமர் தீர்த்தம் இருப்பது இதுவெல்லாம் சத்தியம். நீயே இதற்கு சாட்சி. உனது பிறப்பே இதற்கெல்லாம் ஆதாரம்” என்றார்.

“எனக்கு கல்யாணம் ஆகி இரண்டு குழந்தைகள் பிறந்து இறந்து போனது. பின்பு 10 வருட காலம் குழந்தைகயே இல்லாமல் இருந்தேன். எனக்கு இனிமேல் குழந்தை பிறக்காது என்று கூறிவிட்டார்கள். பின்பு நமது பெரியவர்கள் தனுஷ்கோடி என்று தீர்த்தமாடி பூஜைகள் செய்துவா உனக்கு குழந்தை பிறக்கும் என்று சொன்னார்கள். நான், என் உயிர்த்தோழியிடம் அதை சொன்னேன். நானும் உன் அப்பாவும் என் தோழியோடு தனுஷ்கோடி சென்று தீர்த்தமாடி தனுஷ்கோடி ராமர்பாலம் பகுதியில் சங்கல்பம் செய்து வந்தோம். அப்படி பூஜை செய்து தீர்த்தமாடி வந்த ஒரு வருடத்துக்குள்ளாக நீ எனக்கு பிள்ளையாய் பிறந்தாய். எனவே நீதான் இதற்கெல்லாம் ஆதாரம். இந்த விசயத்தை நான் யாரிடமும் சொல்கிறேன். எந்த கோர்ட்டிலும் சொல்கிறேன். என்னை நீ கோர்ட்டுக்கு அழைத்துப்போ நான் அவர்களிடம் பேசிக்கொள்கிறேன்” என்று ஆவேசமாக என் முன்னே வந்து நின்றார்கள்.

சற்று முன்பு அன்னை பராசக்தியாக, அன்னை பாரதமாதாவக காட்சியளித்த எனது தாயார் இப்போது ருத்ரதாண்டவமாடும் பத்ரகாளியாக

எனக்கு காட்சியளித்தார்கள். இரண்டு கைகளையும் கூப்பி எழுந்து வணங்கி நின்றேன்.

"அடுத்த வாய்தா எப்போ? நான் வருகிறேன் கோர்ட்டுக்கு" என்றார்கள். அடுத்த மாதம் 2ஆம் தேதி (02.02.07) என்றேன். "ஞாபகப்படுத்து. நான் கோர்ட்டுக்கு வருகிறேன்" என்று மீண்டும் கூறினார்கள். 02.02.07ல் நான் ஞாபகப்படுத்தாமலேயே கோர்ட்டுக்குச் செல்ல தயாராக இருந்தார்கள். கோர்ட்டுக்கும் வந்தார்கள். அவர்களை விசாரிக்கும் வாய்ப்பு கோர்ட்டில் இல்லை என்றாலும் அவர்களது மன ஆறுதலுக்காக நான் கோர்ட்டிற்கு அழைத்துச் சென்று இருந்தேன்.

எனது சக வழக்கறிஞர்கள், அறிமுகமானவர்கள், கோர்ட்டில் வெளியே காத்திருப்பவர்கள் எல்லோரிடமும் ராமர் பாலம் இல்லை என்கிறார்களே என்று தனது ஆதங்கத்தை கொட்டித் தீர்த்துக் கொண்டார்கள். இந்த சம்பவம் என்னை வெகுவாக பாதித்தது. நமது நாட்டில் உள்ள தாய்மார்கள் அனைவருமே என் தாயைப் போன்ற எண்ணம் கொண்டவர்களே. அவர்களிடம் இந்த விசயம் சென்று அடைந்தால் அவர்கள் தீர்வுக்கு வழி செய்து விடுவார்கள்.

நமது சமுதாயத்தில் ராம பக்தி, ராமர் பாலம், ராமர் தீர்த்தம் இவையெல்லாம் எவ்வளவு ஆழமாகப் பதிந்துள்ளது என்று வியப்பாகவே உள்ளது. ஏன், நான்கு ஐந்து தலைமுறைக்கு முன்னர் உள்ள நமது முன்னோர்களோ அவர்களின் பெயர்களே நமக்குத் தெரியாது. அப்படியிருக்க எத்தனையோ யுகங்களுக்கு முன் பிறந்த, வாழ்ந்த, வாழ்ந்த ராமனைப் பற்றி, அவன் வாழ்வில் சம்பந்தப்பட்ட இடங்களைப் பற்றி அவன் வாழ்ந்த காலத்தில் இருந்தே தாய்மார்கள் தங்கள் பிள்ளைகளுக்கு சொல்லி வருகிறார்கள், சமுதாயம் தனது சந்ததிகளுக்கு சொல்லி வந்துள்ளது. அது சத்தியம் என்பதால்தான் இன்றுவரை நிலைத்து நிற்கிறது. அப்படிப்பட்ட ராமனுக்கு, ராமர் பாலத்திற்கு, ராமர் தீர்த்தத்திற்கு அறிவியல்பூர்வமான ஆதாரங்களைத் தேடுவது எவ்வளவு அறிவின்மை?

வழக்கை விசாரித்த இராமநாதபுரம் சப்கோர்ட் நீதிபதி மாண்புமிகு.A.முகமது அப்தாகிர் அவர்கள் “புராதனச் சின்னங்கள் காப்பாற்றப்பட வேண்டும்” என்றே தனது உத்தரவில் கூறியுள்ளார். வழக்கு நிலிவையில் உள்ளது.

ஏன் இன்னும் சொல்லப்போனால் இராமேஸ்வரம் பகுதியில் கடல் பாசி எடுக்கச் செல்லும் மீனவர்கள், பாலத்தின் ஒரு சிறு பகுதி கூட உடைந்து விடக்கூடாது என்று பக்தியோடு முன்னெச்சரிக்கையாகவே இன்றும் பாசி சேகரித்து வருகிறார்கள். தப்பித்தவறி ஏதாவது ராமர்பாலம் பாறைக்கு பாதிப்பு ஏற்பட்டுவிட்டால் அது தெய்வ குற்றம் என்றும் அது குடும்பத்தில் பாதிப்பை ஏற்படுத்தும் என்றும், ஜாதி மத வேறுபாடுகளுக்கு அப்பாற்பட்டு இன்றும் அனைத்து சமுதாத்தினரும் நம்புகிறார்கள்.

ஆண்களும் 2000 பெண்களுமாக ஏழை மீனவர்கள் 3500 கடற்பாசி சேகரிக்கும் தொழில் செய்கிறார்கள். வருடத்திற்கு சுமார் 75300 டன் கடற்பாசி சேகரிக்கப்படுகிறது. 147 வகை கடற்பாசி தாவர வகைகள் இங்கு உள்ளன.

ராமேஸ்வரம் மண்ணை எடுத்து சிவலிங்கமாக உருவாக்கி பிரதிஷ்டை செய்து ராமனும் சீதையும் வணங்கியதால் ராமேஸ்வரம் மண்ணை அனைவரும் புனிதமானதாகவே மதிக்கிறார்கள். மத உணர்வகளுக்கு அப்பாற்பட்டு அந்த மண்ணை பக்தியோடுதான் பார்க்கிறார்கள். இன்றும் கூட ஏர் கொண்டோ, டிராக்டர் கொண்டோ யாரும் உழுவது கிடையாது. விவசாயிகள் தங்கள் நிலங்களை மண்வெட்டி கொண்டுதான் பண்படுத்துகின்றனர், பராமரித்து வருகிறார்கள்.

தமிழக அரசியல்வாதிகளும் இப்படிப்பட்ட நம்பிக்கைகளுக்கு விதிவிலக்கல்ல. அவர்கள் தங்கள் ஆர்பாட்ட, ஆடம்பர அரசியலை இராமேஸ்வரம் தீவில் வைத்துக் கொள்ள மாட்டார்கள். தானே பெரியவன்

என்ற அகந்தை எண்ணத்தோடு அரசியல்வாதிகள் இராமேஸ்வரம் மண்ணிற்கு வந்து திரும்பினால், அவர்கள் அரசியல் பதவி பறிபோய்விடும், ஆட்சி கவிழ்ந்துவிடும், தேர்தலில் தோல்வி வரும், தனது சொந்த வாழ்க்கையில் பாதிப்பு ஏற்படும் என்று அனைத்து அரசியல் கட்சித் தலைவர்களுமே நம்புகிறார்கள். இராமேஸ்வரத்தில் இராமஈஸ்வரனாகிய சிவனே பெரியவன், அவனை வணங்கிய இராமனே பெரியவன் என்ற தீவு மக்களின் நம்பிக்கையை அரசியல்கட்சித் தலைவர்களும் ஒப்புக்கொள்ளத்தான் செய்கிறார்கள். இந்த நம்பிக்கையை அவமதிப்பவர்கள் அழிந்துபோயிருக்கிறார்கள். அதற்கு நிறைய உதாரணாங்களும் உள்ளன. "இராமேஸ்வரம் மண்ணை புனிதமாக மதித்தவர்கள் உலகில் வளர்ந்தேறி வாழ்கிறார்கள். அந்த மண்ணை அகந்தையோடு மிதித்தவர்கள் அடியோடு வீழ்கிறார்கள்".

ஆன்மீகரீதியாக இராமேஸ்வரம் ராமர்பாலம் எவ்வளவு புனிதமான புவிப்பகுதியாக உள்ளதோ அதேபோல இந்த பகுதி மன்னார் வளைகுடா பகுதியும் உலகிலேயே தூய்மையான கடக்நீரையுடைய கடல் பகுதியாக விளங்குகின்றது.

அதனால்தான் அரியவகை சங்குகள் உட்பட சுமார் 3600 அரியவகை கடல்வாழ் உயிரினங்கள் வாழக்கூடிய உயிர்க்கோளப்பகுதியாக விளங்குகிறது. இதை நன்கு உணர்ந்த அரசுகளும் இந்தப் பகுதியை மன்னார் வளைகுடா உயிர்கோளப் பகுதியாக அறிவித்து உயிர்கோளக்காப்பக அறக்கட்டளை என்ற அமைப்பை நிறுவி இப்பகுதியை காப்பாற்ற பல நூறு கோடி ரூபாயையும் செலவு செய்து வருகிறது.

மன்னார் வளைகுடா உயிர்கோள காப்பக பகுதி என்பது 10,500 சதுர கி.மீ கடல் பகுதியாகும். இதில் 560 ச.கி.மீ கடல் பகுதியை மன்னார் வளைகுடா தேசிய பூங்காவாக அரசு அறிவித்துள்ளது. இந்த தேசிய பூங்கா இராமேச்வரம் முதல் தூத்துக்குடி வரை 21 சிறிய பவளப்பாறைத் தீவுகளையும் மற்றும் அதைச் சார்ந்த பகுதிகளையும் கொண்ட கடல் வளமிக்க

பகுதியாகும். கரையோரப் பகுதியில் 125 மீனவ கிராமங்கள் உள்ளன. 1,60,000 ஜனத்தொகை உள்ளது. சுமார் 9000க்கு மேற்பட்ட மீன்பிடிப் படகுகள் உள்ளன.

கடலில் உள்ள பவளப்பாறைகளைக் காப்பாற்றுவதன் மூலம் மீன்வளத்தைக் காத்து பொருளாதாரரீதியாகவும் பூகோளரீதியாகவும் காப்பாற்றவே இந்த அறக்கட்டளை. இப்படி பலகோடி ரூபாய் செலவு செய்து பவளப்பாறைகளை காப்பாற்றும் அரசு இந்தப் பகுதியில் உள்ள மிகப்பெரிய பவளப்பாறை, மனிதர்கள் வாழ்ந்ததற்கான அறிவியல்ரீதியான ஆதாரங்களோடு இந்தப் பகுதியின் பாதுகாப்பு, மீனவரிகளின் பொருளாதாரம், இந்த நாட்டின் சமய சார்புகளுக்கு அப்பாற்பட்டு ஆன்மீகம், பண்பாடு, கலாச்சாரத்தோடு தொடர்புடைய ராமர்பாலத்தை பல ஆயிரம் கோடி செலவு செய்து உடைத்து சின்னாபின்னமாக்குவது விந்தையிலும் விந்தையாக உள்ளதே? எந்த வகையில் நியாயம்? எப்படி ஏற்றுக்கொள்ள முடியும்?

பாக்ஜலசந்தியும், மன்னார் வளைகுடாவும் மீன்களின் உறைவிடம். பல மீன் வகைகளின் நாற்றங்கால். அரபிக்கடல் பகுதியில் மீன் வகைகளும், இந்துமாக் கடல் மீன் வகைகளும் இந்தப் பகுதி வழியாகத்தான் வங்கக்கடலுக்கும், வங்கக்கடலிலிருந்து அரபிக்கடலுக்கும், இந்துமாக்கடலுக்கும் செல்கின்றன. மீனவர்களுக்கு வருவாயை அள்ளித்தரும் "ஆயில் சார்டைன்" என்று கூறப்படும் பேச்சாளை வகை மீன்களுள் இதில் அடக்கம். இதனால் தமிழகத்தின் வடபகுதி, ஆந்திரக் கரையோர மீனவர்களும் பயனடைந்து வருகின்றார்கள். ராமர் பாலம் உடைக்கப்பட்டால் இந்த வகை மீன்களுக்கு என்ன கதியோ! இவ்வகை மீன்களால் வளமடையும் தமிழக, ஆந்திர, ஒரிசா கடற்கரை மீனவர்கள் என்ன கதியாவார்களோ!

டிசம்பர் 2004 சுனாமியின் கோரத் தாக்குதலுக்கு ஆளான வடதமிழக, கன்னியாகுமரி, மற்றும் கேரள கரையோர கிராமங்களின் மீன்வள, சுற்றுச்சூழல், பூகோள, பொருளாதார மற்றும் சமுதாய மாற்றங்கள் பற்றியும்,

சேது சமுத்திர திட்டத்தால் ஏற்படும் புதிய அச்சுறுத்தல்கள், விளைவுகள் பற்றியும் முழுமையான ஆய்வு எதையும் மேற்கொள்ளாமல் முந்தைய அரசு சொன்னது அதனால்தான் செய்கிறோம், 150 ஆண்டு காலத்திட்டம் அதனால் செய்கிறோம், 2008ம் ஆண்டுக்குள் முடிக்க வேண்டும் அதனால் செய்கிறோம், இப்படி சொல்லிக்கொண்டு அறிவார்ந்து சிந்திக்காமல், ஆய்வுகள் நடத்தாமல் அவசர கோலத்தில் திட்டம் நிறைவேற்றப்பட்டால் கேரள, தமிழக கடற்கரை மக்களின் கதி என்னவாகுமோ?

Scientific-Economic Aspects

Geological and Geophysical Perspective of the Ramsetu Bridge

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Preamble

There has been lot of interesting debate on the Ramsethu Bridge said to be connecting south-eastern part of India with Sri Lanka. Most of the arguments are based on assumptions and partial data obtained from NASA satellite images. No doubt these images are astounding as they bring out the marine geomorphology of the area. But as stated by NASA official themselves "Remote sensing images from orbit cannot provide direct information about the origin or age of a chain of island and cannot determine whether humans were involved in producing any of the patterns seen". However several other images including close range aerial photographs, bathymetric charts etc were examined. The observations given below are based purely on hard field work including geological and geophysical surveys coupled with logging and interpretations of several cores and boreholes carried out in the area.

Introduction

In order to understand the subject a little amount of geological information is essential. The earth has not always been very warm or cold. There have been periods of extreme cold climate that occurred in the geological past wherein most of the surface of the earth was covered with vast quantities of ice and these periods are referred to as ICE AGES. The recent one occurred during the late Pleistocene age eighteen thousand years before present. During this period the sea level was lowered by about 130m than what is today. Due to this the land area was extending far greater distances than what is today. The Indian subcontinent was extending far beyond Sri Lanka. Subsequently due to global warming and other causes there have been periodic rises in sea level submerging several of these additional areas. About 7300 BP there was a major spurt in sea level rise which resulted in submergence of several areas all over the world.

Geology of the area

The Indian side of the land mass adjoining the Ramsethu originates from the south-eastern end of the Rameswaram Island. The island itself is a long linear sandy terrain providing calcareous sand stone and occasional coral formation. This area was devastated by a major cyclone in 1956 when part of the area was lost to the sea. The Rameswaram Island connects the main land through the Pamban area. Further to the west charnocites and granites are exposed.

In order to understand the geology and the structure of the area in the marine domain several surveys were carried out onboard a research vessel with underwater sensor. These included multibeam echo sounder survey, sub bottom profiler survey, side scan sonar and magnetic survey. The entire area was sampled by deploying vibro core, mainly to the north of the Adams Bridge (Ramsethu). These surveys generally required at least 4m of water surface so that the equipments are not damaged. The bathymetric survey brought out the fact that the Adams bridge, with a shallow ridge varying in width from 1.6 to 4km. This part of the area could not be surveyed due to these factors. However it was seen from the geological and geophysical surveys that the Adams Bridge is a fault zone rising suddenly from the Bay of Bengal side to the north. This scarp like feature is the shallowest part of the Adams Bridge. Even though it is mostly submerged in water there are series of Small Island like features which project above the sea surface. In all about 10 boreholes have been drilled along this ridge up to the international boundary. Out of the ten boreholes six boreholes were in the sea. The result of the bore logging clearly showed about 1.5m to 4m marine sand followed by 1.5 to 2.5m of boulders of calcareous sand stones and coral followed again by marine sand to various depths end at continuous compact formation.

It is a well known fact that the coral reefs can only form in clean and unpolluted water and these being marine organisms required firm and compact formation as foundation. The presence of loose marine sand below these clearly indicates that these are not natural and are transported. Unless somebody has transported and dumped them these could not have come there. Some of the boulders are so light they could float on water. Apparently whoever has done it has identified it as light and strong boulders to make it easy for transportation. Since the boulders are strong they can withstand lot of weight.

There are corals that are present on land in Rameswaram, Pamban and Tuticorin areas. A study of them and dating them clearly show that the age of the coral is about 7300 years and the sea level at the time was 4m above the present day sea level. Then there has been a lowering of sea level and between 4 to 5 thousand years BP the sea level was about 1.5m above present day sea level.

The 1.5 to 2.5m thick zone of corals and rock presently occurring at shallow depths in the sea atop the crustal portion of the Adams Bridge appeared to be an ancient causeway. The ancients appeared to have taken advantage of the crustal portion of the ridge to avoid dumping of lot of volume of rocks and boulders and also utilized less dense but compact rocks and boulders so that these could be carried easily to greater distances and at the same time strong enough to withstand pressure from above both by human as well as sea forces.

The Adams Bridge is a wonderful divide separating the turbulent Bay of Bengal in the north and the calm and tranquil waters of Gulf of Mannar to the south. Due to the tranquil condition very rare species of corals and other sea organisms grew in the Gulf of Mannar, whereas the species are completely absent in the Bay of Bengal side. The turbulent tide and the associated sediments caused by the severe cyclone that occur every year in the Bay of Bengal are prevented by the ridge of the Adams bridge and there by protect the delicate conditions in the Gulf of Mannar.

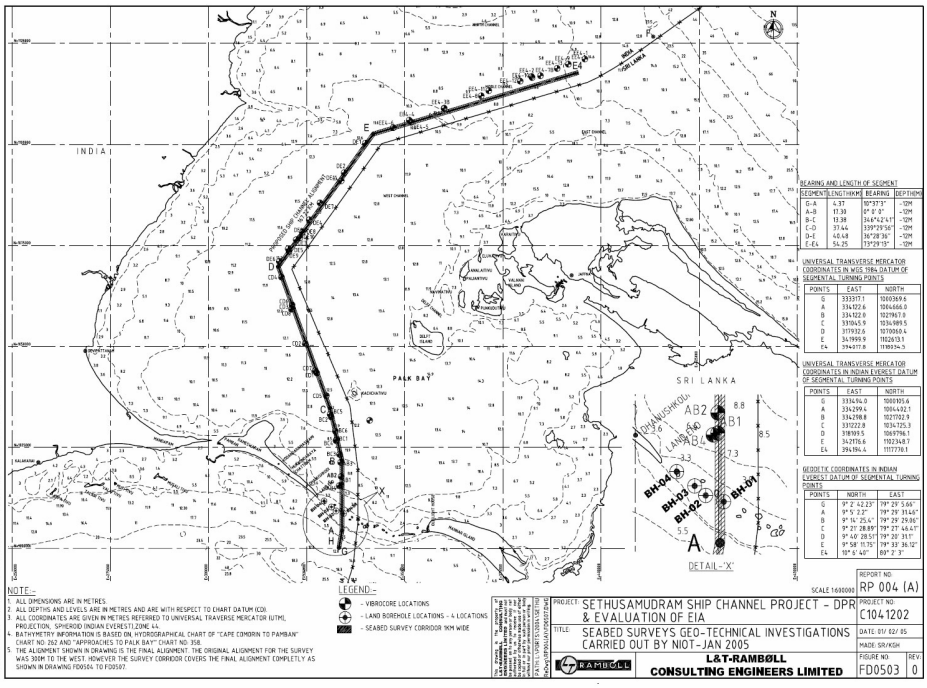
The dredging and opening of the Adams Bridge in all likelihood may cause the sediments and turbulent tide to enter the tranquil Gulf of Mannar and choke and

destroy the delicate coral island. As an alternative dredging in the Pamban or nearby areas and bypassing the Adams bridge could be favourably considered like other inter sea canal (Panama Canal) locks could be provided both in the palk bay side and Gulf of Mannar side so that such calamities could be prevented.

Acknowledgement

The author thanks D. Venkata Rao, Project Director and B.Sasisekaran, Scientist 'D' of National Institute of Ocean Technology for the help extended in the preparation of the paper and power point presentation.

Illustration:



Proposed Navigational Channel Alignment – Sethu Samudram Project- Drilled Borehole Locations.

Scientific evidence for ancient human activity in the project area

Scientific evidences point to human activity in ancient times on both sides of Ramsetu as found by Dept. of Earth Sciences and ocean technologists of Bharatam. This area should be declared a protected monument under the Protection of Monuments Act and declared as a World Heritage site by the Govt. of India and advised to UNESCO…

[quote]… During the glacial Maxima, the sea level was about 130 m lower than what is today. This is evidenced both on the east and west coast of India, where submerged Corals occur around 1 to 2m water depths and they are clear indicators of near coastal zone… However, during the last ice age (18,000 year BP) the entire area from India to Sri Lanka and further south and southeast were contagious land due to the highly lowered sea level. As and when there were major melting of glaciers both from the mountains as well as from the Antarctic area, the sea level was rising. These features were well recorded and studied by several submerged Coral formations all over the world. About 7,300 years BP the sea level in the southern part of India was about 3.5 m above the present level. This has been deciphered by Dr.P.K.Banerjee, who studied Corals that found in the land part as of Pamban, Rameswaram, and Tuticorin etc. Subsequently the sea level went down and rose +2m above than what is today between 5000 to 4000 years B.P. .. In almost of all the boreholes between 4.5 and 7.5m the borehole intersected hard formations, which have been found to be calcareous sand stones and corals. It is to be pointed out here that Corals are comparatively less dense, compact and somewhat easy to carry. The Corals normally grow atop compact to hard formations for the purpose of stability, and as the sea level rises, the Coral colony grows up vertically to maintain water depth of 1 to 2 m, which is essential for their survival. It is always observed that these Corals have continuous vertical growth like Lakshadweep, Andaman's, and Gulf Of Mannar Natural Park. These have always been found to grow on hard rock bottom. In the case of Adams bridge area we observe that the Coral formations hardly occur 1 to 2.5m in length and resting on loose marine sands. Most of these coral rock pieces are seem to be rounded pebbles of corals. These things appear to point these coral rock pieces and pebbles have been transported and placed in these

areas. Since the calcareous sand stones and Corals are less dense than normal hard rock and quite compact, probably these were used by the ancients to form a connecting link to Sri Lanka, on the higher elevations of the Adams bridge ridge and this is analogous to modern day causeway. In support of these observations there are many archaeological and geoarchaeological evidences on the south east coast of India around Rameswaram, Tuticorin and the western coast of Sri Lanka. There are raised Teri formations that supported a rich assemblage of mesolithic – microlithic tools indicating the presence of strong human habitation and activity in these areas as early as 8000 to 9000 years B.P and as recent as 4000 years B.P. On Sri Lanka side there are indications of human habitation extending to late Pleistocene (about 13,000 B.P) based on bone and fossils of human and animal form. All these point to a flourishing human activity on both side of Adams Bridge and probably when the sea levels were just right the link between India and Sri Lanka could have been established. [unquote] Source: Dept. of Earth Sciences, Govt. of India (March 2007)

http://hinduthought.googlepages.com/

Rama's Bridge – A note on its origin

Srinivasan V, consultant Geologist (April 2007)

The origin of Rama's Bridge, which exists between Dhanushkodi in Tamil Nadu and Talaimannar in Sri Lanka and which has later been renamed as Adam's Bridge by the British is examined geologically to find out whether it is a geological feature or whether it is a man-made one.

A submarine linear ridge originates either by the coalescence of volcanic islands appeared as a chain one by one regularly over a moving plate when it reaches a hot spot like that of Hawaii or in the form of a ridge parallel to the coast as in the case of Mid-Atlantic ridge. These two cases represent volcanic phenomena in a permanent volcanic environment. But there is no volcanic activity either in the land area or in the ocean region of Tamil Nadu because it forms part of the South Indian (Peninsular) shield which is considered to be geologically old and stable. Therefore, in the Bay of Bengal, between Tamil Nadu and Sri Lanka, there is no volcanic activity so as to give rise to a submarine volcanic ridge like those mentioned above in the location of the said bridge.

A submarine linear platform or a linear plateau can form a horst, which is a linear block of rock-mass that rises up between two parallel faults or crustal fractures. Such structures and landforms are found only in the land area of Tamil Nadu (in the East-West Salem-Attur belt and in the basement rocks of Cauvery basin). But such structures and landforms are not found in its ocean region of Bay of Bengal in general and in the location of the said bridge in particular.

Further coral islands formed in a chain can also produce a submarine ridge by the accumulation of the dead coral polybs. But in the Rameswaram and Tuticorin regions of Bay of Bengal, there are coral islands, but scattered in the coastal and offshore areas, and not in the said bridge area which is transverse to the coastline.

Similar to the submergence of Kumari (cape Commorin) hills in the Indian ocean, no such submergence of a hill to form the said bridge is observed.

The possibility of this bridge being a submarine anticlinal ridge is also ruled out because the bridge area is located in the recent sediments, which are not yet subjected to any folding activity.

Hence this submarine feature, called Rama's Bridge, cannot be included among the geological features described so far; and thus it remains to be man-made to connect the two landmasses of Tamil Nadu (India) and Sri Lanka, both being separated by the sea. That is, it would have been developed manually to cross the ocean when the sea level was lower than the present one. Such a situation during Sri Rama's visit to Sri Lanka existed, because before he left for Sri Lanka, he worshipped Siva in the form of Sivalinga made of beach sand at the place of Rameswaram Temple. So the shoreline at that time was at Dhanushkodi from where his bridge starts. This lower sea-level continued even during later Cholas' regime, because their capital city, Poompuhar, which was on the sea shore is now in the sea.

Thus Rama’s Bridge is only a man-made feature between Dhanushkodi in Tamil Nadu and Talaimannar in Sri Lanka.

'Rama Setu bridge is man-made only'

An interview with Swami Dayananda Saraswati

NT Bureau Chennai, Apr 29:

Refuting the claim of a scientist that there is no-man made structure called Rama Setu or Adam's bridge between Mandapam at Rameswaram and Thalaimannar in Sri Lanka, Swami Dayananda Saraswati (who is a scholar in such matters) has cited the study of a geologist to reaffirm his position that a bridge had indeed been built by humanity at the present site.

Stating there cannot be a natural, geological formation at the Rama Setu connecting Indian sub-continent with Lanka, the spiritual leader quoting from the observations of the geologist says the climate and soil conditions in the Bay of Bengal between the two land masses did not allow for an undersea volcanic ridge (a long raised strip) as there was no seismic activity in this area. 'Nor can it be a submarine linear platform or plateau from a linear block of rock mass that rises up between two parallel faults or crustal fractures because such structures are not found in this area,' he reasoned.

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Extending the thesis further, the Swamiji said the present formation could not be a coral ridge as coral islands were scattered in the coastal and offshore areas and not in the present site which was running at right angles to the coastline. Also, the undersea land strip could not be a submerged hill or an anticlinal (sloping downward away from a common crest) ridge as the bridge was found in sediments which were not subjected to any folding activity, he explained.

'Thus with no evidence to the contrary, the under-sea bridge could not be a geological formation and remained a man-made structure only,' he said citing the geologist's study.

Referring to the gazette published in 1803 by the British government for the Madras Presidency, Swami Dayananda Saraswati said in the glossary, the first entry was 'Adam's Bridge' which, it noted, was also called Rama's Bridge or Neela's Bridge.

The gazette also mentioned the bridge's position in terms of latitude and longitude with its dimension of 30 miles length and 1.25 miles wide. 'The gazette further reports the bridge was used by people to cross between Tamilnadu and Sri Lanka until the middle of 15th Century when there was a breach due to a storm, causing a part of the bridge to be submerged,' he recalled. The copy of the map of the bridge along with its submerged portion in that period was available in the Saraswati Mahal Library in Thanjavur.

'With all these facts, we can safely assume that Rama Setu is much more than a Hindu sentimental issue. It is an issue of national and human heritage,' the Swamiji said. If UNESCO came to know of this ancient land-strip, it would safeguard Rama Setu as a 'phenomenal accomplishment of human genius,' he said.

http://newstodaynet.com/29apr/ld4.htm

AR Mudaliar Committee (1956) Report against any passage across Adam's Bridge (Rama Setu)

Excerpts below provide an overview of the alternative channel alignments considered to either create a canal or just a passage across the Gulf of Mannar and Palk Straits. The categorical recommendations of AR Mudaliar Committee (1956) are as follows, against any passage across the Adam's Bridge.

> We are convinced that the Adam's Bridge site is unsuitable for the following reasons:
>
> First: The shifting Sandbanks in this area present a far more formidable problem – both at the stage of construction and during maintenance – than the sand dunes on the island site.
>
> Secondly: The approaches to a channel would be far too open with no possibility of construction of protective works. A channel at this site – even if it can be made and maintained (which is unlikely) – would entail definite navigational hazard.
>
> Thirdly: The channel would be bordering on the Setusamudram Medial Line. In these circumstances we have no doubt, whatever that the junction between the two sea should be effectd by a Canal; and the idea of cutting a passage in the sea through Adam's Bridge should be abandoned.

By not heeding these warnings, what started as a canal project has been converted into a mid-ocean channel passage.

It is surprising that these recommendations have been suddenly abandoned in favour of a mid-ocean passage increasing the distance of the channel for ships, increased dredging quantities with related increased costs and exposing the entire coastline of Tamilnadu and Kerala to devastation in a tsunami of the type that struck on Dec. 26, 2004. In fact, all the alignments considered so far should be revisited and reevaluated taking into account the impact on sea-depths caused by this tsunami.

The failure to consider Mudaliar Committee injunctions against any Adam's Bridge alignment and the failure to consider the impact of a tsunami on the alternative channels and the failure to provide tsunami protection measures as an integral and vital component of the project raise matters of serious concern to coastline security and security of the coastal people.

Present Channel Alignment

> The present Setusamudram Ship Channel is locating at a distance of more than 20 Km from Shingle Island of Gulf of Mannar near Dhanuskodi. The channel connecting Gulf of Mannar and Bay of Bengal through Adam's Bridge, Palk bay and Palk Strait running parallel to the Indo-Srilankan Medial Line at a minimum distance of 3Km within India's own territorial waters. The total length of the channel is 167 Km, 12m deep and 300m wide at bottom.

The present channel having two legs one in the Adam's Bridge where the average depth is only about 3 meters and the other leg is in the Palk Strait where the average depth is about 6m to 8m. In Gulf of Mannar and the other stretches at Palk Bay, the channel will utilize the natural depth already available.

The length of the channel in various section is as under:-

Section	Length in KM	Area
G-A	04.37	Adam's Bridge
A-B	17.30	Adam's Bridge
B-C	13.38	Adam's Bridge
C-D	37.44	Palk Bay
D-E	40.48	Palk Bay
E-E_4	54.25	Palk Strait
	167.22	

For further details visit http://Setusamudram.gov.in/

After the NEERI suggestion of alignment 6 (the present alignment on which work is proceeding), a cataclysmic event occurred, the tsunami of Dec. 26, 2004. This event should have necessitated a TOTAL and COMPREHENSIVE review of the entire project since the bathymetry (sea-depths) had changed (with rise of the sea-bed by about 200 metres in some regions) and devastation of aquatic life by denuding the resources in the Gulf of Mannar by as much as 66 percent. As observed in PMO observations of 8 March 2005, the impact of any future tsunami on the chosen channel passage should have been subjected to a careful, multi-disciplinary review and evaluation. This was not done. PMO observations also referred to the views of tsunami-expert, Prof. Tad S Murthy who opined that the chosen alignment with the mouth of the channel directed to the direction of the tsunami would result in the destruction of Kerala and of Tamilnadu coastline due to 1. experience of the tsunami of 1964 in Alberni canal and 2. the principle of quarter wave resonance amplification (when a body of water forcefully tries to enter a tube, the wave amplitude increases four-fold). This is what happened in Alberni canal resulting in the devastation of Alberni port.

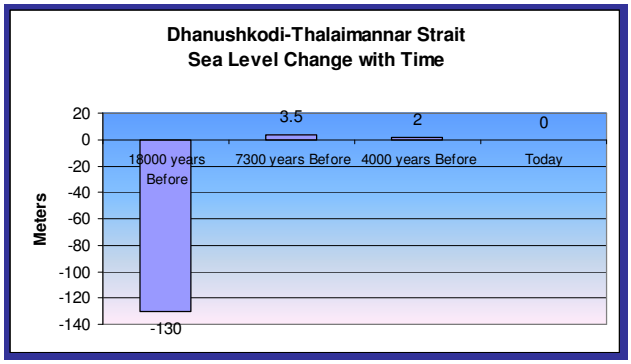
NEERI did not take into account the role of Rama Setu (Adam's bridge) and ocean currents in the accumulation of placer deposits of thorium, a vital nuclear resource of the nation. The impact of another tsunami on these resources have also not been taken into account since the new passage is likely to function like a funnel absorbing the energy of the tsunami (instead of the waves going around Srilanka) and thus, directly impacting the coastline.

Rama Setu (Adam's bridge) is a sacred monument. NEERI has failed to take this fact into account before suggesting the new channel passage route.

An unusual (coincidence?) event occurred on 23 June 2005 following the visit of US naval ships in 1993, 1994 and 1999 in the region to assert the US failure to recognize the traditional claims of India and Srilanka treating these as HISTORIC waters under the Law of the Sea 1958.

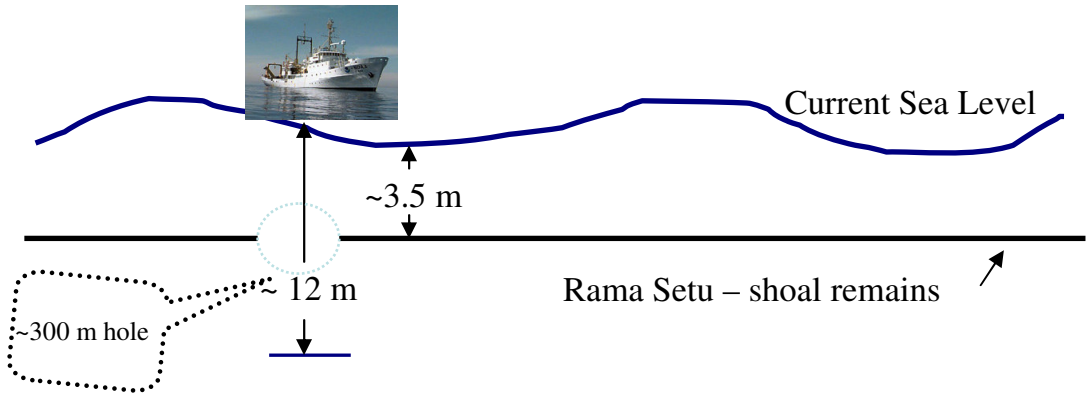
By choosing a channel passage running close to the medial line, a new phenomenon is sought to be created: an international waters boundary between India and Srilanka. A medial line is only relevant for recognizing the ownership of ocean properties of shanka (chank) and pearl fisheries. Traditionally, fishermen and pearl-divers had the freedom to move across the medial line treating the waters as historic, internal waters. US Navy Operational Directive of 23 June 2005 treating these as international waters is a serious assault on the nation's sovereignty and integrity. NEERI did not take into account the implications of the intrusion of international politics in this region.

The impact on the lives of fisherfolk and coastal people will be devastating if the new new channel passage becomes a de facto international waters boundary since fish resources are available on the Srilanka side and will become inaccessible to the coastal people of Bharatam.



Sea levels change; and were 130 m lower about 18,000 years ago, that is, the Setu would have been used to link Dhanushkodi and Talaimannar

Status: 12 April 2007: About 1.4 % dredging done in the Rama Setu area (35.05 kms.)



All the feasibility studies and evaluations done prior during and prior to 2004 in formulating the SSCP have to be reviewed afresh because of a devastating natural catastrophe which struck the Bharatam coastline on December 26, 2004. The tsunami of December 26, 2004 had changed the bathymetry so radically that at some places, the seabed had risen by about 200 metres. It is surprising that little attention was paid to the impact of the tsunami on the project components and the imperative of incorporating tsunami protection measures was totally ignored. This is shocking dereliction of responsibility of the state: (1) to ensure national integrity and security and (2) to protect the lives of coastal people from a natural hazard of tsunami which is likely to recur since it is premised on earthquakes caused by recurrent plate tectonics. It is notable that in early April (April 2, 2007), a tsunami warning was issued to Tuticorin when a massive earthquake struck in Solomon

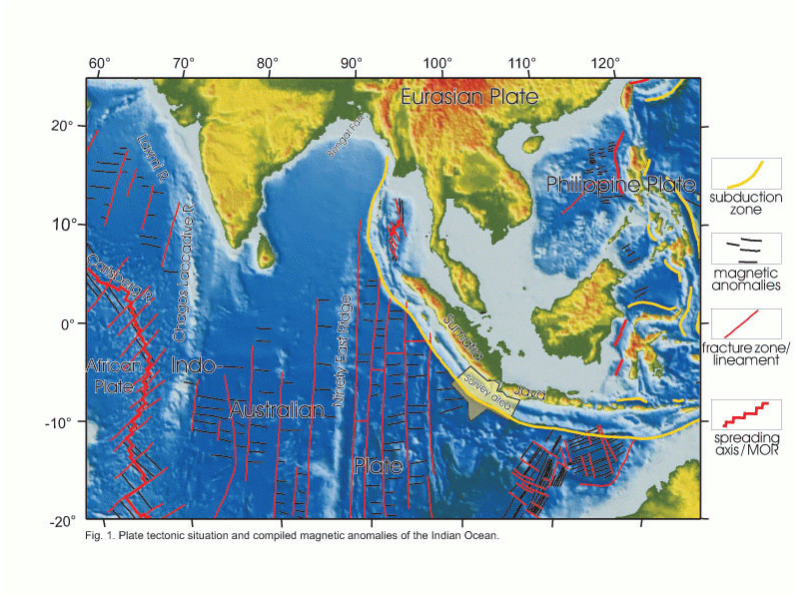


Fig. 1. Plate tectonic situation and compiled magnetic anomalies of the Indian Ocean.

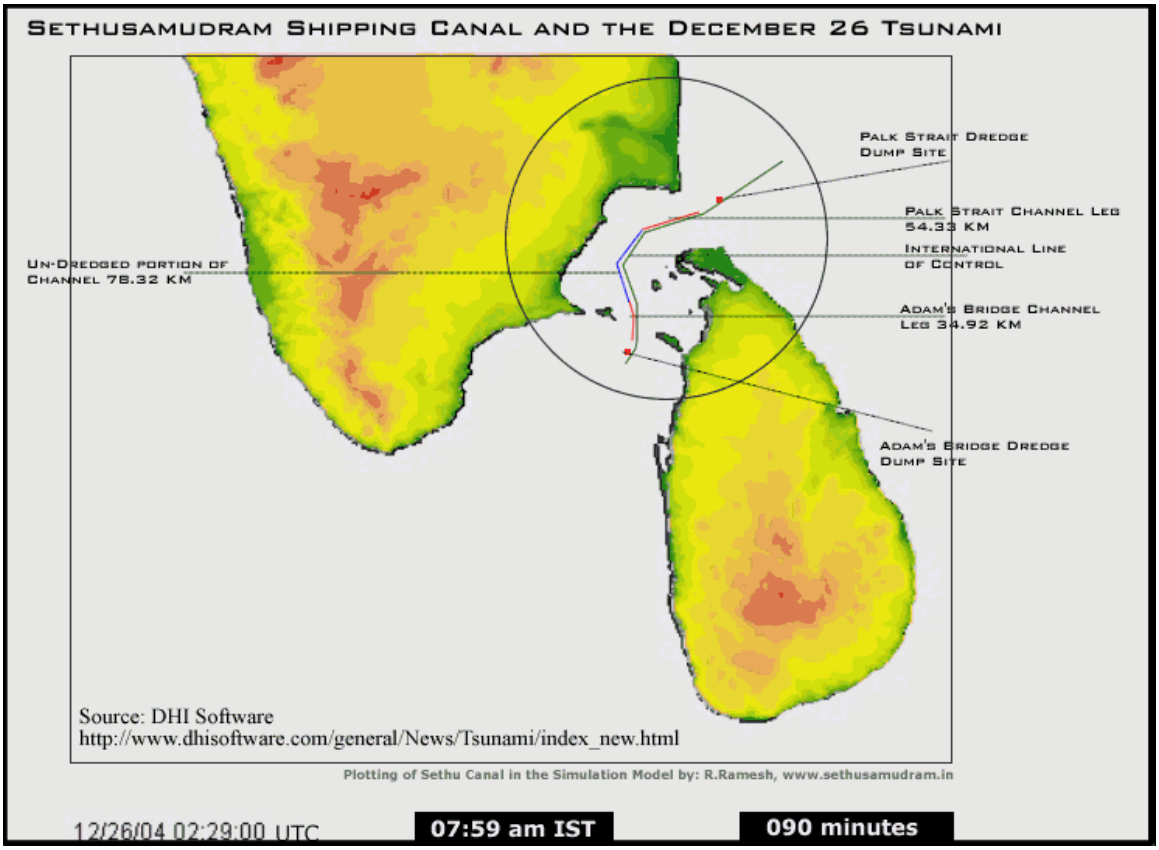
Islands. [quote] Quake lifts Solomons island out of the sea: The seismic jolt that unleashed the deadly Solomons tsunami this week lifted an entire island metres out of the sea, destroying some of the world's most pristine coral reefs. In an instant, the grinding of the Earth's tectonic plates in the 8.0 magnitude earthquake last Monday forced the island of Ranongga up three metres. Submerged reefs that once attracted scuba divers from around the globe lie exposed and dying after the quake raised the mountainous landmass, which is 32km long and eight kilometres wide. Corals that used to form an underwater wonderland of iridescent blues, greens and reds now bleach under the sun, transforming into a barren moonscape surrounding the island. The stench of rotting fish and other marine life stranded on the reefs when the seas receded is overwhelming and the once vibrant coral is dry and crunches underfoot. Dazed villagers stand on the shoreline, still coming to terms with the cataclysmic shift that changed the geography of their island forever, pushing the shoreline out to sea by up to 70 metres. [unquote] http://www.theage.com.au/news/world/quake-lifts-solomons-island-out-of-the-sea/2007/04/08/1175970944155.html
http://www.bgr.de/b322/grafik/ginco_fig1_k.png

Tsunami alert on coast Staff Reporter (The Hindu, April 3, 2007)

Tuticorin: The district administration sounded an alert this morning along the coastline here following a tsunami strike due to an earthquake of 8.1 magnitude at Solomon Islands in the South Pacific on Monday. Collector R. Palaniyandi said that instructions were issued to people living close to the coastline to be cautious.
http://www.thehindu.com/2007/04/03/stories/2007040308260600.htm

Tsunami computer simulation (powerpoint show)
http://sarasvati95.googlepages.com/tsunami.pps

Because shoaling effects are what make the Tsunamis extreme, detailed information of the coastline is essential…



The same gif image is available in video format at http://www.dhisoftware.com/general/News/Tsunami/latest/AroundSriLanka_hd01A2_DivX.avi (Can be played using Windows Media Player).

Details are provided in a technical paper presented in an international symposium. http://www.dhisoftware.com/mike21/download/Papers_Docs/TsunamiPaper_v5.pdf

http://www.dhisoftware.com/general/News/Tsunami/index.htm

Frame from a computer animation of the December 26, 2004, Indian Ocean tsunami (animation can be viewed at URL http://staff.aist.go.jp/kenji.satake/animation.gif). Frame shows the tsunami 10 minutes after it was triggered by the earthquake. Red represents a positive wave (crest arrives first), and blue represents a negative wave (trough arrives first—drawdown warns of approaching crest of tsunami wave). Deeper colors represent larger wave heights. (Note: This model shows a longer wave front than the oblique-perspective model, because the modeler assumed a longer fault rupture as the tsunami trigger. Seismologists are still sifting through the evidence to determine the length of the deep rupture that caused the earthquake and subsequent tsunami.)

Post-**Tsunami** Field Surveys

By December 31, 2004, six international teams (including Japanese and American teams) had been formed to document the magnitude and effects of the tsunami before the evidence is destroyed. Typically, such teams arrive in the affected areas about one to three weeks after the tsunami occurs. Because this was the largest

tsunami in more than 40 years and the area affected is very large, there could be as many as a dozen international teams investigating the tsunami. USGS oceanographer Bruce Jaffe and USGS geologist Bob Morton traveled to Sri Lanka from January 7 to 16 with an international team funded by the National Science Foundation and the USGS to examine inundation areas, estimate wave heights, determine the tsunami's precise arrival time, scour the area for geologic evidence and sedimentary deposits, and examine structural damage. As of this writing, the USGS had also been invited to have scientists participate in post-tsunami surveys in India, Thailand, and Sumatra.

Ideally, post-tsunami surveys will include both a quick response focusing on ephemeral evidence and a later response (possibly in February or March) focusing on tsunami sedimentation and erosion. The quick response will include measurements of water levels, inundation distances (horizontal distance from the shoreline to the farthest inland reach of the tsunami), and indicators of the tsunami's flow direction and flow velocity. The later response will focus on the sediment deposited by the tsunami: whether it has characteristics that reflect those of the tsunami itself, such as its height, power, and extent; how much of the sediment is likely to be preserved in the geologic record; and how much is likely to be eroded away. The more we learn about sedimentary deposits from modern tsunamis, the more accurately we can identify and decipher sedimentary deposits from ancient tsunamis. Because scientists cannot yet predict when a tsunami will occur, learning to read a geologic record of past tsunamis may be one of the only ways to assess future risk.

USGS scientists have conducted such studies of sediment deposited by recent tsunamis in Papua New Guinea (tsunami of 1998, see Preliminary Analysis of Sedimentary Deposits from the 1998 PNG Tsunami) and Peru (tsunami of 2001, see Preliminary Analysis of Sedimentary Deposits from the June 23, 2001 Peru Tsunami). They are working to determine how sediment layers deposited by tsunamis differ from those deposited by large storms, such as hurricanes, to aid identification of tsunami deposits in the geologic record (see Sound Waves article "Group Aims to Distinguish Tsunami Deposits from Large-Storm Deposits in the Geologic Record").

Tsunami Information on the Web

Many Web sites have information about the Indian Ocean tsunami and tsunamis in general. Here are a few particularly useful ones:

- USGS Northern Sumatra Earthquake event page: http://earthquake.usgs.gov/eqcenter/eqinthenews/2004/usslav/
- USGS site, with basic tsunami information: http://walrus.wr.usgs.gov/tsunami/basics.html
- Pacific Marine Environmental Lab (PMEL): http://www.pmel.noaa.gov/tsunami/home.html
- Russian Tsunami Laboratory: http://tsun.sscc.ru/tsulab/20041226.htm
- UNESCO site, with animation and links to additional news stories: http://ioc.unesco.org/itsu/
- International Research Institute for Climate Prediction site, with scientific background on the Indian Ocean earthquake and tsunami: http://iri.columbia.edu/~lareef/tsunami/
- USGS Circular 1187, "Surviving a Tsunami—Lessons from Chile, Hawaii, and Japan" (also available in Spanish): http://pubs.usgs.gov/circ/c1187/

- USGS site addressing the question "Can it happen here in the United States?": http://earthquake.usgs.gov/eqcenter/eqinthenews/2004/usslav/canit.html (summarized in article "Could It Happen Here?," this issue)

The sixteen detailed queries raised by PMO (Prime Minister's Office) on 8 March 2005 and the observations provided (30 June 2005, that is the date the information was posted on the government website) by Tuticorin Port Trust) are cited at the following URL in the official website of Setusamudram Corporation:

http://Setusamudram.gov.in/Prime.asp

Prof. Tad S. Murthy of Canada raised serious concerns on the devastation of Kerala through the proposed canal which will suck in the next tsunami waves if the present alignment is retained. The responses, again provided by Tuticorin Port Trust can be seen at URL http://Setusamudram.gov.in/TedArticle.asp See also: http://manisanga.blogspot.com/

This note deals with the following issues:

1. Questions raised by Prime Minister's Office
2. Questions raised by Tamilnadu Pollution Control Board
3. Questions raised by tsunami expert Prof Tad S Murthy
4. Questions related to impact on aquatic environment of Gulf of Mannar
5. Questions related to social impact on livelihoods of coastal people (not covered by impact analyses)
6. Impact on sentiments of the people based on tradition of Ramar bridge

1. Questions raised by Prime Minister's Office

The timing of the response by Tuticorin Port Trust is significant. After two days, the SSCP (Setusamudram Canal Project) was inaugurated at Madurai.

There is no indication if NEERI was asked to review its 2004 environmental impact analysis. There is also no indication if NEERI was asked to respond to PMO's observations of 8 March 2005.

It is strange that Tuticorin Port Trust was asked to respond to PMO's queries. The correct agency should have been NEERI under the agreement entered into between Govt. of India and NEERI. See the terms of agreement with NEERI at http://Setusamudram.gov.in/Terms.asp

The answers of the Tuticorin Port Trust which formed the basis for inaugurating the project on July 2, 2005 are apparently prepared by a private company, Dr. P. Chandramohan of Indomer Hydraulics Pvt.Ltd., Chennai. The possible conflict of interests in engaging a potential contractor/consultant in making such an evaluation is a matter of concern impacting on the impartiality and objectivity of the answers provided. On such a serious concern raised by PMO, the evaluation of the impact of a tsunami on the canal project has been irresponsibly and haphazardly managed. All the PMO's concerns should have been referred to NEERI and the NEERI should have been asked to re-evaluate the two principal issues: 1. impact of another tsunami on the canal as aligned; 2. impact on the ocean currents by the choice of dumping areas for the dredged materials. These two issues were NOT evaluated by NEERI because

the final alignment was not known to NEERI and tsunami struck on 26 December 2004, an event which was taken into account in the earlier evaluation report of NEERI.

The haste with which Tuticorn Port Trust was asked to respond to PMO's queries raises serious questions on the violation of the process instituted by the Government in conducting an unbiased and objective evalution by a competent agency. The competence of Tuticorin Port Trust in answering all the 14 queries raised by PMO is unclear. This violation of due process raises serious questions on the viability of the entire project.

2. Questions raised by Tamilnadu Pollution Control Board

An Expert Committee appointed by Tamilnadu Pollution Control Board had pointed out shortcomings in the National Environment Engineering Research Institute (NEERI) Report. http://Setunews.blogspot.com/

3. Questions raised by Prof. Tad S. Murthy

Similarly the concerned raised by the tsunami expert Prof Tad S Murthy should have been referred to NEERI for review and response.

In a recent response, Prof. Murthy of Canada has further mentioned that he mentioned about his concerns to the Chairman of SSCP, Mr. Raghupathy and assumed that as a senior IAS officer Mr. Raghupathy would have taken his concerns into account. There is no indication if Mr. Raghupathy reported these issues to the authorities concerned and organized for a scientific technical re-evaluation of the entire project and in particular, its alignment in view of the serious nature of the observation of Prof. Murthy that the next tsunami will devastate Kerala coastline if the canal is not re-aligned to avoid sucking in the next tsunami waves.

The possibility of a next tsunami are very real. There is a high probability that plate tectonic events (subduction of Indian plate under Burmese plate) will continue resulting in another tsunami. This has been confirmed by scientific simulation models. In Japan and Hawaii, tsunami are regular events and Japan has taken measures by raising high protection walls along the coastline. In a situation where the Setu bridge (Adam's bridge) served as a natural protective wall during the last tsunami of Dec. 26, 2004, it will be a serious breach of trust and an impending disaster to the coastline of Bharatam. A re-evaluation of the project should be undertaken immediately and the work on SSCP should be suspended until such evaluation is carried out through world's reputed experts.

Another serious area of concern is the fact that while Panama and Suez canals are canals dug out of land areas, the SSCP is proposed to be constructed within the sea. There is no experience anywhere in the world for such a canal within the sea. It is submitted that Tuticorin Port Trust is NOT the competent authority to provide answers to PMO's queries. Expert opinions should be obtained on the implications of building a canal within the sea, particularly in a region where the seabed has been raised by half because of the continuous accumulation of shoals brought in the ocean currents.

The impact on the flow of the ocean currents which have an effect on climate and monsoon cycles by the creation of a canal should also be evaluated. There is no

indication that NEERI has undertaken such an impact analysis. There are not enough studies on the ocean currents in the region and their effects on the monsoon systems created by the inter-tropical convergence zone around Taiwan which results in regular storms and cyclones all along the Bay of Bengal coastline with repeated damages caused in the coastline of Andhra Pradesh and Orissa.

4. Impact of the project on aquatic environment

A rapid assessment on corals of Gulf of Mannar after the tsunami was made by Dr. JK Patterson Edward. This is available at http://Setusamudram.gov.in/PeterArticle.asp This report concludes that the tsunami did NOT significantly impact the corals.
But this report does not provide any analysis of the impact of the project on aquatic environment with particular reference to the conch-shell diving industry which is the major industry in the Keezhakkarai group of 7 islands.

5.Questions related to social impact of SSCP not covered by impact analyses

What impact the SSCP will have on the livelihood of the shell-divers is unclear from the reports made available so far. Similar impact analysis on the livelihood of fisher folk and other people dependent upon the marine resources has NOT been included in the impact analyses.

This leads to the imperative of the evaluating the sociological impact and impact on the livelihoods of the coastal people dependent on the coastline and the marine resources. What impact the SSCP will have on the area available for fishing and other aquatic industries is not clearly indicated in the impact analyses reports.

6.Impact on sentiments of the people based on tradition of Ramar bridge

SSCP - A monument of fraud and infamy

By V Sundaram

'My conscience hath a thousand several tongues. And every tongue brings in a several tale. And every tale condemns you for a villain.'

- Shakespeare

Many of the Union Cabinet Ministers and many of the Public Servants in positions of high authority in the Government of India need public insults in the larger public interest. Many of them behave or conduct themselves so abominably as oriental sultans that they cry out for public abuse. Like the proverbial Indian monsoon, they also display all the vagaries of an oriental potentate! Abuse is a form of attention, and a little accommodating attention makes anyone feel human again. But in this backhanded humanity the mere shouting of common profanities will never suffice. Nor, by themselves, will your purple gestures! Fill your lungs, certainly, and clench your fingers, but as The Complete Person you must shoot out that agile turn of phrase, that chosen word, that little touch of Shakespeare in the right. ***Shakespeare gets the last word***. The public men who are responsible for the shoddy evaluation and murky implementation of the ***Setusamudram Shipping Canal Project*** (**SSCP**) can only be appropriately described in the words of Shakespeare as: 'horrible villains! Villains of the Earth! Soulless villains! Secret and villainous contrivers! Dissembling villains! Hungry villains! Insolent villains! Smiling, damned villains! Abominable villains! Treacherous villains!' Any one see from this that Shakespeare marshals his robust humility that does not mind admitting human indignity and points out vicious frailties amongst some men with subtlety and power in high positions of public irresponsibility!

I am of the view that the ***Setusamudram Shipping Canal Project*** **(SSCP)** is a monument of fraud and national infamy. The Office of the Prime Minister, The Union Ministry of Shipping and Transport, The Tuticorin Port Trust have collectively bungled in a calculated manner in according sanction to this Project which in my view will only lead to disastrous consequences.

Setusamudram Corporation Ltd has been constituted for the implementation of the project. Once the project is completed, it is expected on paper that the sailing time and distance for ships between East and West coast would be considerably reduced. The **SSCP** involves cutting of a ship channel to connect Gulf of Mannar and Bay of Bengal so that most of the ships moving between east and west coasts of India can have a navigable sea route around the peninsula within India's territorial waters, without circumventing Sri Lanka. But many responsible Merchant Navy Officials and top Indian Navy Officials however say that even after the completion of the project, the depth of the Channel between the two nations will only be 12 metres and big vessels like ***Very Large Crude Carriers*** (**VLCCs**) won't be able to pass through the channel. Only medium-size or empty vessels will be able to pass through it. **SSCP** will thus turn out to be only a planned abortion of sorts!!

In 2002, ***Tuticorin Port Trust (*****TPT)** appointed **NEERI** as consultants for carrying out **Rapid & Comprehensive Environment Impact Assessment Studies** along with assessment of the Techno-economic viability of the project. The

objective of the study was to obtain Environmental Approvals from the concerned local, state, and central government authorities. The terms of Reference issued by **TPT** to **NEERI** comprised of two sections viz. one related to Techno-economic viability and the other related to ***Environment Impact Assessment*** (**EIA**).

In the latter half of 2002, **NEERI** presented a report on the status of the marine environment which was established by drawing on the data collected during the **EIA** in 1998. ***It presented a detailed analysis of the various marine environmental components which clearly confirmed the long known and established fact of rich biodiversity of the Gulf of Mannar and Palk Bay.***

NEERI COMPLETED ITS WORK LONG BEFORE SOUTH INDIA WAS STRUCK BY TSUNAMI IN DECEMBER 2004. All the Geologists, Earth Scientists, Oceanographers, Marine Biologists and other Ocean Scientists (excepting T.R.Baalu and Ragupathy, Chairman Tuticorin Port !!) are categorically of the view that the marine environment in Palk Bay and Gulf of Mannar was radically altered and transformed after the tsunami. The evaluation report prepared by **NEERI** in the light of field data collected or observed before the tsunami in December 2004, cannot form the correct basis for according final sanction for the ***Setusamudram Shipping Canal Project*** **(SSCP).**

What is interesting to note is that sixteen (16) detailed queries were raised by **PMO** (***Prime Minister's Office***) on 8 March 2005 on various aspects relating to the environment impact, viability, dredging and other repercussions following tsunami in December 2004. These queries were sent to the Office of the Chairman, Tuticorin Port Trust on March 8 2005. The Tuticorin Port Trust sent its detailed reply to the **PMO**s Office only on 30 June, 2005 (this is the date on which the information was posted on the government website by Tuticorin Port Trust.)

The People of India in general and the people living in the costal areas of Southern Tamil Nadu and more particularly the fishermen, have a fundamental right to raise the following public issues before the Government of India:

1. Why did the **PMO**s Office refer the matter only to the Office of the Chairman of Tuticorin Port Trust, and not to Government of India's scientific and technical agencies like **NEERI** and several other Scientific Bodies under their own control, for further detailed study, analysis and report? Was not the **PMO**s Office aware of the unprecedented damage caused by the tsunami disaster in South India in December 2004? Is it not strange that only the Tuticorin Port Trust was asked to respond to **PMO's** queries? The correct agency should have been **NEERI** under the agreement that had already been entered into between Government of India and **NEERI**. Why was **NEERI** ignored or neglected on this crucial occasion?

2. Did the Office of the Chairman of Tuticorin Port Trust refer the matter to the **NEERI** for its detailed analysis and comments in the light of the totally new environment and field situation created by the tsunami in December 2004? There is no indication whatsoever as to whether **NEERI** was ever asked to review its 2004 environmental impact analysis taking note of the post- tsunami field situation in December 2004. While the whole world became fully aware of the cataclysmic impact of Tsunami on the Coastline of Southern India as early as in January 2005, why did the office of the Chairman of Tuticorin Port Trust choose to remain in a state of self-chosen amnesia, if not pseudo-secular 'Sonia Coma' on this vital point till June 2005?

Was it because of the unscrupulous and unavoidable partisan political pressure from the DMK Party—a deadly enemy of Hinduism-- in general ?

3. What is intriguing to note is that the Office of the Chairman of Tuticorin Port Trust sent their final reply to the sixteen (16) detailed queries raised by **PMO** (***Prime Minister's Office***) on 8 March 2005 to the **PMO** only on 30 June 2005 (posted on **SSCP** Website on that date!!), after a politically calculated delay of more than 3 months! The timing of the response by Tuticorin Port Trust is significant. Two days after Tuticorin Port Trust sent its final reply to **PMO,** the **SSCP** (***Setusamudram Shipping Canal Project***) was inaugurated by the ***de jure*** Prime Minister Dr Manmohan Singh and the ***de facto*** Prime Minister Sonia Gandhi at Madurai with great fan fare on July 2, 2005. ***The people of India have smelt a rat in this sequence of stage managed events to cover up many shady facts relating to the*** **SSCP**. In the last week of June (23rd of June, 2005 to be exact) the ***Neo***-**Nazi** Government of USA under the leadership of an American Adolf Hitler like President Bush had issued a unilateral notification to the effect that the US Government does not recognise the long established and traditional **"HISTORICAL NAVIGATIONAL WATER RIGHTS OF EITHER INDIA OR SRILANKA IN THE PALK BAY OR GULF OF MANNAR"—**all the time-honoured historical waters ***(Rights)*** that have been duly recognised by the United Nations and all its Maritime Organisations/Bodies during the last 50 years and more. Perhaps, this was an indirect American threat and ultimatum to the Government of India to rush through the implementation of the shoddy, half- baked and politically twisted ***Setusamudram Shipping Canal Project*** (**SSCP).** When Sonia Gandhi shared the dais with Karunanidhi and T.R.Baalu on July 2nd, 2005 in Madurai, there can be no doubt that on that fateful day, the ***hot*** anti-India proclivities of United States, ***cold*** anti-Hindu perceptions of a non-Hindu like Sonia Gandhi, and the rationally brazen anti-Hindu sentiments of a Dravidian leader like Karunanidhi murkily colluded and coalesced with one another with cold premeditated pseudo-secular frenzy for the calculated strangulation of Mother India in perpetuity. Our Surrogate Prime Minister covered himself with everlasting disgrace when he bowed low before the Christian blast of Sonia Gandhi and the Dravidian grunt of Karunanidhi by acting as the Master of Ceremonies on that day of national infamy in Madurai.

The haste with which Tuticorn Port Trust was asked to respond to **PMO**'s queries raises serious questions on the violation of the **Due Process** instituted by the Government in conducting an unbiased and objective evaluation by a competent agency. The competence of Tuticorin Port Trust in answering all the 14 queries raised by **PMO** is unclear. This violation of **Due Process** raises serious questions on the viability of the entire project.

The answers of the Tuticorin Port Trust which formed the basis for inaugurating the project on 2 July, 2005 were apparently prepared by a private company, Dr P.Chandramohan of Indomer Hydraulics Pvt.Ltd., Chennai. The possible conflict of interests in engaging a potential contractor/consultant in making such an evaluation is a matter of serious public concern impacting on the impartiality and objectivity of the answers provided on the serious issues raised by the **PMO** in March 2005.

The evaluation of the impact of a tsunami on the canal project has been irresponsibly and haphazardly managed. All the **PMO's** concerns should have been referred to **NEERI** and the **NEERI** should have been asked to re-evaluate the following two principal issues:

1. What will be the **total overall impact**--**in all its ramifications**--in the tragic event of another tsunami if the proposed **SSCP** is constructed (with reference to its ***'politically'*** proposed physical alignment) on the coast line of Tamil Nadu and Kerala, on the livelihood patterns of fishermen and other people of the area, on the flora and fauna of the region in general etc etc**?**

2. What will be the tectonic impact on the ocean currents by the choice of different dumping areas for the dredged materials?

These two critical and crucial issues were NOT evaluated by **NEERI** because the final **alignment** now chosen for implementation was not known to **NEERI** and the gruesome event of tsunami which struck South India on 26 December 2004 was not taken into account at all in the earlier evaluation report of **NEERI**.

Dr Tad S Murthy of ***Canada*** is one of the world's most respected tsunami experts. Dr. Murty is Chief Editor of the reputed International Tsunami Journal **'Science of Tsunami Hazards'** for over two decades and presently teaches at the University of Ottawa. Till recently, he advised the Canadian government on tsunamis and played an important role in the development of the **'Baird'** simulation model of the 26 December, 2004 tsunami. He has commented extensively and critically about the disastrous consequences of the ***Setusamudram Shipping Canal Project***

Prof Tad S Murthy of ***Canada*** has raised serious concerns about the devastation of Kerala through the proposed **SSCP** which will suck in the next tsunami waves if the present alignment is retained, completely blasting out the coastline of Kerala from Cochin to Thiruvanandapuram. The Chairman of Tuticorin Port Trust has completely ignored the scientific and technical warnings given by ***Prof. Tad S Murthy*** of ***Canada.***

No one can dispute the fact that the ***Setusamudram Shipping Canal Project*** (**SSCP**) has been planned, organised and launched as a ***Political Asset*** for a few Cabinet Ministers in the UPA government and some of their counterparts in Tamil Nadu. According to expert, unbiased technical and scientific opinion in India and abroad, **SSCP** is a scientifically inconsistent, technologically non-feasible project at the present time. The cogent arguments presented by some Tsunami specialists and Earth scientists of international stature have not been considered or answered in open-transparent forums by the leading proponents of the project. Many of the vital questions raised by ***Prime Minister's Office*** (**PMO**) in March 2005 were bypassed in a subterranean manner by imaginative, covert, sly and stealthy manoeuvres and operations by all the **SSCP** implementing agencies of the Government of India. What is amazing is that the top brass of the Indian Navy has remained silent or neutral on the **SSCP** and the brazen promoters of the **SSCP** – ***I mean the firmly entrenched vested interests invested with Ministerial Authority and involved only in an organised private loot under the garb of public interest*** -- have become the final arbiters and Naval Strategists of Palk Bay and Gulf of Mannar!! The Union Defence Minister and Chief of Naval Staff seem to have surrendered their Constitutional Authority to the Union Minister for Shipping and Transport T.R.Baalu. It is a well known national public fact that some are more interested about the ***'commercial contract'*** implications of **SSCP** than about considerations of national security or national defence.

Setusamudram Shipping Canal in its present form is scientifically inconsistent and technically indefensible for the following reasons:

1) According to Dr Ramesh, **NEERI *Environmental Impact Assessment* (EIA**), the study that gives the **SSCP**, its scientific legitimacy, has ignored the studies available on the sedimentation pattern of Palk Bay completely and has not fixed the exact locations wherein the dredged material would be dumped. These studies are crucial for the economic and technical survival of project, as they will give us an idea of how much sediment should be dredged each season and also help us to know as to how and where the dumped sediments will move every season in the future.

2) Subsurface geology has been studied only for the 20 kilo meter stretch of the canal in the Adam's Bridge area. ***Nothing is known about the subsurface geology of the Palk Strait region.*** Considering the fact that the canal's length will be 54.2 km; if the sub surface turns out to be rocky, the cost of the project will go up many times, and the effect of blasting these rocks would cause serious damages to the Palk Bay environment. This was clearly stated in the Technical Feasibility Report prepared by **NEERI,** only to be politically ignored at the time of politically partisan sanction of **SSCP**.

3) The historical cyclone data for this region from the years 1860 to 2000 clearly indicate that cyclones cross this region and its neighbourhood once in every four years. Historically we have enough data to show that all these cyclones have caused severe erosion of the coastal stretch in the nearby areas from time to time by dumping the eroded material in Palk Bay and Adam's Bridge area. **NEERI**'s **EIA** has not taken note of this natural phenomenon at all.

4) Indomer's 'Hydrodynamic Modelling Study for **SSCP**' has also ignored the issue of the impact of cyclones on the canal completely. Thus, we do not know, what will happen to the canal in scientific terms during the period of cyclones.

5) Tsunami computer simulation models by ***Professor Steven N Ward*** of University of California, ***Professor Aditya Riyadi*** of Pusat Penelitian Kelautan Insitut Teknologi, Bandung, Indonesia, WI-Delft Hydraulics, Netherlands and DHI Softwares, USA and Indomer-Alkyon have described graphically the way tsunami waves attacked Palk Bay on 26 December, 2004. It is against all this background that the International Tsunami Expert Professor Tad S Murty chose to warn the ***Prime Minister's Office*** on 30 January, 2005 about the possible negative and dangerous impact of **SSCP** during the times of future tsunamis, more particularly on the Southern coastline of Kerala. The **PMO** instead of referring the matter to the **NEERI**, who were the official consultants of the Government of India, chose to refer the matter directly to the Office of the Chairman of Tuticorin Port Trust.

The **NEERI** had undertaken their **EIA** of **SSCP** long before Tsunami hit several parts of Tamil Nadu and Kerala in December 2004. A preliminary **Tsunami Impact Assessment Report** prepared by the Zoological Survey of India for the Union Ministry of Environment and Forests in early 2005 had clearly concluded that the tsunami that hit the Tamil Nadu and Andaman and Nicobar coasts in December 2004 had irrevocably altered the marine ecology of the Bay of Bengal region. No public authority connected with **SSCP** has taken note of this report.

When the **SSCP** was about to be launched in July 2005, **Dr C.P.Rajendran** of the ***Centre for Earth Science Studies in Thiruvananthapuram***, a Paleo-Seismologist and one of India's top geologists gave a timely warning to the effect that the **SSCP** should be put on hold. Giving detailed technical reasons, he concluded: ***"Setusamudram, as the name suggests, is the part of an ocean that is being constantly bridged by natural sedimentation processes, and Mother Nature has been at this work for hundreds of thousands of years. By implementing this project, we are disturbing these processes. The project lacks technical, scientific and economic credibility, and is another disaster in the making. All the objections raised by me will remain valid until these issues are resolved by an independent group of experts".***

Professor G Victor Rajamanickam is one of India's eminent coastal geo-morphologists and mineralogists. And he is an authority on the Tamil Nadu's coastal geomorphology.

In August 2005, **Professor Rajamanickam** when asked about the environmental impact of Tsunami of December 2004 replied as follows: 'The Tsunami had completely disturbed the Shelf sediment right from river Krishna down to Kanyakumari. It had disturbed the seabed even up to 200 metres. ...So, the shelf sediments now have a completely new texture after the Tsunami. If one studies the present sediments, one would be surprised to find the seabed to be a radically different one now. It is in this regard I feel that we have to undertake a resurvey of our seabed and understand the nature of the sediment present in its new dispensation and formation. **Hence I feel an understanding of the pre-Tsunami sedimentation condition alone cannot work possibly for any modelling".** The grim national tragedy is that the **SSCP** in its present shape and form is based on **an understanding and analysis of the pre-Tsunami sedimentation condition alone. The catastrophic impact of the tsunami of December 2004 on the coastline, seabed and natural environs has been deliberately ignored to politically rush through the implementation of SSCP.** I have no doubt that the ***'criminal'*** men responsible for giving a hasty clearance to the **SSCP** based on irrelevant, insufficient, and physically non-existent/ tsunami obliterated premises at the sea bed level in Palk Bay and Gulf of Mannar, will get suitably arraigned and punished under the due process of law to be enforced without any fear or favour by any successor Government in the not very distant future.

During the last tsunami in December 2004, the **Rama Setu Bridge**, also known as Adams Bridge in the Palk Bay acted as a natural barrier preventing the direct devastation of the entire South Indian coastline, south and southwest of Nagapattinam. Thus the Rama Setu Bridge, traditionally and popularly also known as Rama Setu, played a key role in protecting the coastline in South India against the unforeseen ravages of the tsunami in December, 2004.

The implementation of the ***Setusamudram Shipping Canal Project*** (**SSCP**) will operationally involve the breaking and dismantling of the Rama Bridge for creating a 300-metre wide canal. This in turn will suck the next, impending, tsunami waves directly into the South Indian coastline. The spread of the massive displacement of waters displaced by the Tsunami 'plate tectonics' of 2004 was such that it doused the Southern Tamil Nadu coastline, circling the entire Sri Lanka Island and moving partially into Kerala and towards the Rama Setu bridge. This circling around Sri Lanka occurred because the Rama Setu Bridge acted as a natural shoal

barrier preventing the inflow of waters. If the ***Setusamudram Shipping Canal*** is dug through the bridge, it will act as the channel for the waters to flow directly into the entire Southern India coastline beyond Dhanushkodi and into the coastline of Kerala right into the Konkan region. The resultant devastation will be incalculable. Keeping this aspect in mind, **Dr. Tad S. Murty,** an acknowledged international authority on the **'Tsunamis'** has clearly indicated that building the Setusamudram Canal as per the existing alignment will only lead to unprecedented disasters during the next Tsunami which can happen at any time. To quote his exact words of warning in this context: ***"I like this Setusamudram Shipping Canal Project (SSCP) but there is a flaw. The entrance to the channel should be re-oriented towards the eastern side. Otherwise, there is a chance that it may create a deepwater route for another devastating tsunami. This may cause huge destruction in Kerala".*** Taking note of this ominous warning, Government of India should immediately stop the construction of the project till this technical point raised by Dr Tad S Murty is carefully considered by a team of experts drawn from all the concerned technical fields, including the whole gamut of Earth Sciences.

Professor Tad S Murty has categorically affirmed that Chairman, ***Tuticorin Port Trust*** (**TPT)** sent him a fax dated early February 2005 stating that the **SSCP** ***had been finalised by the end of February 2005*** (!!) and they wanted Professor Murty's comments within 24 hours!!. Murty sent a short reply explaining as to why the Eastern entrance of the proposed channel in the **SSCP** should be realigned and reoriented in the larger interest of coastal safety. Murty has stated that he received a reply from Chairman, **TPT** saying that his experts outright dismissed Murty's idea/perception as ridiculous because it had absolutely no merit. Murty's comments are very relevant in this context: ***"I do not worry that TPT does not think much of my ideas or me. I do not have to justify myself to TPT. I have to fight my battles, not with TPT but in the field of peer reviewed international scientific journals".***

Further, the Monitoring Committee set up by the Ministry of Shipping, Government of India to assess the impact of the dredging activity on the environment and advise the project authorities had included only marine biologists and microbiologists besides experts from the fields of fisheries and agriculture. It is shocking to note that it had not considered including sedimentologists, geo-morphologists or meteorologists, hydrographers, geologists, coastal tectonics experts, or experts from atmospheric sciences in the Committee. The present monitoring team, of scientists drawn from the disciplines of Marine Biology, Fisheries etc., will be able to do only 10 per cent of the total required monitoring work and the remaining 90 per cent has to be legitimately done by earth scientists. The total absence of eminent Earth System scientists in the Monitoring Committee will definitely bring in or create new problems to the continued maintenance of Palk Strait in the future.

Against this background it should be clear that there has been an organised conspiracy of firmly entrenched vested interests, composed of the **PMO**, the Union Ministry of Shipping and Transport and the **TPT,** to ignore the best technical advice given by International experts about the wholly avoidable dangers and disasters of the **SSCP** in its present shape. The beautiful words of the great ***American Judge*** **Justice Cardozo** are very relevant in this context***: "Means unlawful in their inception do not become lawful by relation when suspicion ripens into discovery".***

There is no table of weights and measures for ascertaining or determining what constitutes the **Due process**. What is **Due Process** of law or procedure depends upon circumstances. It varies with the subject matter and necessities of the situation. **Due process** requires that the proceedings shall be fair, but fairness is a relative, not an absolute concept. It is fairness with reference to particular conditions or particular results. Whichever way one looks at it, there has been a total violation of the **DUE PROCESS** by the Government of India in according sanction for the **SSCP**. That is why I am appealing to the Chief Justice of the Supreme Court of India to treat this article as a petition for Public Interest Litigation and to stay the construction work till all the public issues are fully thrashed out openly in the highest judicial tribunal of the land.

Map of Rama's Bridge (Adams Bridge) and environs

Against this background, it will be clear how the Rama Setu Bridge had acted as 'a high wall' and, in fact, saved most of the coastline west and northwest of Dhanushkodi from total devastation during Tsunami 2004.

There are clear indications that the environmental clearance was given to the **SSCP** without taking into account the following fundamental engineering and cost-benefit factors/implications:

1. Definitely expected disastrous effect of a tsunami-type of event on the **SSCP**. All the scientists are unanimous in their view that a recurrence of tsunamis cannot be ruled out.

2. Differential advantages / disadvantages of different locations for dumping the dredged sand.

3. Costs of continuous dredging given the continuous sea currents which tend to create the shoals through the never-ending natural accretion process, again and again rebuilding the Rama Setu Bridge, and thus making the **SSCP**, apart from being financially unviable, inoperable most of the time.

4. There has been no market study of the numbers and types of vessels which will navigate through the channel and the freight rates expected to be paid by these vessels for being tugged through the proposed Canal.

In the interest of safety of the lives of the coastal people, it is prudent to stop the project work until the fundamental factors are re-studied and re-evaluated. It is also essential to involve ***National Institute of Ocean Technology*** (**NIOT**) in this exercise and create a Marine Archaeological Unit to study the archaeology of the Rama Setu Bridge and Kizhakkarai where S'ankha Industry has been flourishing for centuries. It will be a tragedy of incalculable proportion from the point of view of the cultural traditions of India, if this age-old industry is allowed to be devastated by the **SSCP**.

The possibility of choosing alternative strategies of physical alignment of the proposed Channel, with little or no impact on the Rama Setu Bridge should also be

re-studied, taking into account the satellite images made available by NASA. To quote the beautiful words of the eminent Cultural Historian **Dr S.Kalyanaraman** in this context: "The received narratives of the submergence of Kumarikandam should be a pointer to the imperative of careful studies before embarking on projects which hurt the cultural sentiments of the people who are inheritors of a glorious sea-faring, maritime, riverine civilization continuum".

Having dealt with the broad technical, scientific, administrative aspects of **SSCP** let me now turn to the cultural, spiritual and religious aspects/implications of **SSCP**. I am shocked by the reply which the Union Tourism and Culture Minister Ambika Soni gave in Parliament recently on the issue of this avoidable destruction of the Rama Setu Bridge. She said: ***"there are no archaeological studies which confirmed the existence of a RamaSetu Bridge between India and Sri Lanka in ancient times. …. The Government has no plans for any preservation imperative in this regard".*** Rama Setu, according to immemorial tradition, was an Indo-Sri Lanka causeway build by Lord Rama and it has an instant appeal to the imagination of Hindus in majority not only in India but throughout the world. Since insidious and wicket Union Ministers like Ambika Soni and T.R.Baalu know that they cannot so easily confiscate sacred Hindu thoughts and memories going back to the dawn of history ***(though they would love to do that!!)***, they have come together to destroy the Rama Setu Bridge in order to give a death blow to the feelings, emotions, sensibilities and sentiments of all the Hindus of India in a politically calculated manner.

I fully endorse the brilliant words of Radha Rajan, a fearless journalist with soaring idealism firmly rooted in ardent Hindu nationalism, in this context: ***"Union Minister for Tourism and Culture Ambika Soni has only confirmed the anti-Hindu bias of the UPA government. I would have been surprised only if she had not said this. It is the accepted custom and tradition of anti-Hindu Indian polity to ignore or humiliate Hindu religious sensibilities. Ambika Soni and her party President are both non-Hindus who cannot be expected to respect Hindu sentiments in this regard or venerate a traditional Hindu belief or custom. Partnered in their plans to fulfill the Setu Samudram Project is of course the genetically anti-Hindu Dravidian Chief Minister of Tamil Nadu. Caught in a pincer between non-Hindu and anti-Hindu polity, the Hindus of India, whether on Ramjanmabhumi, Srirangam temple, arrest of Pujya Kanchi Acharya or the Rama Setu, repeatedly have their noses rubbed in the dirt. Nowhere in the world, except in India, will you find a country's polity being driven by ideologies inimical to the majority populace".***

In India's decadent and immoral public life in general and politics in particular today, this is an age of classical ignorance - more particularly of Hinduism and Sanathana Dharma. I am not therefore surprised that the mighty Government of India is also steeped in Himalayan ignorance about many fundamental historical facts about the Rama Setu Bridge. Enough irrefutable cartographic evidence, which can stand the severest judicial scrutiny in any court of law, is available about the existence of the 'Rama Setu Bridge'.

Raman Coil has been shown on a 1747 map made in Netherlands. Malabar_Bowen map prepared by Netherlands given below shows Raman Coil:

We also have the 1788 edition of the map called Map of Hindustan or the Mughal Empire, which is available in Saraswati Mahal Library, Thanjavur. This map is based on explorations by an Australian Botanical Explorer called Joseph Parks. On this map, The Bridge linking Raman coil and Talaimannar (Ceylon, then Sri Lanka) is called Rama Setu Bridge.

A map of India titled as A Map of Hindustan or the Mughal Empire from the latest authorities inscribed to Sir Joseph Banks Bart President of Royal Society, was produced by James Rennel, a pioneer in map making, on 1 January 1788. James Rennell (1742-1830), was the First Surveyor General of the East India Company. He is sometimes also referred to as the ***'Father of Indian Geography'***. The original print of the map (112c.m x 106c.m) is available in the Saraswati Mahal Library in Thanjavur. The 1788 edition of this map which is open to any judicial or public scrutiny calls it the RAMA BRIDGE. But in the 1804 version of the map, the same Rennel calls it the Adam's Bridge. This renaming can only be viewed as a motivated action by a Colonial and Imperialist Administrator.

Further the space images recently taken by NASA reveal a mysterious ancient bridge in the Palk Strait between India and Sri Lanka. This recently discovered bridge currently named as Adam & laqno's Bridge is made of chain of shoals, c.18 mi (30 km) long. To quote the words of **NASA**: ***"The bridge & laqno's unique curvature and composition by age reveals that it is man made. The legends as well as Archaeological studies reveal that the first signs of human inhabitants in Sri Lanka date back to the a primitive age, about 1,750,000 years ago and the bridge & laqno's age is also almost equivalent"***. NASA, unlike Ambika Soni or Karunanidhi, is not influenced by either non-Hindu or anti-Hindu vote bank politics of India.

The Rama Setu Bridge has withstood the onslaught of centuries and seen the rise and fall of mighty global empires from the dawn of history. I would like to invite the kind attention of the Supreme Court of India to the following words of Annie Besant (1847-1933): ***"Make no mistake, without Hinduism, India has no future. Hinduism is a soil into which India's roots are stuck and torn out of that she will inevitably wither as a tree torn out from its place. And if Hindus do not maintain Hinduism, who shall save it? If India's own children do not cling to her faith who shall guard it? India alone can save India and India and Hinduism are one"***.

Against this background, I would make a fervent appeal to the Chief Justice of the Supreme Court of India to treat this article as a Public Interest Litigation Petition and to stay the implementation of the **SSCP** by issuing notices to all concerned.

(The writer, who is a retired IAS officer, was the first chairman of Tuticorin Port Trust. He was the one who completed the work on coal jetty, oil jetty and other facilities in connection with the commissioning of Tuticorin Harbour Project. He became its chief on 1 April, 1979.)

e-mail the writer at vsundaram@newstodaynet.com
See also:
http://newstodaynet.com/2007sud/mar07/060307.htm
http://newstodaynet.com/2007sud/mar07/070307.htm
http://newstodaynet.com/2007sud/mar07/080307.htm

Will ships use canal at such costs?

K.S.Ramakrishnan

Former Deputy Chairman, Madras Port Trust

Madras Musings 1-16 July 2005

The basic justification of the Setusamudram Ship Canal Project (SSCP) is that it will reduce the distance between Kolkata and Tuticorin by 340 nautical miles and between Chennai and Tuticorin by 434 nautical miles, thereby saving for the ships plying between these places both fuel cost and time involved in sailing the additional distance.

This justification will be readily valid if the SSC is a free seaway which ships can sail through without any payment to the project authority.

But the SSC can not be a free seaway… as ships will be allowed to pass through the canal only under regulated pilotage, and pushed /pulled by tugs belonging to the SSCP.

Obviously, even while saving on the cost of fuel, a ship passing through the canal will be expected to make a payment to the SSCP for using the facility.

The likely pilotage charge to be levied by the SSCP has not been made public, but an approximate figure can be guessed by extrapolating similar charges levied by the Chennai and Tuticorin Port at present.

The approach channel to the Chennai port has a length of 7 km. A 36,000 tonne coal ship calling at Chennai has to pay approximately Rs.21.75 a tonne, or a total of Rs.7.83 lakh, as pilotage charges averaging Rs.1.11 lakh per km.

Tuticorin's approach channel is only 2.4 km long and an identical coal ship calling at this port is levied Rs.17 a tonne, or a total of 6.12 lakh, towards pilotage, working out to Rs.3 lakh per km.

(The comparative lower rate per km at Chennai is because the capitol cost of digging the much older channel has been amortised a long time ago.)

The projected length of the Setusamudram channel is 56 km. Both capital and recurring cost will be much higher for the SSCP than for the Chennai and Tuticorin ports, and its levy of pilotage per km is likely to be substantially higher than that of even the latter if it has to have a 9 per cent return on the capital.

Even if the Chennai rate is assumed, the same ship will have to pay over 60 lakhs to the SSCP for passing through the canal.

But the cost of fuel that will be saved by the same ship by taking the shorter route through the Setusamudram canal instead of sailing round Sri Lanka will be less than Rs. 7 lakh, which is even less than 1/8 of SSCP's likely levy.

The saving in sailing time for that ship will also be substantially less than the 36 hours projected by the SSCP because the ship can not be towed through the canal at its normal speed through the canal, and the time will also be lost in embarkation/disembarkation of pilots and other inspection procedures. The saving in sailing time of just about a day will not justify the incurring of over 8 times the cost of fuel saved.

http://www.Setusamudram.in/htmdocs/Articles/Article%201.htm

Why the Ram Setu must not be destroyed

Tarun Vijay

Setusamudram, a project to create alternative shorter route for ships to cross the Gulf of Mannar, is a wonderful idea -- one which is more than 150 years old. The channel, originally an idea of a British commander named A D Taylor was put forth in 1860. In 1955, the Government of India set up the Setusamudram project committee to look into the feasibility of the project and five routes were discussed till 2001 but nothing happened. The National Democratic Alliance government sanctioned a few crore rupees to study the project but before a final decision on the route could be taken, the government lost power.

The official web site of the project says, 'Ships originating from the west of India and destined for Chennai, Ennore, Vishakapatnam, Paradeep, Haldia and Kolkata have to travel around the Sri Lankan coast resulting in increase of travel distance and time. Apart from this ships belonging to Indian Navy and Coast Guard need also to traverse around Sri Lanka. In order to reduce the steaming distances between the east and west coast of India and to improve the navigation within territorial waters of India, a navigation channel connecting the Gulf of Mannar and Palk Bay through Adam's Bridge has been envisaged so that the ships moving between the east and west coasts of India need not go around Sri Lanka.' The total cost of the project is Rs 2,427 crores (Rs 24.27 billion).

But due to political expediency and a pathetic problem of a 'secular amnesia' about heritage matters, it has got a controversial hue, which could have been avoided if some transparency was maintained and points of collective sensitivities and faith were not ignored. The project is fine, but the present route is not, as it involves destruction of a bridge believed to have been built by Lord Rama and Muslims and Christians believe it to be Adam's creation.

Foreigners and Indians alike have described it as Rama's bridge since ancient times in their maps and travelogues. The first time someone called it Adam's Bridge was in 1804 by James Rennell, the first surveyor general of the East India Company. Even if the Government of India prefers to use the name Adam's Bridge, it simply proves that not only Hindus but Muslims and Christians too have a reverence for the bridge it is going to destroy.

Now when the media and political leaders are busy with the Uttar Pradesh election and exit polls, the Setusamudram dredgers are busy destroying a great world heritage site India has.

The Ram Setu or Adam's Bridge connects India's Rameshwaram to Sri Lanka's Talaimannar. A movement has begun to safeguard it at the shores of Rameshwaram on April 18. Two former judges of the Supreme Court, Justice K T Thomas and Justice V R Krishna Iyer, none of them close to the saffron side, have warned the government against destroying the Ram Setu.

It is ironical that a government which changes the metro rail route to protect the Qutub Minar, built with the material of destroyed temples, stops a corridor to protect

the Taj Mahal's surroundings and spends crores of rupees to showcase ancient potteries and jewellery in heavily guarded museums, is destroying a unique symbol of national identity and an icon well preserved in our minds since ages. Even a child knows that a bridge was built by the friends of Lord Rama using floating stones and Rama's army marched over it to Lanka to rescue Sita and destroy the evil regime of Ravana.

Hence during Dussehra every year and in dance dramas depicting Rama's life enacted across the globe, specially in East Asia, they never ever fail to mention the Setu Bandhan or the construction of Rama's bridge. Apart from the Ramayana, the Mahabharata also refers to the continued protection of Nala Setu following Sri Rama's command. Kalidasa's *Raghuvamsham* also refers to the Setu. So does the Skanda Purana (III 1.2.1-114), the Vishnu Purana (IV 4.40-49), the Agni Purana (V-XI), the Brahma Purana (138.1-40).

That is the memory so beautifully adopted by the Geological Survey of India in its logo, which describes India in this line etched at the bottom of its insignia -- *Aasetu Himachal*, meaning India is spread between the Bridge and the Himalayas. That is the Ram Setu Bridge on the southern tip of our motherland, an identity of the nation, under destruction now.

The credit of digging up material regarding the Ram Setu and providing impeccable factual content goes to Kalyan Raman, a former senior executive of the Asian Development Bank. He astounded even the government with his material on the entire project. His findings have stirred up protests from the Rashtriya Swayamsevak Sangh, the Vishwa Hindu Parishad, the Bharatiya Janata Party and the Hindu Dharma Acharya Sabha. Ashok Singhal of the VHP is spearheading a movement to protect the Ram Setu. He addressed a big public meeting in Rameshwaram with religious heads and Dr Subramanian Swamy. BJP leader and former Union human resources development minister Dr Murli Manohar Joshi has written to the prime minister, urging him to stop the destruction of the great heritage site.

The government, very 'secular and fair' indeed, tries not to remember or give any credence to what Hindus, Muslims and Christians believe, But this is what NASA says about the bridge, 'Exploring space with a camera by NASA's [193] Gemini XI, this photograph from an altitude of 410 miles encompasses all of India, an area of 1,250 000 square miles,' George M Low, then the deputy director, Manned Spacecraft Center, NASA, notes. 'Bombay is on the west coast, directly left of the spacecraft's can-shaped antenna, New Delhi is just below the horizon near the upper left. Adam's Bridge between India and Ceylon, at the right, is clearly visible...' We can see the picture dramatically resembles the description given in Kalidasa's *Raghuvamsham*. Kalidasa wrote, (sarga 13): 'Rama, while returning from Sri Lanka in Pushpaka Vimaana told Sita: "Behold, Sita, My Setu of mountains dividing this frothy ocean is like the milky way dividing the sky into two parts".'

The Encyclopedia Britannica describes the bridge thus, 'Adam's Bridge also called Rama's Bridge, chain of shoals, between the islands of Mannar, near northwestern Sri Lanka, and Rameswaram, off the southeastern coast of India.'

Apart from such issues of heritage and belief, there are genuine concerns regarding security and the tsunamis' impact increasing in case the Ram Setu is destroyed. If the new channel is created through the present Rama's bridge, international ships

would pass through it making a *de facto* international boundary between India and Sri Lanka, facilitating an increased alien presence, burdening our navy to a great extent.

So far the sea between India and Sri Lanka has been recognised as historic waters, though the United States has been pressurising to have it declared as international waters and said in a naval notification in 2005 that it does not accept the sea between India and Sri Lanka as 'historic'. The US declaration and the role of the Tuticorin Port Trust, the nodal agency to implement the Setu Samudram Canal Project coupled with the haste with which the project was inaugurated, has given rise to many unanswered questions.

The US Navy operational directive refusing to accept the sea between India and Sri Lanka as 'historic' was made on June 23, 2005. The Prime Minister's Office sent some queries in March 2005 to N K Raghupathy, chief of the Tuticorin Port Trust. He sent answers to the PMO's queries on June 30, 2005 and Prime Minister Manmohan Singh with United Progressive Alliance Chairperson Sonia Gandhi inaugurated the project on July 2, 2005. Why were the queries sent to the TPT and not to an agency which had scientific authority to look into the geological and maritime aspects of the project? Why did the prime minister and the UPA chairperson rush to inaugurate the project without, *prima facie*, having the time to look into the answers given by the TPT chief? Why was the present route okayed which essentially requires the destruction of the Ram Setu, while other options, closer to Dhanushkodi, which did not touch the Ram Setu were ignored?

Local fishermen, Hindus, Muslims and Christians alike oppose the present route and are demanding alternative channels, which are available. They say the present channel would destroy marine life and corals. This will kill the trade in *shanka*s (shells) that has a turnover in excess of Rs 150 crore (Rs 1.5 billion) per annum. Invaluable thorium deposits would be affected, which are too important for our nuclear fuel requirements.

Professor Tad Murthy, the world renowned tsunami expert, who advised the Government of India on the tsunami warning system and edited the *Tsunami Journal* for over 20 years, has also warned that the present Setu Samudram route may result in tsunami waves hitting Kerala more fiercely. In a reply to a query regarding the Setusanmudram's impact, he wrote, 'During the Indian Ocean tsunami of December 26, 2004, the southern part of Kerala was generally spared from a major tsunami, mainly because the tsunami waves from Sumatra region travelling south of the Sri Lankan island, partially diffracted northward and affected the central part of the Kerala coast. Since the tsunami is a long gravity wave (similar to tides and storm surges) during the diffraction process, the rather wide turn it has to take spared the south Kerala coast. On the other hand, deepening the Setu Canal might provide a more direct route for the tsunami and this could impact south Kerala.'

The issue concerns us all, and should be taken up as Indians, without getting entangled in party lines and political games. The Ram Setu or Adam's Bridge belongs to all humanity, being an important heritage site; hence the government should not allow it to become another issue affecting Hindu sensitivities. Nobody is opposing the Setu Samudram Project, only a realignment of the route is being asked, as the present one destroys the Ram Setu.

Tarun Vijay is Editor, *Panchjanya*, the Rashtriya Swayamsevak Sangh's Hindi weekly.

http://in.rediff.com/news/2007/apr/25tarun.htm

Where Will The Next Tsunami Hit?

Franz L Kessler

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This picture shows the 1755 tsunami of Lisabon. The preceding earth quake was so strong, that it could be felt throughout Europe. Even micro-tsunamis were reported from sub-alpine lakes. The Lisabon quake/tsunami destroyed a flourishing city, and damaged profoundly one of the leading western nations. Tsunamis are, together with massive volcano eruptions and hurricanes, spontaneous events that can cause massive destruction on a regional scale. Tsunamis are caused by strong earthquakes, sub aqueous landslides, volcanic eruptions, asteroid impact or a combination of the mentioned. This article ponders about the trigger mechanism for tsunamis, and which areas need to be watched in particular.

http://www.authorsden.com/ArticlesImage/16492.jpg
The world is stunned by the incredible pictures of misery and grief, hitting areas of our planet which were among world's most beautiful landscapes. It brings reality to our mind that violent change is part of our planet. Wherever tectonic plates are compressed, there is danger of earth quakes. One can compare it to an armed gun: the bullet is loaded, and the spring is being squeezed. A gentle touch on the trigger - spontaneous energy is released. Some plate margins are associated with active volcanism and violent earth quakes. Other compressive plate margins are perceived to be calm, or dormant. Tsunamis form when sudden changes of the ocean's geometry occur. These are:

- **Earth quakes** (sea quakes) deep under the ocean. The crust buried under the ocean is often a lot thinner than continental crust and can react with high elasticity. Compression (strike-slip or subduction) along plate margins builds up stress over time. For many years, this stress is absorbed by the rock until a critical point is reached: the rock spontaneously ruptures. I have seen many examples of razor-sharp faults with vertical escarpments on the continental margins of the Atlantic. Earth quakes can cause a spontaneous movement of the sea floor. Like a whip, the surface of the ocean floor bounces upwards and displaces several cubic kilometers of waters in a fraction of a second. The kinetic energy released travels through the ocean, until it hits a nearby or distant shore.

- **Subsea landslides**. Along both compressive and passive margins sediments accumulate, sometimes forming cushions that are several kilometers thick. The city of New Orleans, for example, is built on a very thick sediment wedge, that originated from deposits carried by the Mississippi River. Very often, these sediments are poorly lithified, and can slide towards the ocean floor, to form (turbulent flow)= turbidite currents. Deltas do collapse at times. The Congo Delta, for example, spontaneously collapsed at the Miocene/Pliocene time boundary, some 6 million years ago and for unknown reasons. The Agadir Canyon in Morocco is an equally young incision feature, possibly

caused by a super-strong earth quake. Its associated turbidite fan reaches far out into the open ocean. Some sub-sea landslides can be triggered by earth quakes, others or spontaneous release of methane from the sediment. The sliding avalanche forms a turbulent, and often high-density flow. Ahead of a turbidite flow, water is compressed and displaced on a massive scale. This can trigger a different kind of tsunami, although it is not very well known what amount of damage this may cause.

- **Volcanic eruptions**. During volcanic eruptions, the volcano's rock vibrates and can easily form fractures. Water can penetrate these fractures, and reach areas of hot rock creating overheated, and highly pressurized steam. Several volcanoes at the Indian plate margin have exploded that way – Krakatoa and Tabora are examples that occurred fairly recently, in geologic terms. Some volcanoes are formed by walls of unconsolidated sediments. These become unstable at times and can cause massive landslides, at times.

Which areas of the world might become particularly tsunami-prone in the near future?

- The **Pacific Ocean** is the classic terrain of tsunamis. Surrounded by compressive margins with active subduction and strike-slip (lateral movement fault) zones, the Pacific is quivering with seismic life. An area of particular concern is the Pacific Plate Boundary, which reaches from Northern California to Alaska. Recent studies seem to indicate, that stress has been building up along this margin for several hundreds of years, and that a strong sea quake is overdue. Tsunamis could potentially have serious consequences even in remote areas - I wonder what would happen if a strong tsunami would hit the Antartic shelf ice. Massice slabs of ice might become unstable, detach itself from the bedrock, and float into the ocean, leading to a sudden seal level rise.
- The eastern **Indian Ocean**. The spectacular earth quake witnessed on Dec 26 may have shifted the ocean floor by several tenths of meters. This means, as the examples in California and Turkey have shown, that compressive energy is shifted farther up along the plate margin. Strong earth quakes, with associated tsunamis, will occur along the Andaman and Nicobar margin, but it might take several years, or hundreds of years before the next huge earth quake is due. A tsunami in the Bay of Bengal could endanger millions of people living in the densely populated Ganges Delta area.
- The **Atlantic margins**. Two volcanoes of the Canary Island group appear to have unconsolidated and highly unstable flanks, that could yield massive landslides. Cities such as Casablanca, New York, Miami or even Rio de Janeiro could be threatened by tsunamis, if these volcanoes were to collapse into the Atlantic Ocean.

- The **Southern Mediterranean**. Coastal areas, in particular Algeria, have seen many violent earth quakes in recent history. Areas of the huge Nile Delta might prove unstable- several recent fault escarpments are seen on the sea floor. A tsunami originating along the North African margin could endanger dense populated areas both along the North African and the Italian/Greek coast lines.

- The **Texan and Louisiana Gulf coast**. Massive submarine landslides have occurred along this margin throughout the Tertiary, given the accumulation of massive, unstable sediments deposited at the mouth of the Mississippi River.

A big, submarine landslide might cause a tsunami with the potential of hurting coastal cities such as New Orleans, or Galveston.

What can be done to prevent tsunamis? Nothing! Tsunamis do happen. Improved tsunami warning systems, however, could help evacuate some areas before the tsunami strikes. It makes sense when a targeted coastline is located several hours away from the tsunami's origin. Alerting the population early enough can help the evacuation of people from the vulnerable coastlines to the safety of higher grounds. Areas located close to an epicenter such as the 26 December Aceh, however, are doomed and will be doomed in future events – there won't simply be enough time to alert the coastal population.

The author holds a PHD in sedimentology and has worked 20 years in the oil and gas exploration business. He has been teaching deepwater geology courses in Australia, Norway and Egypt.

http://www.authorsden.com/visit/viewarticle.asp?AuthorID=14304&id=16492
See also: http://wave.oregonstate.edu/news/story/1658

Assessing the Stability of the Setusamundram Shipping Canal

C.P. Rajendran

Centre for Earth Science Studies, Akkulam, Trivandrum 695031, Jounal of Geol.Soc.India, September 2005, Vol. 66, No.3, pp. 367-370.

The Setusamundram Ship Channel Project (SSCP) envisages excavating shallow sea between the Palk Bay and Gulf of Mannar (Fig. 1 and Fig.2). This work is expected to create a narrow shipping passage, linking the east and west coasts of India, obviating the present 'hassle' of circumnavigating Sri Lanka to reach the eastern coast of India and vice-versa. The total length of the channel is estimated to be 152.2 km, which will consist of two phases of dredging (or even blasting, depending on the nature of substratum): the 20-km-long Adam's Bridge and the 54-km-long Bay of Bengal segments. Besides these, the third segment falls in the Palk Bay with a total length of 78 km, which is reportedly requires no dredging as this area has a clearance of 12 m depth (NEERI, 2004). One must bear in mind that these are pre-tsunami estimates, as we do not yet know if there are any changes in depths in various zones of this region because of the December 26 tsunami sediment dispersal, and its effect on deposition or erosion.

The National Environmental Engineering Research Institute (NEERI) had been entrusted with the environmental impact assessment (EIA). The EIA conducted by NEERI and also the Technical Feasibility Report (TFR) certifies that the project is feasible and rules out any environmental hazard. However, serious concerns have been raised from different quarters on the stability of the proposed canal and the environmental impact of this project that would cost more than Rs. 2,233 crore, going by the pre-tsunami estimates (see Ramesh, 2004, 2005). With the approval of the Cabinet Committee on Economic Affairs, the concerned ministry is now going ahead with the project work with full steam.

The obvious issue is whether the authorities have made any sincere efforts to address some of the questions on this expensive project. In my judgment, the Government agencies entrusted with this work show an extraordinary enthusiasm to brush aside the uncomfortable questions, and keep the public at large in the dark about the stability of the canal and also on possible environmental impact. I must also point out that the efforts from the geological community to bring out the facts and initiate a wide-ranging discussion on this venture have been minimal, notwithstanding some tentative steps. Summarized from the above sources, especially the report prepared by Ramesh (2004), I highlight the major scientific objections with regard to this project:

1) Sedimentation dynamics: The Palk Bay region is a veritable sediment sink and is characterized by a high depositional rate (for details see Agarwal, 1988; Rajamanickam and Tooley, 2000, articles therein; Natesan, 1993;2002; Chandramohan et al., 2001; Sanil Kumar et al., 2002). However, various authors having given contradictory values, and all of them from different sites in the region. The EIA has used the values selectively to come up with an average eastimate to suit its conclusions. Fact of the matter is that different stretches of the Palk Bay, through

which the alignment of the canal passes, may have variable sedimentation rate. Further, Ramesh (2004), in his report, persuasively argues that the EIA report is yet to identify the source for 99.386% of the net annual quantum of sediment that is supposed to enter into the Palk Bay. A review of the EIA report prepared by the National Environmental Engineering Research Institute (NEERI) indicates that it has not addressed the question of sedimentation dynamics, comprehensively. In particular the EIA has been ambivalent about the net annual quantum of sediment transported into the Palk Bay. The lack of precise understanding on the net annual quantum of sediment will make the predicted values on both the capital as well as on the maintenance dredging, a suspect.

2) The impact of the cyclones: The cyclonic storms are a major risk factor in the region. The coast of Tamil Nadu in general and the project area in particular is considered to be most vulnerable to tropical cyclones (Pant et al., 1977). The cyclone occurred on December 23, 1964 is a typical example when the storm surge washed away the Pamban Bridge and the Dhanushkodi Island (reflections of this tragedy are given in "Wings of Fire- An Autobiography" by A.P.J. Abdul Kalam). The cyclones can unleash an autonomous dynamics of their own in redistributing sediment and also dispersing the dredged material (Dubey, 2004). The question of cyclonic disturbances in changing the sedimentary budget of the region has not been properly addressed by the EIA studies, and consequently skews the predicted estimates of the sedimentation pattern and its rate. This means that total amount of material to be dredged could be much more than what had been predicted. Another question is how would the cyclones rework the dredged material to be dumped at various sites, although fortified with embankments (e.g. Dhanushkodi).

3) The threat of tsunamis- a newly realized danger: The Indian press quoted a note (March 9, 2005) reportedly issued from the Prime Minister's office voicing the concern about the sustainability of this canal in the event of a cyclonic storm or tsunami. This was a valid query not only from a purely hazard point of view and this phenomenon is yet another process typical of this region that adds to sedimentation. However, in a recent statement, the Union Minister for Shipping, Ports and Highways states that this canal will have a 'dissipating effect' on tsunamis if they strike the east coast (The Hindu, dated June 6, 2005). He further states that the Ministry is now ready with scientific data to answer any questions on this project. I assume the Minister's repertoire also includes a tsunami model of deep-sea wave propagation in a post-project scenario. The post December 26 tsunami simulation models (Steven Ward, Univ. of California; and Aditya Riyadi, the Pusat Penelitian Kelautan Institut Teknologi, Bandung, Indonesia) that are available at web sites (http://manisanga.blogspot.com). After reviewing these models, Ramesh (2005) (http://palkbay.wikicities.com) suggested that the central portions of the Palk Bay and those located to the northeast and the east of Palk Bay received waves of higher energy. In other words, this part of the bay received higher amount of sediments, rendering it more turbid than other parts. Ramesh (2005) further points out that the above models also indicate that waves entered the Palk Bay from the north and south, corresponding with the canal alignment. Therefore, the open question is that whether the deepening activities would 'create a new deep water route' for a future tsunami to reach the west coast with a devastating impact, a concern already expressed by a tsunami expert. I would like to know whether the Ministry sponsored modeling studies have come up with a different scenario. However, an expert thinks that that the Bay of Bengal entrance of the present orientation of the canal will funnel tsunami energy into the channel and through constructive interference with the tsunami propagating from the south of Sri Lanka at the southern part of Kerala

will augment the tsunami wave amplitudes, which will impact the Kerala Coast (Tad Murty, personal communication).

4) Nature of substratum: With limited availability of borings, we are still not certain about the nature of the substratum of the region: are they soft or hard? This information is important to decide on whether to dredge or blast the sea bottom and to plan the safe disposal of the dredged material.

5) Finding the sites for safe disposal of dredged material: The EIA study appears to be ambivalent regarding identifying the areas of safe disposal of dredged material and that too without posing environmental hazard for the marine organisms (Sri Lanka has a major stake here). Recently, some experts have also pointed out threat of sediment slides as a cause for instability of the channel.

6) Economic viability: Have we considered the pollution that would be created by ships in such a narrow channel and its modes of dispersal or other dangers, for example the prospect of grounding or straying, from the canal alignment, of a rogue ship containing coal or oil or even a collision of such ships, and the ensuing ecological disaster? On the other hand, if the ships are going to be guided by tugs, there will certainly be a huge toll that would work out be more expensive than sailing around Sri Lanka (see Ramakrishnan, K.S., The Hindu dated Dec. 21, 2004). Would this be finally end up as a patrolling route for the Indian Navy and the Indian Coast Guard? We have to work out a realistic cost-benefit analysis of this project, taking all the above contingencies into account?

I have not touched upon much on the possible environmental impact of this project. I hope somebody who is qualified to deal with that topic will speak out. Personally, I believe all the objections highlighted in this article will remain valid until these issues are resolved by an independent group of experts. I am curious to know how our scientists respond to such projects. What is appalling is the complete silence from the earth science community of the country. I think here we have an excellent geological problem (according to the NEERI report, the depth of the area has been reduced by about 0.51 m between 1975-1999; What more do you need to excite a geologist?), and an area where our expertise would make a difference (see also Rajendran, 2005 for a reiteration of this issue).

Our academies and other professional bodies of Indian scientists should take their positions on such important issues, based on the considered opinions of the independent experts. Setusamundram, as the name suggests, is the part of an ocean that is being constantly bridged by natural sedimentation processes, and the nature has been at this work for hundreds of thousands of years (Indian epic Ramayana makes direct reference to a putative land bridge in this region). Going by the rates of sediment build up, some believe that in another 500 years there would be a land bridge connecting Rameswaram with Sri Lanka (Ramasamy et al., 1998). By implementing this project, we are disturbing the natural processes for reasons that are not convincing. The onus is on the project sponsors to convince us about this project's technical, scientific and economic credibility, and prove that why this is not another disaster in the making. Let us call up on the Ministry and the institutes concerned to prepare a forum to debate these issues, involving both national and international experts as well as the stakeholders.

Acknowledgments:

I thank Dr. R. Ramesh for providing the background material on the Setusamundram project. I am indebted to Dr. B.P. Radhakrishna for his encouragement to prepare this article.

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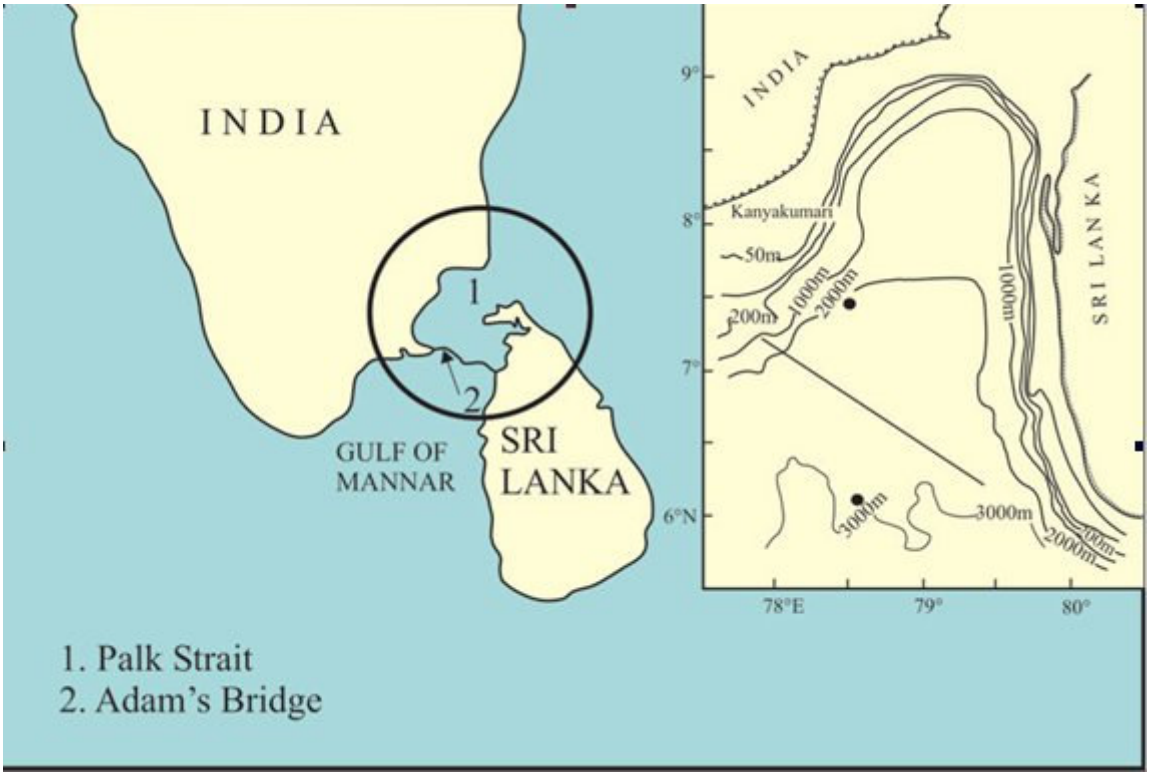

Location map. Inset: bathymetry map of the Gulf of Mannar (reproduced from Murty et al., 1994) http://www.Setusamudram.in/htmdocs/Articles/cp_rajendran_2.htm

Sediment Characteristics of the M-9 Tsunami Event Between Rameswaram and Thoothukudi, Gulf of Mannar, Southeast Coast of India

S. R. Singarasubramanian, M. V. Mukesh, K. Manoharan, S. Murugan, D. Bakkiaraj, A. John Peter, and P. Seralathan
pages 160-172 http://www.sthjournal.org/253/singa.pdf e-mail: laksrs@yahoo.com

Excerpts:

ABSTRACT

On 26th December, 2004, a massive earthquake occurred NW of Sumatra in the seismically active zone close to Sunda Trench at a water depth of about 1300m and with an epicenter located at a shallow depth of 10km below the ocean floor. This earthquake triggered tsunami waves in the Indian Ocean and hit most of the Tamilnadu coast, with wave height varying from 3 to 10m. In the study area dunes were breached. Erosional channels were created. Inundation in the study area ranges between 10 and 600m from the shoreline. The inundated sediment thickness varies from 1 to 30cm and was well preserved. Sediments thickness gets reduced landwards and occurs as set of layers. The sediments were fresh, grey to dark grey in color.

INTRODUCTION :

Tsunamis transport sediments from the offshore and beach, subsequently deposit them over the coastal low lands. Tsunami deposits fine landward, while river deposits generally fine seaward (Nelson et. al. 1996b). Multiple normal graded beds within the deposit suggest deposition by successive tsunami waves rather than a storm surge (Nelson et. al. 1996b). Tsunamis have the potential to deposit sand farther inland or at a higher elevation than storms (Dawson and Shi, 2000). Tsunami deposits may be of three categories (Whelan and Kelletat, 2003) as large clasts, coarse to fine sand and other fairly obscure deposits such as wash over fans. The composition and texture of sand grains can be used to determine a coastal source (Peterson and Darienzo, 1996).

Ancient tsunamis have also been inferred based on sand sheets found in coastal low lands, including those found in Scotland (Dawson et. al., 1988; Long et. al., 1989), Japan (Minoura and Nakaya, 1991), New Zealand (Clague-Goff and Goff, 1999), the Mediterranean (Dominey- Howes et. al, 1999; Minoura, et. al., 2000) and the Pacific Coast of North America (Clague et. al., 2000). Sand sheets are important markers of ancient tsunamis, especially serve as the only record of some prehistoric tsunamis. The impact of tsunami waves on coastline will be very severe due to their greater wavelengths and wave periods. If there is sufficient sediment supply, tsunami waves are constructive as they move inland, and transport a variety of grain sizes ranging from silt to large boulders. The retreating waves can remobilize and erode sediments (Barbara Keating et al., 2004). The most common tsunami deposits are fine sediments that most frequently occur as sediment sheets. An attempt has been made to decipher the tsunami sediment deposits and its characteristics between Rameswaram and Thoothukudi, Gulf of Mannar, Tamilnadu, India.

STUDY AREA

The present study area forms the part of east coast of India and southern part of Tamilnadu. The study area is located between Rameswaram (Lat. 9.28345 and Long. 79.32142) in the north and Thoothukudi (Lat. 8.44593 and Long. 78.10071) in the south. The study area includes the coastal villages of Ramanathapuram and Thoothukudi districts. (Map No. 1).

The shelf width off Pamban in the Gulf of Mannar is about 25 km and the shelf break occurs more or less at about 200m depth. The shelf is very wide off the coast between Sippikulam and Tuticorin. The 20m depth contour lies at distance of 30 km between Rameswaram island and Valinokkam and about 40-45 km between Valinokkam and Tuticorin. The Rameswaram and Tuticorin coast is characterized by the presence of 21 coral islands with varying sizes and arranged in an en echelon manner within the 20m depth contour. These features have effectively altered by the tsunami waves. Along the coast several morphological features have induced in the inundation levels. A prominent spit is occurring near Thoothukudi, running few kilometers in length. It joins with main land and forming Tombolo. Beach ridges are found to be discontinuous. They are varying in length and width. These are distributed for a few kilometers away from the coastline, but lying parallel to the shoreline. These ridges are separated by salt pans and in some places by swales. Beach ridges are compact and almost covered by vegetation.

Sand dunes are formed at interface between sea and land. They bordered the high tide mark and extend inland up to 2 to 5 km. They run parallel to the shoreline separated from each other by marked troughs. The crests are flat and range in height from 0.5 to 2m. They are stabilized by the vegetation. After the mega tsunami event the sand dunes were breached in many places and the coastal geomorphology has changed. In many places the channels were diverted or filled with sediments or new formations of erosional structures were observed. The coastal regions become steep in some places and shallow in some places due to the differential erosion and accretion of sediments by tsunami waves…

SUMMARY AND CONCLUSION

The catastrophic waves generated by tsunami on 26th December, 2004 in the Indian Ocean devastated the Tamilnadu and parts of Andhra and Kerala coasts. Houses built along the coastal belt, coastal landforms and beaches were heavily damaged by strong tsunami inundation. The tsunami waves alter severely the mouth and estuary regions. The tsunami waves enter inland from the SSE direction in the study area as diffracted waves. The inundation varies from 0.01km to 0.6km. The waves alter the sediment dynamics when enter the coastal zone, thus altering the coastal geomorphology by breaching coastal dunes, eroding beaches to form new channels, filling of estuaries and backwater channels by sediments. This preliminary investigation gives an idea about the sedimentological evidence preserved between Rameswaram and Thoothukudi.

The coastal morphology in Taruvaikulam and Thoothukudi harbor were altered by breaching of coastal dunes, erosion along the beach and deposition of fines along the coast. Effect of tsunami waves was more along the projected and flat beaches. The shallow shelf beaches were not affected by the tsunami waves. Beach erosion is also prominent in the flat beaches. Thick and extensive sediment deposition was observed at Taruvaikulam, where the coast is slightly projected towards the sea in

the northern part. The northern part hence received a good sedimentation than the southern part, where there was no much change.

In general the tsunami sedimentation in the study area indicate that they were deposited at different time intervals at different inundation distances. They were thinning landward. Multiple grading of sediment deposition was prominent, indicating that the deposition took place at different time intervals and by successive waves. From the granulometric analysis of sediments indicates a moderately well sorted nature of the sediments and moderate energy condition in the depositional environment. This is well supported by the mean size of sediments which vary from fine to medium in size and the standard deviation of sediments indicating that they were well sorted to moderately sorted characters. The sorting character infers that the sediments were from beach and not from rivers. The predominant positive skewness of the sediments indicating a unidirectional transport or deposition in sheltered low energy. The mesokurtic to leptokurtic nature of sediments refers to the continuous addition of finer or coarser materials and retention of their original characters during deposition. The size distribution of sediments indicate that a bimodal or polymodal distribution. The histogram indicates wide range of size distribution and asymmetrical nature of sediments, but predominantly the finer clastics are more and the lacking by coarser clastics.

From the energy process discriminant functions of Sahu (1964), the sediments were deposited by beach and fluvial processes under shallow agitating environment and carried by turbidity action. The results indicate that most of the sediments were deposited by beach processes than by fluvial influence under a nearshore whirlpool agitating environment.

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Map -1 Showing study area and sampling locations
Table – 1 Showing the Statistical Analysis of surface samples
Table -2 Showing Linear discriminant function values (after Sahu, 1964) (page 169)

Plate- I
Plate – I A- Distribution of fresh layered sediments after tsunami along the coast for 4” inch at Vellapatty; B- Distribution of fresh sediments and deserted trees by tsunami waves about 50m inland at Vellapatty; C- Deposition of heavy minerals by tsunami waves along the shore at Taruvaikulam; D- Deposition of fresh sediments and creation of water bodies by erosion due to tsunami waves at Taruvaikulam; E- Erosional land surface and formation of water bodies to a distance of 70m rom the shore at Thoothukudi ; F- Deposition of fine sediments in channel (150m from the shore) during the inundation of tsunami waves.

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Save our dugongs from extinction

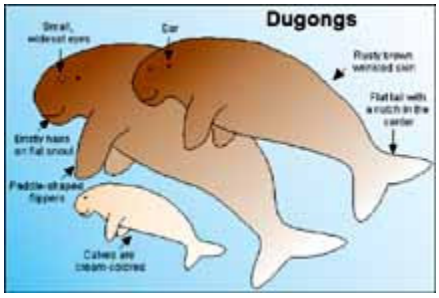
Derrick Schokman (Saturday, 26 July 2003)

The Gulf of Mannar on the Northwest coast between Puttalam and Jaffna is famous for many things - early sea trade, pearl fishing, whales and a rare species of marine mammal known as the dugong.

There was the ancient port of Mantai, much spoken of in the Sinhalese chronicles. Also Kalpitiya at the Northern end of the peninsula of the same name, which was a busy trading port used by the Arabs, Portuguese and Dutch. There is a well preserved Dutch fort yet to be seen there and the remains of Dutch settlements.

Between Mannar and Puttalam, now very much a desolate coast, the pearl-fishing camps were once located from which the annual pearl fisheries were conducted from very ancient times.

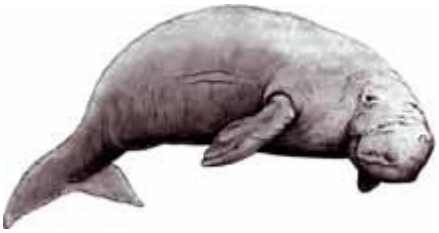
More recently whales of several species have been seen in the Gulf, opening up the prospects of a lucrative whale watching business.



And last but not least, the Gulf has been home to the dugongs or so-called "mermaids" from time immemorial. More commonly known as the sea cow (Englihs) mudu-ura (Sinhala) and Kudal-pandi (Tamil), these animals were once considered as fabled creatures of the sea that sailors of old thought to be half-woman and half-fish.

What gave them this impression was the rough human outline of the shape of the head, and the attitude of the female in the way she carried and suckled her young held close to the breast with one flipper, the other being used to swim with both heads above water. When disturbed the creature would dive displaying its fishlike tail. That is why the sailors called them "mermaids" or sea maidens.

These creatures seven to eight feet long when adult, lived in tropical waters close to shore bordering countries such as East Africa, Arabia, Sri Lanka, New Guinea and Northern Australia. Their diet consisted of sea weed and small marine fauna found in shallow waters.



The Gulf of Mannar was once plentiful with dugongs. But their numbers have since been considerably reduced owing to over exploitation for human consumption.

About two decades ago the National Aquatic Resources Agency (NARA) estimated that there were only about 100 dugongs left in the Gulf. The mermaids of yesteryear were now a threatened species.

In 1983 NARA accordingly outlined a conservation project to raise these creatures in pen-like structures in the Puttalam lagoon adjacent to the Kalpitiya Peninsula where they would be safe. Nothing came of this envisioned project because of the war that erupted soon after. Hopefully with a return to stability we must expect this conservation project to be renewed before our "mermaids" are doomed to extinction.

http://www.dailynews.lk/2003/07/26/fea05.html

Will the Gulf of Mannar be saved?

S S Singan in Keelakarai | August 30, 2005 18:58 IST

Will the Gulf of Mannar, the 'Paradise of Biologists', be lost or saved due to indiscriminate fishing? This is the question often posed by environmentalists.

Hope has emerged in the form of Gulf of Mannar Biosphere Reserve Trust, which has launched a conservation programme by creating awareness among the people residing along coastal areas of Ramanathapuram and Tuticorin Districts of Tamil Nadu.

When Gulf of Mannar was declared a Marine National Park in 1986 and as a bio-reserve three years later, it was thought the flora and fauna would remain intact as fishing activities were restricted in the 10,500 square kilometre area. But mere declaration and law could not effectively protect the ecology.

According to S Ramasubramanian, an eco-development officer, "not much success could be achieved by law alone… we understood that something more has to be done. So, it was suggested that alternative methods be adopted to protect the environment with the cooperation of the local populace, especially teachers and students of schools and fisherfolks."

Fortunately, the bio-reserve was among the World Network of Biospheres. The United Nations Development Programme with the Global Environment Facility, allocated $ 7.5 million for protecting bio-diversity of the Gulf.

According to Ramasubramanian, the Government of India and the Government of Tamil Nadu also co-financed the project that totalled $ 26.5 million.

He claimed that after introducing the richness of the Gulf of Mannar to fishermen and how it could help them earn more money if it was protected, at least a section of them volunteered not to use the banned nets for fishing.

Several misconceptions were cleared and fishermen knew that coral reefs were breeding centres of fish and it was essential to protect them for sustained fish-catch.

The intiative to educate the fishermen has begun with educating students and teachers. It would strengthen the role of the community in managing the reserve in ways that were ecologically sound, equitable for groups with a stake in the unique area.

"We cannot all of a sudden tell people not to fish and restrict them. They need to be educated. To some extent we are successful. The future generation now knows indiscriminate fishing affects hatcheries and fish population," said Ramasubramanian. In each batch about 30 teachers are introduced to the Gulf of Mannar who are taken to 21 islands, from the one closest to the coast just 500 metres away.

In the shallow waters around the islands, one can see the unique endemic organisms called "Balanoglosus" (Ptych dera flora) a taxonomically unique living thing that links vertebrates and invertebrates. 3600 species of plants and animals and 117 species of corals in seven genera are present in the Gulf of Mannar.

The GMBRT plans to establish 220 National Green Corps units in schools situated along the coast of Ramanathapuram and Tuticorin districts.

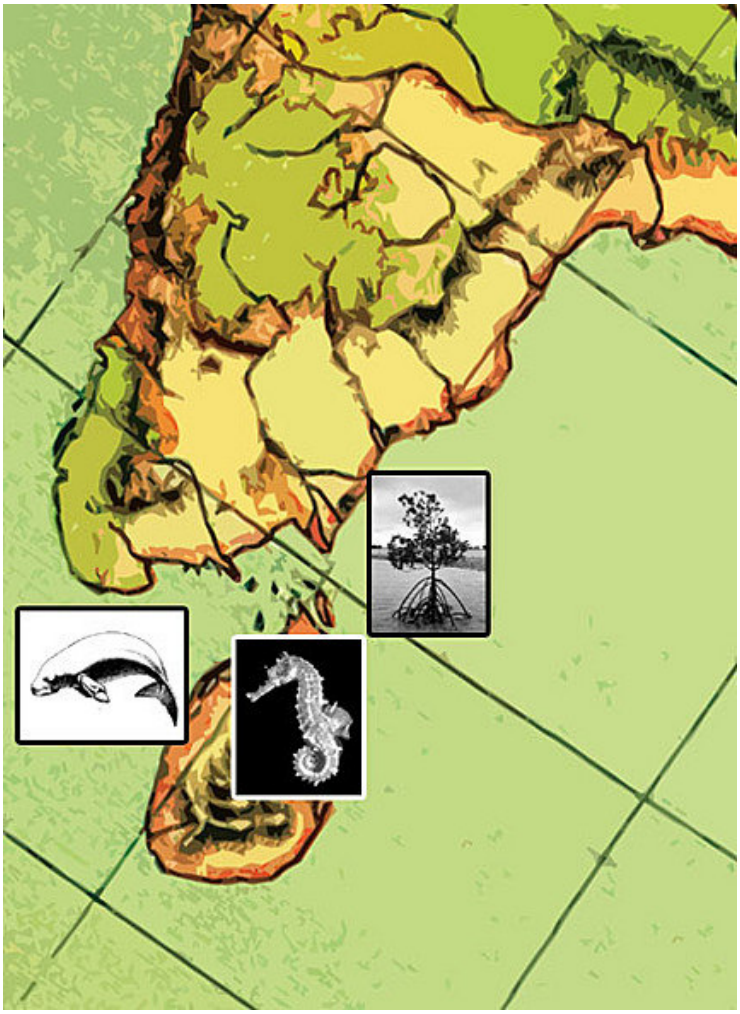
Aganus Virgin, another teacher, says school children from coastal villages should also be brought to the islands for first-hand information about the gulf. They, in turn, would influence their parents, the fisherfolks better than others.

http://www.underwatertimes.com/oceans/oceans.php?page=3

Gulf of Mannar:

the first marine biosphere of South Asia

The first marine biosphere reserve in all of South and Southeast Asia is located on the southeastern tip of India in the state of Tamil Nadu, in the Indo-Pacific region. The GOMBR is an international priority site for many reasons – it's biophysical and ecological uniqueness, economic, social, cultural, scientific importance, national and global significance. The Biosphere reserve extends from Rameswaram Island to Tuticorin in a NE-SW direction to a distance of 140 km. There are 21 islands running almost parallel to the coastline of Gulf of Mannar with three distinct Marine ecosystems namely corals, seagrass and mangroves. The islands in the Gulf of Mannar are classified into 4 major groups - Tuticorin, Mandapam, Keezhakarai and Vembar.



Biodiversity

Around 3,600 species of fauna and flora have been identified in the Gulf of Mannar area, which comprises of 3 different ecosystems - Sea grass, Mangrove and Coral Reef Ecosystem. 17 species of mangrove occur within the reserve and act as an important nursery of habitats. The shallow waters in the area have the highest concentration of sea grass species along India's 7,500 km coastline. 11 species of sea grass recorded in India are found in the reserve. The island's surrounding shallow waters harbours 3 species of seagrass that are found nowhere else in India. These same shallow waters are also known to have at least 147 species of marine algae *(seaweed).* These support complex ecological communities and provide feeding grounds for many species, including the globally endangered marine animal, dugong. Endangered species such as whales, dolphins, sea horse and sea snakes are found in these waters as well.

Productive fringing and the patchy coral reef surrounding the Park's islands are comprised of at least 91 species of coral reef systems. The islands are used by 168 migratory bird species and the sandy shores of most islands provide a nesting habitat for 5 species of marine turtles. This region is also home to over 450 species of fish, 79 species of crustaceans, 108 species of sponges, 260 species of mollusks and 100 species of echinoderms.

Krusadai Island, in Mandapam, exemplifies the biological significance of the Gulf. The fact that close to 3,600 species of plants and animals are natural inhabitants of the Gulf of Mannar make it the biologically richest coastal region in India. http://www.greenpeace.org/india/campaigns/save-our-seas/biodiversity-hotspots/gulf-of-mannar

Causes for concern

Coral in Gulf of Mannar April 01, 2000

The complex and fragile ecology of this reserve is under severe duress. The primary threats to the globally significant biodiversity of the Gulf of Mannar are: -

Over harvesting of marine resources

Over harvesting of marine resources threatens to disrupt the ecological balance of the region as a whole. In a situation where there is no control exerted over who takes how much, the result has been that the trawlers are catching most of the fish, through techniques like {bottom trawling}, precluding the smaller, traditional craft from catching their share. This in turn forces them to take up destructive practices such as mangrove cutting and coral mining in and around the park. Seagrass beds are also harmed by inappropriate bottom trawling practices.

Pollution by industries

Pollution by industries is largely on the southern side of Gulf. The major polluting sources include effluent from chemical industries and a thermal power plant. The dumping of fly ash slurry into the Karapad bay by the thermal power station has resulted not only in filling up of an extensive portion of the Bay, but also fly ash entering the sea directly. The ash, on being carried far into the sea has caused irreversible and extensive damage to the sedimentary biota, algal beds, chank, corals, pearl oysters and to all the biota connected with the reefs. Mangroves, which grow on the margin of the shoreline, have come to accommodate alarmingly high levels of ash borne contamination.

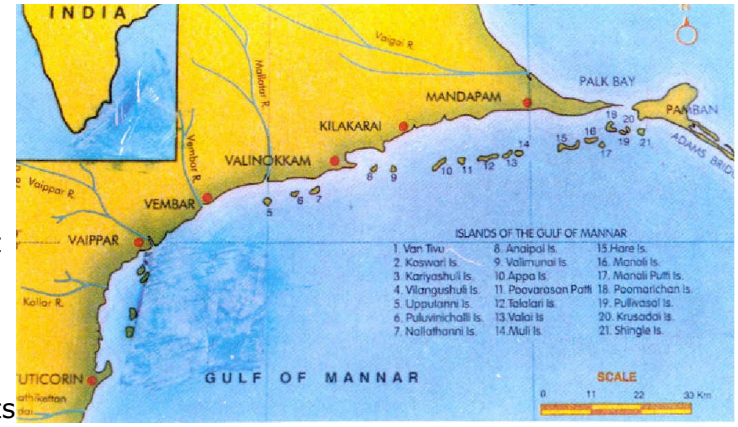
Setu Samudram

The most crucial threat, which would be the telling blow, is the proposed Setu Samudram Canal. The Setu Samudram Ship Canal Project on the coast of Tamil Nadu is under serious consideration by both state and central governments, and allocations have been made for this project in the latest budget. The project threatens to destroy the pristine Gulf of Mannar Marine Biosphere. It entails the dredging of a canal to enable faster sea travel between the east and west coasts to prevent ships having to around Sri Lanka. The Canal will destroy the unique and fragile marine ecology of the area through constant dredging to maintain a canal depth of about 10-14 m. Aside from the immediate area of the sea bed, the consistent churning of sediment will also smother the coral reefs. The increase in shipping traffic will inevitably result in an increase in oil spills and marine pollution.

http://www.greenpeace.org/india/campaigns/save-our-seas/biodiversity-hotspots/gulf-of-mannar
http://www.greenpeace.org/india/campaigns/save-our-seas/biodiversity-hotspots/gulf-of-mannar/causes-for-concern

Ramanathapuram District: Gulf of Mannar Marine Biosphere Reserve

Gulf of **M**annar is the first **M**arine Biosphere Reserve not only in India, but also in south and southeast Asia. The IUCN Commission on National Parks and WWF, identified the Reserve as being an area of" "**Particulars concern**" given its diversity and special multiple- use management status. In addition, as the first marine biosphere reserve declared in India, this area has long been a national priority.



The Gulf of Mannar and its 3,600 Species of flora and fauna is one of the biologically richest coastal regions in all of mainland of India. Some of the islands are veritable "**Biologist's paradise**"

It is equally rich in sea-algae, sea grasses, coral reef pearl banks, fin & shell fish resources, mangroves, and endemic & endangered species. It is an important habitat for the highly endangered sea mammal, the Dugong dugon commonly called as sea cow.

There are 137 species of Corals found in Gulf of Mannar. The Coral come in myriads of shapes. Some have finger like branches and others dome-shaped colony with a net work of ridges and furrows.

Sponges, although at casual glance look like plants, are animals, living singly or in colonies of many individuals. Their colours vary as much as shape, being green, red, yellow, and even black or white. In the crevices, these sponges are found with many animals, ranging from tiny crabs and brittle star to bivalve mollusks. 275 species under 8 orders are found in Gulf of Mannar.

http://www.ramnad.tn.nic.in/biosphere.htm

Coral Reefs Distribution (Gulf of Mannar)

Geomorphology:

The Gulf of Mannar has a chain of 20 islands located between 8 º 48' N, 78 º 9' E and 9 º 14' N, 79 º 14' E on the southwest coast of India

Reef Structure and Corals:

All islands in the Gulf of Mannar have fringing reefs. In addition, there is a 8 km long reef in the Palk Bay adjacent to the Gulf of Mannar, as well as patching coral formation in the passage (Adam's Bridge) between India and Sri Lanka.

Noteworthy Fauna and Flora:

The Gulf of Mannar is particularly important for Green turtle and sea cow population, both of which depend on the large seagrass beds particularly around Musal, Appa and Balayamunai islands. Olive Ridley turtle is also occasionally found in this area. The pro-chordate Balanoglossus is found in the northern reefs.

Mangroves are found on all islands and are particularly extensive in the Mandapam group.

Status of Reef & disturbance / deficiencies:

The high turbidity of the water due to large scale coral mining and coastal erosion from mainland cause deterioration of the reefs.

Exploitation of coral & shells for lime industries and hunting of dugong & turtles is still prevalent.

Socio-economics:

Most of the islands have no freshwater and are therefore uninhabited. The most productive chank and pearl oyster beds in India are found near Tuticorin and Kilakarai. The Windowpane oyster Placuna placenta is also found in the same area. Large quantities of molluscan shells for the ornamental trade are collected in this area. Recently, native people of this area have begun developing tourism also.

http://envfor.nic.in/icrmn/dist/mannar.html

Coral Reefs of India: Review of Their Extent, Condition, Research and Management Status

by Vineeta Hoon

Abstract

The major reef formations in India are restricted to the Gulf of Mannar, Palk bay, Gulf of Kutch, Andaman and Nicobar Islands and the Lakshadweep islands. While the Lakshadweep reefs are atolls, the others are all fringing reefs. Patchy coral is present in the inter-tidal areas of the central west coast of the country. Coral reefs in India are being damaged and destroyed at an increasing rate. They face serious problems of stress from anthropogenic pressures and interference. However we cannot be precise about how much and where, because of special difficulties of monitoring underwater. The Reef condition is generally poor and declining in near shore waters and areas of high population density. Relatively pristine reefs are located around uninhabited islands or barrier type reefs located away from population centers. Sedimentation, dredging and coral mining are damaging near shore reefs, while the use of explosives and bottom nets in fishing are damaging offshore reefs in specific sites. Although institutions and laws are sufficient in theory to manage and protect the reefs in India, authorities in the field have taken little effective action in implementing these laws.

Introduction

This paper provides a macro view of the status of coral reefs, coral reef research and Government policy towards conservation and management of reefs in India. It draws information from earlier reports prepared by Shepard & Wells (1988), Alan White & Arjan Rajasuriya (1995) and Gopinatha Pillai, (1996). More recent information is cited as available and analyzed to show the most recent trends in resource condition, use and conservation.

Field visits to the Andamans, Lakshadweep and the Gulf of Mannar were made to verify the physical condition of the most frequently visited reefs and to assess the local community attitudes towards reefs and their dependence on reefs. Discussions were held with officers from the Ministry of Environment and Forests, New Delhi, Department of fisheries; Department of environment and forests at the State level, Naval officers, Tourist resort managers and Diving Instructors, to provide a picture on the status of management of coral reefs in India and arrive at the recent trends on Government Policy towards conservation, management and monitoring of reefs. (A visit to the Gulf of Kutch was not possible due to time constraints).

To arrive at the current status and trends in coral reef research, discussions were held with scientists of premier institutions of India associated with coral reef research. Requests were also sent out to research Institutions to provide information on their contributions to coral reef research.

The paper reviews and analyses the existing information found in both published and unpublished reports on the coral reefs in India. It is divided into five sections. The first section deals with an inventory, distribution and extent of coral reefs in India.

Section two deals with the status of coral reef research in India and who are the key players. Section three deals with the human impact on coral reefs. Section four discusses Government policy and approaches to coral reef management in India. Section five provides a concluding summary.

Coral reefs are shallow water, tropical marine ecosystems which are characterized by a remarkably high biomass production and a rich faunal and flora! diversity perhaps unequaled by any other habitat. Corals require certain conditions to occur and can flourish only in relatively shallow waters, exposed to direct sunlight, with optimum temperature of 23-25°c and free from suspended sediments.

The structure of a reef is formed by the calcareous skeleton that houses corals, a type of soft-bodied, radially symmetrical, marine invertebrates of the phylum coelenterate. Individuals of a colony are called polyps or hydroids. Millions of coral skeletons cemented together over a period ranging from a few thousand to millions of years give rise to such reefs (WWF1992). Reefs can vary enormously in structure and complexity and are roughly divided into three major types.

1. *Fringing reefs',* reefs that grow close to the shore and extend out into the sea like a submerged platform.

2. *Barrier reef:* reefs separated from the land by wide expanses of water and follow the coastline.

3. *Atolls: a* roughly circular ring of reefs surrounding a lagoon, a low lying island, common in the Indian and South pacific oceans.

Inventory, distribution and extent coral reefs in India

India with its coastline extending over 7,500 kilometers and subtropical climatic conditions has very few coral reef areas. The absence of reef in the Bay of Bengal is attributed to the immense quantity of freshwater and silt brought by the rivers (Seawell,1932). Other disincentives to reef growth are the heavy monsoonal rains and the high human presence on the coastline (Arthur: 1996)

The mainland coast of India has two widely separated area's containing reefs: The Gulf of Kutch in the north west, which has some of the most northerly reefs in the world (Kelleher et al, 1995) and Palk Bay and the Gulf of Mannar (with numerous fringing reefs around small islands) in the south east.

There are patches of reef in the inter-tidal areas of the central west coast of the country. Coral patches have been recorded in the intertidal regions of Ratnagiri, Malvan and Redi, south of Bombay (Qasim and Wafer, 1979) and at the Gaveshani Bank, 100 Km west of Mangalore (Nair and Qasim, 1978). Hermatypic corals along the shore are reported from Quilon in the Kerala coast to Enayem in Tamilnadu (Pillai, 1996). Corals also occur on the east coast between Parangipettai (Porto Novo), south of Cuddalore (10°50'N, 79°80'E) and Pondicherry but these communities have not been surveyed (Ramaiyan and Adhiyapatham, 1985)

Important off shore island groups of India with extensive reef growth include the Andaman and Nicobar Islands in the Bay of Bengal and the Lakshadweep group of

Islands in the Arabian sea. The Andaman and Nicobar islands have fringing reefs and a 320 km long barrier reef on the west coast. The Lakshadweep Islands are made up of atolls.

Figure 1 shows the distribution of coral reefs in India. Table 1 provides an overview of the area estimates of coral reefs in India. These area estimates were calculated from maps developed from IRS LISS II, Landsat TM (bands 2,3 & 4) and SPOT bands 1,2 and 3) FCC (DOD & SAC: 1997). Table 2 provides an overview of the diversity of hermatypic corals in the Indian seas.

Table 1: Area Estimates of Coral Reefs in the Country (Km^2)

Category	Gujrat	Tamilnadu	Lakshadweep islands	A&N Islands
Reef flat	148.4	64.9	136.5	795.7
Sand over reef	11.8	12.0	7.3	73.3
Mud over reef	117.1	-	-	8.4
Coraline shelf	-	-	230.9	45.0
Coral heads	-	-	6.8	17.5
Live coral platform	-	-	43.3	-
Algae	53.8	0.4	0.4	-
Seaweeds	-	-	0.7	-
Seagrass	-	-	10.9	-
Reef vegetation	112.1	13.3	-	8.9
Vegetation over sand	17.0	3.6	0.4	10.5
Lagoon	-	0.1	322.8	-
Sandy substrate	-	-	(67.4)	-
Reef patch	-	-	(13.4)	-
Deep	-	-	(98.5)	-
Uncertain	-	-	(143.5)	-
Total	460.2	94.3	816.1	959.3
Ref: DOD & SAC, 1997 "Coral reef maps of India," D O D and S A C, India				

Table 2: Diversity of hermatypic corals in the Indian Ocean

Locality	Genera	species
Gulf of Kutch*	24	37
West Coast Patches*	17	29
Lakshadweep Islands	37	103
Palk bay and Gulf of Mannar	36	96
Tuticorin	19	21
Andaman Islands	31	82
Nicobar Islands	43	103

Total for India*	37	199
Source: Bakus, G.J (1994) and * Pillai, G (1996).		

Figure 1. Distribution of coral Reefs in India

South East Coast of India

Palk Bay

Coral reefs on the Tamil Nadu coast are located in Palk Bay near Rameswaram and in the Gulf of Mannar. Palk Bay is separated from the gulf of Manner by Mandapam peninsula and Rameswaram island. The reef is centered on 9 °17'N and 79° 15'. There is only one fringing reef in the Palk bay, which lies in an east-west direction along the mainland from the Pamban channel at the Pamban end of the bridge to Rameshwaram Island. This reef is 25-30km long, and generally less than 200m wide; maximum depth is around 3 m. Visibility is poor around 1 meter and it is badly affected by the north east monsoon. The reef flat is relatively broad from Pamban channel to the southern end near Ramnad and narrow from Pamban to south of Rameshwaram.

Diversity in the Palk bay reef consists of common sea grasses, sixty five species of coral have been recorded with a large number in the family *Acroporidae.* Turtles and Dugongs are found in the area. Squid breeding grounds occur near Rameshwaram.

Present status

The present day reef growth is poor and it is not in a pristine condition since it was quarried in the sixties (Pillai, 1996). Satellite data shows that the reef flat is barren and is followed by sandy beach on the landward side. A small patch of reef fringes at the Dhanushkodi tip (Bahuguna A. & Nayak, S,1994).

The Gulf of Mannar

The Gulf of Mannar reefs on the other hand are developed around a chain of 21 islands that lie along the 140 km stretch between Tuticorin and Rameswaram (Krishnamurthy, 1987; Kumaraguru, 1997). These islands are located between latitude 8°47' N and 9° 15' N and longitude 78° 12' E and 79° 14'E. A detailed account of each Island is provided by Krishnamurthy (1987) and Deshmukh and Venkatramani (1995). The islands lie at an average of about 8 km from the main land. They are a part of the Mannar Barrier reef which is about 140 km long and 25 km wide between Pamban and Tuticorin (Venketesan, n.d). Different types of reef forms such as shore platform, patch, coral pinnacles and atoll type are also observed in the Gulf of Mannar. The islands have fringing coral reefs and patch reefs around them. Narrow fringing reefs are located mostly at a distance of 50 to 100 m from the islands. On the other hand patch reefs arise from depths of 2 to 9 mt and extend to 1 to 2 km in length with width as much as 50 meters. Reef flat is extensive in almost all the reefs in the gulf of Mannar. Reef vegetation is richly distributed on these reefs. The total area occupied by reef and its associated features is 94.3 sq km. Reef flat and reef vegetation including algae occupies 64.9 and 13.7 sq km, respectively. (DOD & SAC, 1997). Visibility is affected by monsoons, coral mining and high

sedimentation load. The reefs are more luxuriant and richer than the reefs of Palk bay.

Reef diversity and resources

A detailed report on the Gulf of Mannar, their coral fauna, reef associated resources and suggestions for conservation and management was prepared by Krishnamurthy (1987). A comprehensive account of the coral fauna of this region are provided by Pillai (1986). There are about 96 species of corals belonging to 36 genera in the Gulf of Mannar. In a recent survey only 94 species of corals have been identified (Ramaiyan V et al, 1995). The most commonly occurring genera of corals are *Acropora, Montipora* and *Porites.* The hermatypic coral harbour filamentous algae in their "skeletal framework" as well as symbiotic zooxanthellae in their soft parts. The imprisoned algae release enough oxygen to meet the entire respiratory needs of corals. Apart from algae the reefs also harbour boring sponges, molluscs, worms, echinoderms, common shrimps, and fish (Krishnamurthy, 1987). Coral associated ornamental fishes belonging to the family *Chaetodontidae,* (butterfly fish); *Amphiprion spp* (clown fish), *Holocentrus spp* (squirrel fish), *Scarus* spp (parrot fish), *Lutjanus* spp (snapper fish) and *Abudefduf saxatilis* (sergeant Major) are abundant. (Kumaraguru, 1997). Extensive sea grass beds are present; green turtles, olive ridley turtles and dugongs are dependent on the sea grasses.

Current Status

Pillai (1975,1978,1986,1996) presents an overview of the status of coral reefs in Mannar and the species diversity. His publication (1975) cites the example of Manali island in the Gulf of Mannar, and lucidly presents the situation in the gulf before the 1960's coral mining activities and the situation after the mining had taken place. He feels that coral growth in the Gulf of Mannar will be irretrievably stunted since the bottom is sandy and the planulae will not be able to settle (Pillai: 1996). Recent underwater survey's conducted by Kumaraguru (Personal Communication: 1997) are more encouraging. They reveal that there is luxuriant coral growth around the Mannali island and that the overall condition of the reef patches in the Gulf of Mannar is not too alarming…

Gulf of Mannar and Palk Bay

The Reefs in the Gulf of Mannar are fairly accessible to researchers from Tamilnadu and so have been well studied. The CMFRI has regional offices at Mandapam and Tuticorin and have carried out pioneering work related to surveys of the islands and the reefs. An effect of environment and human interference on the coral reefs of Palk bay and Gulf of Mannar has been carried out by Pillai in 1975. A study of the different species and genera of corals found in the Gulf of Mannar has been carried out by Pillai in 1986.

The Centre for Advanced study in Marine Biology, Annamalai University has also carried out several studies on the ecology and status of the reefs in the Gulf of Mannar.

The Madurai-Kamraj University is involved in an underwater survey using scuba equipment, of the islands of Gulf of Mannar in relation to studying the ecology of ornamental fishes of export value in the Gulf of Mannar. They have established

Scuba diving facilities with all the necessary equipment to carry out underwater ecological studies in the Gulf of Mannar. These facilities will be utilized for man-power development in this field of practical significance. (Kumaraguru, 1997).

With the emphasis on people centered development and sustainable management of biodiversity, management research has become a priority. The M.S. Swaminathan Research Foundation has recently received GEF funding to develop a management plan for the Gulf of Mannar. The project report is being prepared jointly with the Tamilnadu Forest Department. The focus of the plan has to be on co-management initiatives involving participation by local people…

3. Human and economic impact on the reef systems

Reefs resources have traditionally been are a major source of food for local inhabitants and of major economic value in terms of commercial exploitation. Reefs in India provide economic security to the communities who live alongside them. In the villages around the Gulf of Mannar the traditional fishermen have been catching reef fish, diving for pearls, sacred chanks, holothuria and sea weed for centuries. In Lakshadweep the reefs are a safety net for food in the monsoon season and also provide the live bait that forms the basis for the commercial Tuna Fishing.

Perceptions of Coral reefs differ according to the priorities of the people in contact with the reef. Traditional fishers and people whose livelihood is dependent on the reef perceive reefs as a safety net in their food production system. For them they are happy hunting grounds where clams, octopus, mollusks and other rich food organisms live and provide them with food and cash income. They also perceive the reef as a defense against the erosive forces of the ocean waves. These people would never willingly destroy the reefs since they realize that they have a long term dependency on them and any destruction of the reef would be destroying the goose that lays golden eggs.

Navigators dread reefs and associate them with ship wrecks. Naval officers only see them as hindrances that come in their way of carrying out their navigational duties. They consider them as hazard zones on their navigation routes. Scientists, scuba divers and snorkeling tourists perceive reefs as places of mystery and wonder. How the corals grow and reefs develop have been questions that have excited their imagination and stimulated their enquiries for several centuries. Mainland communities see reefs as a storehouse of limestone to be extracted for the cement and lime industry. These different perceptions and the fact that reefs are common property resources can often lead to conflicts in resource use on reefs. It also raises special questions on how to effectively manage and monitor coral reef resources.

To have an understanding of the human ecology of the coral reef islands it is important to understand the relationship between local populations and the reef resources. These are the people whose livelihoods become endangered when the reefs are provided protection under protected areas such as biosphere reserves, sanctuaries or marine parks.

One also has to take into account the corporate sector such as cement and lime industries and their exploitative extraction of the reef and the new sector that is coming up in live ornamental fish and reef fish trade. Coastal populations even if they do not live off the reefs will have a effect on the reef habitat merely by their

presence. Sewage disposal is becoming one of the biggest management problems both at the Gulf of Mannar and the inhabited islands of Lakshadweep. All this gives us an idea about interactions between the communities and their ecosystem. It also gives an idea about the political situation and answer questions such as: Who are the main stakeholders of the coral reefs?, are their conflicts arising due to different priorities of users? What are the perceptions of the local population *vis-a-vis* coral reefs etc.

Palk Bay and the Gulf of Mannar

There are about 47 fishing villages along the coast of which 38 are in the Ramanathapuram district and nine in V.O Chidambaranar district bordering the Gulf of Mannar park area. Exploitation of fishery resources in the inshore waters have been the sole occupation of hundreds of fisher families along the coast for centuries. The reefs are used to carry out, reef fishery, chanks and pearl fishery, ornamental shell trade and illegal mining of corals. The villagers around Palk Bay harvest holothurians. Other harvesting activities include chanks and milk fish fry. Turtles are being harvested up to a 1000 individuals annually; Dugongs are also taken.

There are about 50,000 fisher-folk in these villages of whom more than 12,000 are active fishermen. They employ traditional craft such as catamarans, vallans, masula boats, dug out canoes and mechanized boats for their operations. The fishing gear used for fish capture are trawl nets, gill nets, shore seines, drift nets, long lines, traps and others. The average annual fish landings from the Gulf of Mannar in the period 1989-94 are around 46,000 tonnes of demersal fishes and 33,000 tonnes of pelagic fish. These are landed in 33 landing centres along the coast bordering the park area. (Deshmukh S & Venkatramani, 1995). Trawl net fishing and gill nets used for catching lobster causes damage to the reefs around the Tuticorin group of islands.

My own observations at Mandapam in November 1997 are that here are three hundred families from seven villages who are totally dependent on reef fisheries. They place a fish trap *(Kood)* in the patch reef areas in the Gulf of Mannar and every morning go to collect the fish trapped in the trap. Two men go together in a small dug out canoe one dives in to bring the trap and the other in the boat empties the trap and returns it to the diver to place in the reef flat. Shrimp heads are used for bait and trap fishing seems to be restricted to the people who have access to these shrimp heads. These fishermen fish in the Gulf of Mannar during the NE monsoon and for six months in Palk Bay. Personal observations show that this method of fishing causes no harm to the corals.

Studies carried out by various authors indicate severe coral exploitation in the Gulf of Mannar and the Palk bay region. Corals were used in large scale as raw material by the calcium carbonate industry. Extensive areas were leased by the government for coral mining and large scale quarrying was taking place until 1979 when the leases were stopped. However illegal removal still takes place. Cora! mining is centered on the reefs of the Tuticorin group of Islands. Pillai (1973) estimated the annual exploitation of the Gulf reefs to be 90,000 m^3. Venkata-ramanujam et al (1981), show that annually about 15,000 tonnes of coral stones are removed from four islands near Tuticorin alone. Acropora formosa fragments are collected for lime preparation; In tuticorin about 30 boats are involved in this activity and collect over 80,000 m^3 annually. The genera Porites and Favia the principal reef builders and the

most abundant massive species on the reef are quarried for use as building blocks, the construction of roads and for the lime industry. It is estimated that the amount of coral removed over 7 years from Mulli, Talaivi and vali in the Kilakarai group is equivalent to a strip of reef 1 m deep x 18.5 m wide x 10 km long (Shepard and wells, 1988). The net result is that the growth rate of their removal and as present day exploitation is largely confined to water less than 1 m deep, the destruction of live corals is extensive, up to even 100 % in localized sites (Wafer, 1986, Ramaiyan et al, 1995)

Other activities in this area include sea weed collection by local people (mainly women) for supply to institutions and agar-agar manufacturing units. Corals especially the branching type, chanks and shells are collected for selling as curios for the tourist market along the coast. Tourism is not well developed and tourism associated disturbance is minimal.

This being an excellent area for various rare marine specimens, students and scientists tend to be over enthusiastic about collecting zoological specimens. Krusadai and nearby islands are the worst hit.

Population pressure around the Gulf of Mannar and the untreated sewage disposal is causing bacterial infection. Disposal of sewage including the fecal matter and urine due to defecation on the beach is causing problems since it ends up in the Gulf of Mannar. Coliform count even around the islands is high. With the high growth rate of the population in the coastal areas, both due to migration and natural increase these problems are going to be more severe.

AH these activities are no longer sustainable and have a serious impact on the breeding habitats of several species and the reduction of density of the commercially exploited species…

4. Institutional Jurisdiction and Management Responsibility

The coral reefs of India come under the jurisdiction of the department of forests and wildlife and it is their responsibility to monitor, manage and conserve these fragile eco-system. The Ministry of Environment and Forests is responsible to develop an action plan to manage the reef resources and issue guidelines for the sustainable utilization of coral reefs. These plans have been under preparation since 1986, they are however yet to be published. The management of coral reef ecosystems has also been affirmed in India's National Conservation Strategy and Environment Action Plan. (UNDP, 1997).

The National Committee constituted for conservation and management of wetlands and mangroves also advises the Government on policy issues related to conservation and management of coral reefs. State level steering committees have been set up for the formulation and implementation of the Management Action Plans for the identified coral reef areas. Management plans for the Gulf of Kutch Marine National Park and Sanctuary has been prepared by the Conservator of Forests in 1994. Recently the Ministry of Environment and Forests has sanctioned preparation of management action plans for the Andaman and Nicobar and Gulf of Mannar coral reefs (MoEF, 1997).

The wildlife protection act 1972 as amended up to 1991 covers various important aspects with regard to protection of wild animals and certain plants. Corals are not as yet covered by this act. It is important to stress here that coral reef areas come under the jurisdiction of the state Wild life department only when the area is deemed a protected area.

The coastal regulation zone notification, 1991 offers the only legal protection to all coral reefs and In this coral reef areas come under the CRZ1 category. A special category CRZ 4 has been prepared for the Islands of Andaman, Nicobar and Lakshadweep. Norms for regulation of activities within the CRZ state that corals and sand from beaches and coastal water shall not be used for construction and other purposes. Dredging and underwater blasting in and around coral formations shall not be permitted. Section 7 (2) also states that construction of beach resorts/hotels shall not be permitted in ecologically sensitive areas such as marine parks and coral reefs (Notification 8.0114 (E) of 19 February, 1991).

Table 4: Protection Status of Coral reef areas

Locality	Protection	
	established	**proposed**
Gulf of Kutch	Marine National Park (110 Sq Km-1982)	Nil
Lakshadweep Islands	collection of corals is banned.	Nil
West Coast Patches	Nil	Sanctuary proposed at Malwan - South of Bombay.
Palk bay	Nil	Nil
Gulf of Mannar	Gulf of Mannar Biosphere reserve.	Nil
Andaman Islands	Mahatma Gandhi Marine national Park at Wandoor - 234 sq km. of islands and reefs.	Ritchies Archipelago
Nicobar Islands		Nil

While the formation of protected areas and the CRZ notifications and Acts are laudable one finds that there seem to be problems in trying to implement them. These problems are magnified due to the difficulties arising out of monitoring coral reefs and lack of trained departmental staff to carry out these activities. A good example is that coral reefs in protected areas have now come under the control of foresters and Wildlife specialists, who have very little understanding of coral reef ecology and many of them have also never seen a reef first hand. They therefore are only following a projectionist policy where possible and banning the entry of people into the protected areas.

Palk Bay and the Gulf of Mannar

The Government of Tamilnadu has banned the quarrying of massive corals; dead corals on landward sides can be extracted under a lease. Collection of marine organisms are allowed only for scientific purposes around Krusudai island.

Management responsibility of the protected areas and marine biosphere lies with the state department of forests and wildlife. No management or legal protection exists for Palk Bay.

Gulf of Mannar has been declared a Marine Biosphere Reserve. All 21 islands have been notified as reserve lands under sec.26 of the Tamil Nadu Forest Act. Notification of these islands and the sea around the island up to 3.5-5 fathom deep, as a national park under the provisions of the wildlife Protection Act 1972 has also been published. Dugong hunting has been banned and awareness created among fishermen.

Zoning for tourism development; education and scientific purposes have been recommended for total protection of marine life including dolphins, turtles and sea weeds (Krishnamurthy, 1988).

The M.S. Swaminathan Research Foundation and the Tamilnadu Department of forests are currently in the process of developing a management plan for operationalising the management activities of the Gulf of Mannar Biosphere Reserve…

5. Conclusion

Coral reef research in India is still at a preliminary stage and has not yet gone mainstream. Enormous data exists on corals and related species taxonomy. However very little information exists on population density of corals and reef associated species in relation to abundance.

Little information is available on the coral reef ecosystem as a whole or on the relationship between human economy and the ecological resources of coral reefs. This makes development of realistic management plans for coral reef areas involving local community participation especially difficult. The main problem is that each institute has its own research agenda and special focus. Coral reef research has been more incidental than a main stream programme in nearly all these institutes. This has to change if we are serious about developing people centered management plans for conserving and managing our reef heritage.

Status of Coral reefs in India

	Bio-physical	**Research**	**Perceived threats**
Palk Bay	Slow recovery from 60's coral mining	Mainly on Bio-physical aspects	Population Pressure and associated effects
Gulf of Mannar	Slow recovery from 60's coral mining	Bio-physical aspects; associated fauna and Human activities damaging the reefs.	Population Pressure and associated effects
Andaman & Nicobar	Fair Excellent, Problems around south island	Bio-physical aspects; associated fauna and Human activities damaging the reefs	Siltation due to logging, Sand mining.

Lakshadweep	Excellent off uninhabited islands and endangered along habited islands.	Bio-physical aspects; associated fauna and Human activities damaging the reefs	Population Pressure and associated effects
Gulf of Kutch	30% of the reefs are living	Bio-physical aspects; associated fauna and Human activities damaging the reefs	Sedimentation and siltation due to cutting of mangrove forests, sand mining for industrial use. Population pressure
West Coast	Unknown	Limited	Unknown

Changing the mandate of research institutions is difficult, hence it is recommended that a special institution to serve the purposes of Coral Reef Research, Conservation and Sustainable Management may be set up under the control of the Department of Ocean Development. This could be an agency like MPEDA or an authority like the Great Barrier Reef Marine Park Authority in Australia. Such a National Centre can help to bring together all agencies/institutions working on coral reefs into a National Network on Coral reefs.

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Crusader against the Setusamudram project speaks

***The Rediff Interview*/O Fernandes, Co-convenor, Coastal Action Network**

July 19, 2005

O Fernandes, co-convenor of the Coastal Action Network (CAN) had filed an unsuccessful petition in the Madras high court seeking issue of a writ to quash the March 31, 2005 order of the Central government granting environment clearance to the Setusamudram Canal Project near Rameswaram in Tamil Nadu.

The Coastal Action Network and several other NGOs are relentlessly fighting to discontinue any action by the shipping ministry in the Palk Strait. What they are trying to do is garner public support against what they consider would be an environmental disaster.

The voice of the Coastal Action Network has reached far and wide -- Fernandes was being interviewed by BBCE when *rediff* called on him. He spoke to **Shobha Warrier** on CAN's future course of action as far as the Setu canal project is concerned.

Are you disappointed with the high court's decision to reject your petition seeking to quash the Centre's order granting environmental clearance to the Setu project?

There were two high court orders. The first one was regarding the unscientific and undemocratic nature with which the public hearings were held. There, the high court said it was premature because the public hearings weren't completed. We had said that because of the tsunami, many fishermen were unable to come to the hearings but the court refused to entertain our arguments on merit, and dismissed it as premature.

The more recent high court petition which we had prayed for was for staying or quashing the clearance given to the project. The court did not go into the merits of the arguments. They asked us to look at the alternative, to go to the environment tribunal, which already exists.

The judges suggested that we go before the tribunal (The National Environment Appellate Authority). We said the tribunal should be headed by a Supreme Court judge; it has remained headless for the last five years. Hence, we said we cannot go before the tribunal. So, the judge ordered that within thirty days, such a head must be appointed, and we were given 30 days to file a petition there.

So, to that extent, the second order, since it hasn't gone into the merits of the argument, was another disastrous judgement or order. Still, it's open to us.

Are you not losing out on time? The project has been inaugurated.

No. Our entire strategy is not based on the legal case. It's also based on people's resistance to the project. You know in Madurai, Tuticorin, Rameswaram, Nagapattinam -- everywhere, people are resisting the need for this project. So, it's based on people's strength.

How do you plan to make people resist the project? How do you plan to unite them against the project?

As a representative of the Coastal Action Network, we are members of the movement against the Setusamudram Canal Project. So, we jointly plan, though I am petitioner in the matter, with people's movements, scientists, environmentalists and lawyers, and co-ordinate our strategies.

How optimistic are you about creating a strong people's movement against the project? Will a people's movement be able to resist political power?

I am very optimistic. Increasingly, there is a growing awareness among a lot of fishing people and coastal people, and the awareness is growing in cities too. It's growing not only in Tamil Nadu but across India.

We are creating awareness that this canal is not going to benefit the people at all. The question then is, who is it going to benefit?

The shipping industry is not going to use this canal. The international shipping lines are not going to use this canal. So, then, who is going to use it and at what cost?

Our estimate is that for the 10 year period which we calculated, not less than 24,000 crore rupees of the wealth of fishing people will be destroyed. They have said publicly that it will take 10-13 years for the project to even get back what is invested. It will take 18-19 years to break even. It is a ridiculously, economically unviable project.

The argument from the other side is, it is a 135-year-old dream of the Tamils.

The first thing I want to ask these politicians is, which Tamils are they talking about? If they are really talking about Tamil people, they shouldn't be digging this canal. It's not going to bring in commerce.

Secondly, it is not going to bring any development or employment excepting during the construction period.

The real issue is [*this*] -- right now the coast is protected by the Coastal Regulation Zone (CRZ). They cannot dig a road through this coast because it is banned under the CRZ law. So, instead of digging the road, they are digging the canal. Once you dredge the canal, they are going to have stopovers, or small harbours. Once you set that up, you break the CRZ law. So, the real interest is to smash the CRZ law because they claim the CRZ law is not allowing them to put up projects along the coast.

For international and national big capital, the coast is the easiest dumping site you can get for all your wastes, whether you are looking at thermal plants, ports, chemical industries, petrochemicals or pharmaceuticals. All the big industries are trying hard to locate themselves on the coast, including tourism.

Since the CRZ law is there and since the fishing people have used the law to resist [*it*], they have not succeeded. So, you dig a canal a little outside and then you invade the inside. That's the strategy. But they are not telling this to anyone.

If you see the arguments of the former chief minister [*K Karunanidhi*] or Union Minister T R Baalu or the Tuticurin port authorities, every single argument of theirs is not based on any scientific report. They haven't quoted a single scientific report. On the other hand, I will name 40 scientific studies showing that it's not viable. Now, they have appointed five institutes to do the environmental studies. On what scientific basis did you give clearance when you say in the clearance order, you have to do 16 more studies? This is what I told the BBCE also when they asked me the question.

We are carrying out a big international campaign. We have begun by asking all foreign companies to stay off this canal or face the wrath of the people.

Another thing I want to point out is, the Prime Minister's Office objected to this project first, and said there was no comprehensive Environmental Impact Analysis . The PMO has not answered our letters on how they cleared this project when they themselves raised objections in the first place. The PMO raised the same objections that we have raised. Within two months, it gets passed. How? We have politicians who are simply selling this country piece by piece.

Arguing your case, the CAN lawyer said you are not against the project *per se*. You only wanted a concrete scientific study before the project starts. Does that mean you don't object to this project at all?

Well, that's for the courts. We want the courts to appreciate that our arguments are scientific. Hence we want the court to recognise that here's a project going through without a scientific base. That's why we spoke like that. It's illegal and violates several laws of the land. Several aspects like fishing are state subjects. If the fishing people's access to the sea is going to be hampered by the canal, obviously it is the state government's job to examine the project.

If the project under a Union minister has violated so many laws, who is going to stop him?

In both the times of judgement, that's what we wanted to open up. We want to open up the discussion on merits. We would like to have the judges set up a scientific team to guide them.

So, what is your course of action?

One is, the people's resistance will go on. There's no doubt about it. We, and by we I mean the people, are not going to allow dredging. In the worst scenario, the fishing people are going to just log their catamarans in ports when the dredging starts.

Secondly, we are very grateful to the media for supporting us over the last 2-3 months in a very major way. So, we do like to communicate through the media as that is our only means of communication. From the litigation point of view, we have

three options, one is going before the centrally empowered Supreme Court appointed committee which is looking at wildlife and environment.

The other is, we go to the Supreme Court, again looking at the clearance aspect and asking the SC to examine our argument. Number three is, we go before the Tribunal, the Appellate body.

Professor KNJ Katupotha of the Sri Jayewardenepura University said in a seminar that the project could upset the entire ecological system in the seabed of the fertile Indian Ocean. He also talked about the project causing earthquakes. Later, Union Minister T R Baalu said they have cleared Sri Lanka's fears.

It's a chain of fragile zone right from Kanyakumari up to West Bengal. The tsunami showed the mud and sludge that was thrown up had killed a lot of flora and fauna right from the Gulf of Mannar biosphere in the Palk Strait.

Tsunami is a good lesson which they are not willing to learn from. This is the only major biosphere you have in India. If this goes, it will totally affect fish breeding. Our calculation shows immediately, 70,000 families will be affected. It will soon be five times more than that.

A good part of the part of the Gulf Mannar biosphere is in the Sri Lankan territorial waters. Now, I think they are going to court to challenge this canal for violation of international law and the law of the sea.

The minister also says the project will help our defence...

That's the height of ridiculousness. No naval fleet will ever commit suicide by going through that 12m canal.

Chief Minister J Jayalalithaa has raised several questions, though a bit late. Do you feel it is also a political game?

Whether it is politics or not, they were correct. The authorities had no business to clear the project without the Tamil Nadu government giving them the no-objection certificate from the TN Pollution Control Board.

But Union Minister Baalu has said in a press conference that he didn't have to get the NOC from TN Pollution Control Board.

He is not reading the law correctly. Mr Baalu can be challenged for illegality. We haven't yet challenged them on violation of several laws. The NOC is absolutely necessary.

There is no use of Chief Minister Jayalalithaa trying to say, I want the project but procedurally, environmental matters have to be followed. If you look at procedurally and scientifically, the project is unsustainable. She is only technically correct.

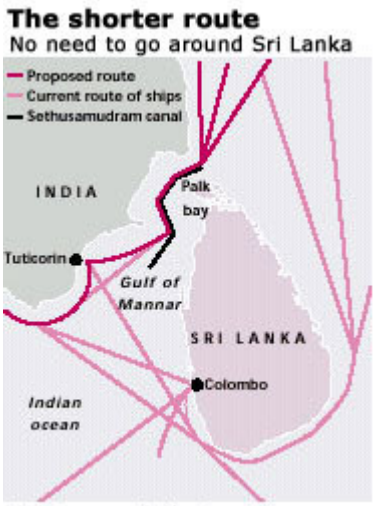
Are you optimistic about your fight becoming successful?

Very, very optimistic because the fight is not between Mr Baalu and us, or us and ministry of environment and forests. The fight is between sustainable development and destructive development, and that's the key issue.

http://in.rediff.com/news/2005/jul/19inter.htm?zcc=rl

Prime Minister’s Office exposes system slip-up

Downtoearth, VOL 13 ,NO 22 Tuesday, April 05, 2005



Source: www.tuticorinport.com, viewed on March 18, 2005

Tamil Nadu’s mega Setusamudram project, cleared by other agencies

the Prime Minister’s office (pmo) has raised serious concerns about the Setusamudram Shipping Canal Project (sscp) in Tamil Nadu. The sscp aims to provide a route linking India’s eastern and western shores, doing away with the current need to circumnavigate Sri Lanka. In a note issued in the first week of March 2005, the pmo raised many questions about the environmental impact assessment (eia) study on the project carried out by the National Environmental Engineering Research Institute (neeri) , Nagpur. It has sought many clarifications before according a final approval to the project. The note directs that the clearances issued by the Union ministry of environment and forests (moef) and the Tamil Nadu Pollution Control Board to sscp be put on hold till a proper evaluation of specific issues is made. In September 2004, the Cabinet Committee on Economic Affairs had also given a green signal to the project .

The over Rs 2,000 crore project will be implemented by the Tuticorin Port Trust (tpt) . The 152 kilometres (km) long canal will originate from the Tuticorin harbour in the south and run through the Gulf of Mannar, the Palk Bay and the Palk Strait in the north and northeast directions before joining the Bay of Bengal (*see map*: The shorter route). The canal will be 300 metres (m) wide and 6 km long in the Adam’s Bridge area and 68 km long in the Palk Bay and the Palk Strait area. It will be 12 m deep to enable ships with a draught of 10.7 m to pass through. Dredging of the sea bottom will be done in about 74 km length of the canal.

Flawed impact assessment “The canal project faces the problems of sedimentation, cyclonic disturbances and dumping of the dredged sediments which have not been effectively tackled in the neeri study. neeri neither considered the sediment contribution from the rivers flowing into the Palk Bay nor from the previous cyclones, with the result that the study did not pinpoint the source for 99.4 per cent of the sediment volume in the region,” the pmo’s note reads. Quoting the meteorological department, it points out that the stretch between Nagapattinam and Pamban is a high-risk zone for cyclones.

The pmo has also highlighted that that the information furnished by neeri about the effects of tsunamis and cyclones was “incomplete” and there were huge gaps in the knowledge about “the sedimentation regimes existing in the various micro regions of Palk Bay”. “The environment impact assessment and the technical feasibility report prepared by neeri have ignored these aspects...Going ahead with the construction of this mega project without collecting information on the above aspects could lead to major economic, technical and human problems in future that could border on a disaster,” it says.

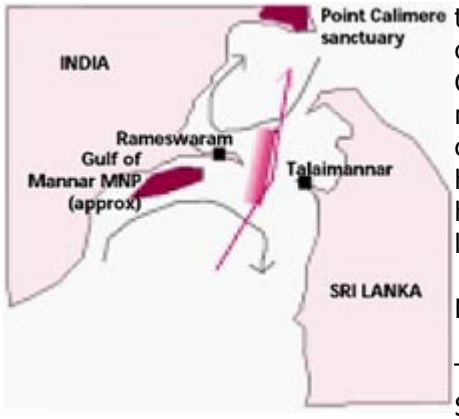
Telling response Sources at neeri say they are not experts on tsunami and related issues and theirs was not the only study to be commissioned by tpt. "There were several other studies ordered by tpt and they will be responding to the queries raised by the pmo. " tpt chairperson N K Raghupathy and the project's superintending engineer V V Ramamoorthy were in Delhi on March 18, 2005 to respond to the pmo's queries. "We have given our replies to the pmo and have cleared all the doubts they raised," claimed Ramamoorthy. But he added that tpt had not undertaken any specific study on the tsunami's impact. In that case, it is a mystery how they managed to answer the pmo's queries satisfactorily, as the latter's main concern was a tsunami-like disaster. "Had the Setusamudram shipping canal been operational at the time of this (December 2004) tsunami, the currents in the Palk Bay and the associated turbulence would have damaged the canal considerably and would have caused a wide dispersal of the dredged material placed at seas," the pmo's note says.

The pmo's objections to the project comes as a blow to the Dravida Munnetra Kazhagam (dmk) and some other allies in the ruling coalition at the Centre. These parties have been trumpeting the sscp in the run up to the 2006 Tamil Nadu assembly elections. dmk 's T R Baalu, the Union minister for shipping, road transport and highways, had pressured the moef to give it an early clearance. The project comes under Ballu's ministry. But now the pmo's move has put a question mark on the entire process of approving projects like sscp. It has revealed how environmental concerns take a back seat when political pressure influences the decisions of technical bodies and ministries.

http://www.downtoearth.org.in/full6.asp?foldername=20050415&filename=news&sec_id=4&sid=9

Concern on environmental impacts

The Setusamudram project could well be one of the major environmental disasters of this decade. It has the potential to affect coastal communities over a large stretch of the Coromandel Coast. A series of public hearings are being held now in areas where the local communities are in complete opposition to the political parties, which have their storm troopers in large numbers at each hearing. The opponents of the project are being labelled anti-national (as usual).



Here is a possible impact of the project (see map).

The map shows the Palk Straits between India and Sri Lanka. The grey arrows show the probable direction of the currents today. The currents must be going in this circular fashion for there to be a shallow portion between India and Sri Lanka. The brown patches are the protected areas in the region, on the India side.

The Setusamudram project envisages deepening the shallow part of the Palk Straits to allow large ships to go through the straits. The red bar indicates the approximate location of the channel to be deepened.

Two scenarios are possible:

If the currents do not change due to the channel, then siltation will continue, and the project will fail.

But if the currents change and go along the channel, as shown by the red arrow, then coastal erosion is likely to be heavy at both Dhanushkodi and at Point Calimere. The project will succeed but chances are that the changed sedimentation patterns might totally destroy the coral reefs in the Gulf of Mannar Marine National Park (mnp).

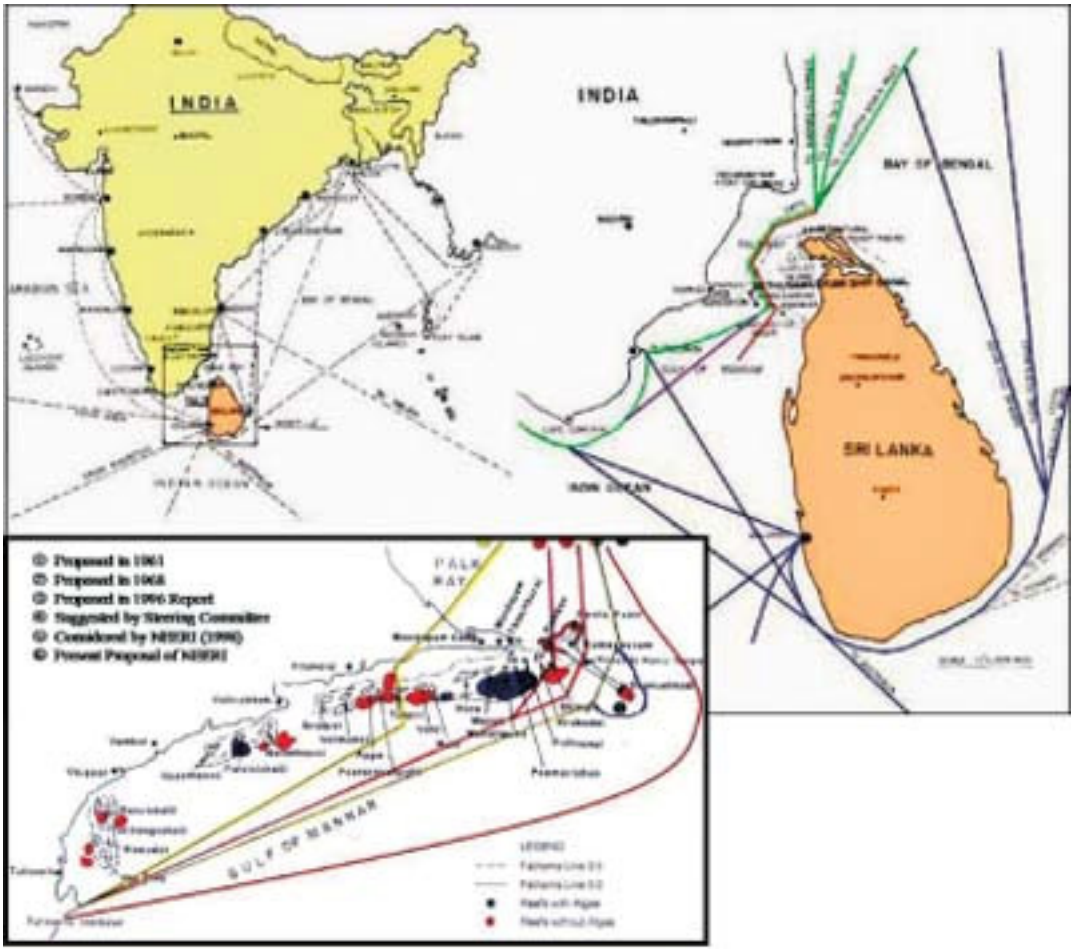
If the Environmental Impact Assessment (eia) had been properly conducted, we would have had the correct answers to this question today. However, the eia conducted by the National Engineering Environmental Research Institute lasted exactly four months. It is then not surprising that the current changes have gone unmonitored, and the possible impacts of changing currents never spared the attention they deserved.

RAUF ALI *Pondicherry* (Sep 28 2004 9:21PM)
http://www.downtoearth.org.in/new_letter.asp?foldername=20041015&sec_id=1

Setu Channel passage: 34 Lankan experts call it eco disaster

Controversial Setusamudram canal dredging project
Lankan experts caution against eco disasters

By Ravi Ladduwahetty



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An eminent 34- member advisory group of Sri Lankan professionals have cautioned that the Setusamudram canal dredging project could have disastrous environment impacts, particularly, maritime environment, for Sri Lanka.

What is most disconcerting is the absence of any response from the Indian Government to the Lankan concerns.

The Group, after a year's study, submitted their report to Foreign Secretary Dr. Palitha Kohona, earlier this month.

The Experts Group comprised Secretary, Education Ministry Ariyaratne Hewage - Chairman, Peradeniya University Professor of Geography Shantha Hennayake -

Deputy Chairman, Special Advisor, Technical Planning & Development, Sri Lanka Ports Authority, Prasanna Weerasinghe and Systems Advisor, Setusamudram Ship Canal Project (SSCP), Tikiri Jayatilleke.

The Advisory Group was supported by sub committees from the Ministry of Foreign Affairs headed by Assistant Director Sugeesawara Gunatunga, on hydrodynamic modeling headed by Moratuwa University's Prof of Coastal Engineering Samantha Hettiarachchi, on Environmental Measures for Sustainability headed by the Director, Institute of Technological Studies, Dr Aziz Mubarak, including IUCN Ecologist Dr. Channa Bambaradeniya and Head of Oceanography, NARA, K. Arulananthan, on Fisheries Resources & Livelihood, headed by Head of Marine Biological Resources, NARA, Dr Champa Amarasiri and on Navigational Emergencies headed by Commander Y.N. Jayaratne, Sri Lanka Navy.

The primary concern for Sri Lanka is that the initial dredging, the infinite maintenance dredging and subsequent shipping through the channel, could have negative impacts on Sri Lanka's maritime and environment resources, sources in the Advisory Group told The Nation yesterday.

Another major Sri Lankan concern which also relates to environment resources, is that the Indian studies have not taken into account the single environment impact on the Sri Lankan side of the international boundary, they said.

The Advisory Group is of the view that, despite the SSCP being located only one mile away from the Indian side of the maritime boundary, the impact is unlikely to remain only on the Indian side and that, Sri Lanka's concerns have become even more significant, in the light of insufficient attention paid to minimise the environmental aspects on the Lankan side of the boundary.

The Advisory Group has also noted that the Environmental Impact Assessment (EIA) carried out by India is inadequate for a number of reasons.

The Nation in its edition of January 7, 2007, exclusively reported that, despite the Indian assertion (Commercial Counsellor, Indian High Commission, Colombo, Sanjay Sudhir refers) that it has shared the Ahamedabad based Indian National Environment & Ecological Research Institute (NEERI) report with Sri Lanka, is insufficient justification to prove that there will be no adverse impact on the environment. Simply because, the NEERI report by itself, was flawed and was sufficient legal justification to put the entire NEERI repot into scientific question.

For example, the NEERI report is yet to explain the sedimentation issue, silting possibilities and underwater ocean currents, when the canal is constructed.

According to Sudharshan Rodriguez, a Chennai based conservation analyst, the EIA report furnished by NEERI, has used secondary data going back to 1976. "Hence, how can a project, which will pass through a biological hot spot, with so many likely impacts, be assessed on the basis of secondary data?" is the next most logical question.

The Convenor, Indian Coastal Action Network, Ossie Fernandez has alleged that the NEERI EIA report is also a re-hash of the preliminary report and that, many activists and professionals are querying the data sources, including the bio diversity readings.

Furthermore, there would be increased turbidity, which has never been studied by NEERI, which has neither studied the possibility of a tsunami through the canal water flow, due to the deep water channel linking the Indian Ocean and the Bay of Bengal.

The United Nations Law of the Sea mandates that neighbouring States need to be consulted and sufficient safeguards and guarantees provided.

Fishery resources

There is also concern of the lack of concern on the Indian side, of the unique, biologically rich resource areas linking two Marine Eco systems in the Gulf of Mannar and the Palk Bay. Unless accurate forecasts are made of the mitigation effects, it could eventually destroy this fragile marine eco system. This is all the more significant in the light of the Northern and North western communities in Sri Lanka being heavily dependent on the fisheries resources of this area.

The concerns that Sri Lanka has expressed are protecting the endangered species, protecting the fisheries resources, the coastal and maritime eco diversity system, integrity of the eco system in the seas around the island and immediate and long-term ecological stability.

According to research done in Jaffna, by Sri Lanka born Monash University's Professor of Systems Ecology and UNDP Consultant Prof. Ranil Senanayake, fresh water fish such as Dandiya (Rasbora Daniconius), Tittaya (Amblypharygnodon Melenittus) and Amblypharygnodon Melenittus, migrate down towards underground caverns and chambers, during dry weather and surface when it rains. This also demonstrates the existence of massive underground freshwater caves off Jaffna, with which the salt water of the Palk Straits would mix, if the dredging continues.

This is a shallow area which is highly productive, biologically. As a consequence to the dredging, rare species of mammals, dugongs and fish and invertebrates such as the guitar shark and cone shells would become extinct. One cone shell (Conus Zonatus and Conus Gloria Maris) is worth around US$ 3,500 apiece.

Dredging will also reduce the photosynthetic rate, resulting in the collapse of the fishing industry.

Ecological and archaeological concerns

Among a host of serious problems, one major issue is that the canal is to be dug through vesicular limestone, which is a formation of limestone, consequent to the myocene sea encroaching upon parts of Northern Sri Lanka and Southern India. This entails Mannar and Jaffna on the Sri Lankan side and Tuticorin and Rameswaran on the Indian side, which means that the groundwater on both sides of the channel, would be affected.

It is also salient that no maritime archaeology has been conducted on this site. Scientific evidence, in a paper presented by Prof. Senanayake, indicates that 13,000-years ago, the area around the Kalpitiya lagoon, up to Mannar, was forested. Even today, stumps of old trees are found underwater.

There are innumerable stories in Sinhala history, regarding noblemen and royalty living underwater.

Navigational Emergencies

Sri Lanka has proposed that a plan to ensure vessels that cause pollution and oil spillage are identified and necessary compensation mechanisms put in place, is established. Sri Lanka should, invariably, be involved in the preparation of contingency plans for oil spills, including modalities to work out the cost of marine pollution and other navigational emergencies and how they be met.

Recommendations

Sri Lanka has also proposed the sharing of information on existing studies and collaboration on further studies and assessments and the setting up of a common database. Also that a Joint Environment Management Plan for impact assessment and monitoring of the project area be established.

Both Sri Lanka and India will be tremendously benefited if the recommendations are implemented to minimize the adverse environmental impacts of the SSCP, the Advisory Group has pointed out.

http://www.nation.lk/2007/04/22/newsfe3.htm

Study sought on impact of Setusamudram

T'PURAM: A detailed study, with the people's participation, should be carried out to assess the impact of the proposed Setusamudram project on the sea off Kerala and the Kerala coasts, a seminar jointly organised by the Centre for Innovation in Science and Social Action (CISSA) and the Botany Department of Kerala University urged the government.

There is a need for scientifically assessing the impact of the project on the marine resources and fisherfolk before going ahead with it, speakers at the seminar said.

Kerala University Vice-Chancellor M K Ramachandran Nair inaugurated the seminar. Organising committee chairman C S P Iyer who presided over the seminar said that the environmental impact on Kerala due to the project is yet to be put under the scanner.

Several factors in the environmental impact study conducted by the National Environmental Research Institute (NEERI), Nagpur, were not taken into account, said scientist C P Rajendran in a paper presented on the occasion.

http://www.newindpress.com/NewsItems.asp?ID=IEO20070427011849&Page=O&Title=Thiruvananthapuram&Topic=0

The impact of Sethusamudram canal on Tamil Nadu and Kerala coasts

C.S.P. Iyer

Background

India does not have a continuous navigable route around the peninsula, within her territorial waters, due to the presence of a shallow patch, Adam's bridge, where average depth is only 3 meters. The Sethusamudram ship canal project (SSCP) envisages the creation of a navigable channel of 152.2 km from Gulf of Mannar to the Bay of Bengal through the Palk Bay and Palk Strait to facilitate the movement of ships. A 20 kilometer 300 meter - width channel will be created by dredging shallow areas of Adam's bridge up to 12 meters depth. Similar excavation is to be carried out in Palk Straits over a distance of 26 kilometers. This would connect the east and west coasts of India, thus obviating the necessity of going around Sri Lanka. It would also provide a direct link between Tutucorin and Chennai. Once the project is completed, the ships now traveling around Sri Lanka are expected to reduce travel time by 36 hrs and the distance by 400 nautical miles.

The proposal for such a canal was discussed as far back as 1860. After Independence, it was taken up by Pt. Jawaharlal Nehru cabinet in 1955. Further, it was reviewed by three expert committees. Finally it was approved by the cabinet and inaugurated by Prime Minister Manmohan Singh on July 2, 2005.

Though the clearance of the project has been given based on the EIA and technical feasibility report of NEERI, many doubts about its scientific aspects still persist. This has been further accentuated by the tsunami of Dec 26 2004, and the destruction it caused on the east and west coasts of India. In the light of above, it is necessary to reevaluate the project from all angles, supported by further scientific studies. Some of the issues which are causes of concern are discussed below.

Ecological and Environmental Issues

Biodiversity

The Palk bay and the Gulf of Mannar covering an area of 10500 km^2 in which the proposed canal is to be built are biologically rich but fragile ecosystem. The Gulf of Mannar has been internationally recognized as a marine biosphere reserve. The 21 islands between the coast and the proposed canal route have been declared as National Parks. The marine bio – reserve houses more than 3600 rare species of plants and animals. It is believed to have the highest concentration of sea grass species along India coast. It is the largest remaining breeding ground for the globally endangered species Dugong. Endangered sea turtles, dolphins and sea horses are found here. Coral Reefs abound in this region. Though the proposed navigation route would be 6 - 20 km away from the marine national park, it is very difficult to accept the argument that there would be no adverse effect on this sensitive ecosystem. The waters cannot be compartmentalized.

Sedimentation and dredging

The Gulf of Mannar and the Palk bay form a backwater system. The Adam's bridge acts as a barrier to flow of water. In the area, a complex ecosystem exists. A factor for serious consideration is the fact that the Palk Bay is a sedimentation sink with high deposition rate. Various sedimentation rates have been reported, depending on the area studied. The EIA report of NEERI selectively takes a convenient value for the sedimentation rate which does not reflect the true picture. Even accepting the NEERI report, around 85 million m^3 of material has to be dredged (20 km of dredging at Adams Bridge and 54.2km in the Bay of Bengal). In addition, for the maintenance of the canal, material of 0.1 million cubic metres has to be removed annually for the Adam's Bridge Leg alone. This is excluding the Bay of Bengal leg for which no value has been reported. Due to dredging, the bottom flora and fauna would be destroyed. Doubts have also been expressed about the nature of sea bed in this area. It is feared that that with depth some places would be rocky which would call for blasting. The damage to marine life by such underwater blasting can be imagined. The impact of dredging and dumping on the marine life has not been assessed. Literature survey has brought out very clearly that turbidity, which would result from such activities would drastically reduce the productivity in the area and thus of the fish population. Many of the species in this region would face extinction. Similarly the corals would also be destroyed. Excessive inputs of sediments can destroy coral reefs by smothering, reducing the light availability and potentially reducing coral photosynthesis. Once the material is dredged, the next important question is the dumping site. It is suggested that the sites for dumping would be over Pampan Island, between Rameswram and Dhansukodi and in the Bay of Bengal.

Oil Pollution

Besides dredging which results in turbidity, another source of pollution is from oil spills from the ships passing through the canal. Major oil spills from cargo spills are frequent events that have serious consequences on the environment. On the global scale about 1% of the cargo vessels are involved in accidents resulting in oil spills. It may be mentioned that the traffic potential in the canal is estimated to be 11000 ships per year which means that every three days there will be an accidental spill. It is worth mentioning that the sea bed surrounding the proposed route of the canal through the Adams Bridge is shallow no more than 4m deep. Thus even a small deviation from the planned route would be catastrophic.

Cyclonic storms and Tsunamis

The east coast of India is subjected to frequent cyclonic storms. These can disturb the sedimentation dynamics of the region and thus the quantity of dredging to be undertaken. Similarly cyclones can rework the dumped material. Unfortunately, the EIA report has not paid any serious attention to the meteorological factors. Added to that is the realization that the east coast is vulnerable to disasters like Tsunami. In this context, It is worth recalling the Tsunami which occurred on Dec 2004. The epicenter of the earthquake, which triggered the Tsunami, was located south west of Sumatra at the interface of Indian and Burmese plates. Due to the presence of the lithosphere boundary around Simeuleus Islands which continues up to Nicobar Island, the earthquake rupture initiated west of this boundary did not cross to the east, but got propagated northwards to the Andaman and Nicobar Islands. The tsunami caused destruction in 12 countries, from Indonesia to Somalia Islands. It killed 1, 76,260 people. In addition, 49, 682 were reported missing. Indonesia suffered the maximum damage as the epicenter of the earthquake which initiated the Tsunami was located there. It affected Andaman and Nicobar Islands, Sri Lanka,

Tamil Nadu coast and to a lesser extent, the Kerala coast. Further, it affected the southern part of the eastern continental shelf of India, from Karaikal in the south to Vishakapatnam in the north. In particular, Nagapatnam – Cuddalore part was worst affected. The reasons for this high surge in this area were the bathymetry of the shelf and the concave configuration of the coastline It has been noted that the Park Bay received tsunami waves of higher energy and that these could not directly pass on to the Gulf of Mannar due to the presence of Adam's bridge. The waves taking a higher arc, circumventing Sri Lanka (Carolio's effect) and which hit the Kerala coast, were thus of lower energy. In case the Adam's bridge is broken, making a wider passage, it is feared that the waves coming into the Park Bay, would be funneled through this passage. The funneling process would increase the intensity of the waves. Further increase would take place due to the waves propagating from south of Sri Lanka. Thus, if these waves of higher intensity were to hit the Kerala coast, the devastation would be catastrophic. The funneling effect and the destruction it can cause is noted to a certain extent at Valiazhckal on the Kerala Coast.

Economic issues

Another lacuna in the project report is the lack of the economic benefits that would accrue, if the canal is established. The investment, at present proposed, is 2500crores. This expenditure is proposed to be met entirely from Governmental or semi governmental source. No private participation is expected. This gives the feeling that private entrepreneurs are not attracted to the enterprise. With the kind of unrealistic figures on the amount of dredging and the additional costs to be incurred if blasting of rocky surfaces have to be undertaken, the final figures on investment would be much higher. There are varying figures on the number of ships which would be plying on the route and the charges to be levied on them. A cost benefit ratio for the project is called for. It is argued that ships can save time and fuel by taking the route. However, for ships coming all the way from Africa or Europe, the gain is minimal. Moreover, the passage through the canal would take longer, as they have to be piloted. Another issue of concern is the number of people who would be displaced from the area, affecting their livelihood. The report of NEERI admits the adverse impact on traditional fishing activities.

Defense

One factor, which appears to have been, may be purposefully kept out of the public view, are the strategic benefits. The movement of the naval ships from east to west and vice versa would be facilitated by the SSSC. Defense experts should discuss this issue and come out with their opinion.

Conclusion

There is a necessity to address the issues mentioned above in a rational and scientific manner before proceeding further with the project. Some of these relate to further studies on

- Bathymetry of the region after Tsunami
- More realistic estimates of the sedimentation rate
- Modeling Tsunami waves with and without Adam's Bridge
- Taking into account Meteorological factors
- Environmental impact on the biodiversity
- Economic viability of the project

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Socio-Cultural Aspects

Justice K.T. Thomas says "Ram Sethu should not be broken"

Justice K.T. Thomas, former judge of Supreme Court of Bharat, is well known for his rectitude. President of India Dr Abdul Kalam decorated him with 'Padma Bhushan' award at a grand function at Rashtrapati Bhavan, New Delhi, on April 5, 2007 for his impeccable judicial career and for the service he rendered to the cause of justice. After his retirement, Justice (Retd.) Thomas had headed as many as four judicial commissions, that too on sensitive issues. But he completed the task within the stipulated time in all the four instances. Never did he ask for extension of the tenure of his commissions. Also, never did he take a paisa as remuneration for his work in any of these four commissions. His logic: "The pension I get after my retirement from the Supreme Court is from government treasury. How can I take money from the government a second time for doing a government job?" He can afford to be candid on vital issues, thanks to his spotless career. For example: "In projects like this (Sethusamudram Shipping Canal Project), decisions are to be based not only on a study of geological implications; the religious sentiments of the people are also to be taken into account. The religious sentiments of the people of Bharat must be honoured and there exists a tradition in this land, of honouring religious sentiments. So, it is my definite opinion that Ram Sethu must not be broken", says Justice (Retd.) Thomas.

http://www.organiser.org/dynamic/modules.php?name=Content&pa=showpage&pid=181&page=6

Pride in History first step to renewal

Professor M D Nalapat

Vice-Chair, Manipal Advanced Research Group, UNESCO Peace Chair &
Professor of Geopolitics, Manipal University

Prime Minister Manmohan Singh frequently refers to India's future. He, however, forgets that the future is a continuum of the past, and that unless the citizens of this ancient civilisation are given knowledge of its past, they may not have the courage to attempt to build a worthy future. The history of India is not only a litany of glorious deeds but a catalogue of missed opportunities that resulted in much pain. Unfortunately, our "official" historians have usually tended to dismiss the civilisational achievements of their own country as "myth", while portraying the pain as either something that was deserved or which, indeed, was pleasurable. Reading through numerous texts, one may be forgiven for believing that Nadir Shah, give or take a few lapses, was a wise ruler and Aurangzeb (for whom towns and streets are named in India) was almost a philanthropist. Just as there is almost no mention of the numerous famines that afflicted the country at the cost of tens of millions of lives during the "benign" rule of the British, there is only a passing mention of historical facts such as the *Qatil-i-Aam* and other massacres during Mughal rule. India is characterized by "Indutva" - the confluence of cultures from across the world - but the correct depiction of history is needed to avoid repeating the errors that led to the many disasters that befell the land, another of which is now in the making, the destruction of Ram Setu

Muthuvel Karunanidhi has been honest when he condemns the rising crescendo of voices against the hooliganism represented by the attempted destruction of an important segment of India's history, one that is at the core of our value system, the *maryada* of Lord Rama. Let us not forget that in the 1960s, Karunanidhi was open about his desire for a Tamil Eelam, or that in 1989 he organized protests against the Indian soldiers returning from Sri Lanka after Ranasinghe Premadasa signed the death warrant of his nation by making Viswanath Pratap Singh recall forces that had boxed the LTTE into a tiny corner of Sri Lanka. Since then, the Tamil Tigers have bounced back, and are today in a position to make unsafe life anywhere in their island. Instead of accepting the advice of friends in India and putting in place a federal system that would devolve substantial autonomy to the Tamils, the present Sri Lankan government is concentrating on a military solution, using an army that is Sri Lankan only in name. Just as the "Pakistan" army is in reality simply an instrument to ensure the overlordship of the Punjabis over the other ethnic groups in Pakistan, the Sri Lanka army is the sword-arm of just a single group - the Sinhalese - and is openly being deployed in a manner that they judge would preserve Sinhala domination over the Tamils. Such chauvinists have no place for Indian tradition, and in this, Sinhala Chauvinism and Indian Regionalism have come together to seek to destroy the Ram Setu. It is an alliance of Rajapakse and Karunanidhi against Bharat.

Lord Ram was not a myth. Lord Ram was a reality. And unless this be openly admitted, the young women and men of India will not have the link with their noble past that gives them the ability to see themselves as the equals of any other peoples, and as the generation that would restore India to greatness. Lord Ram is not a "Hindu" icon, he is an *Indian* hero, and as such part of the cultural and historical heritage of every citizen of our country, be he or she Muslim, Christian,

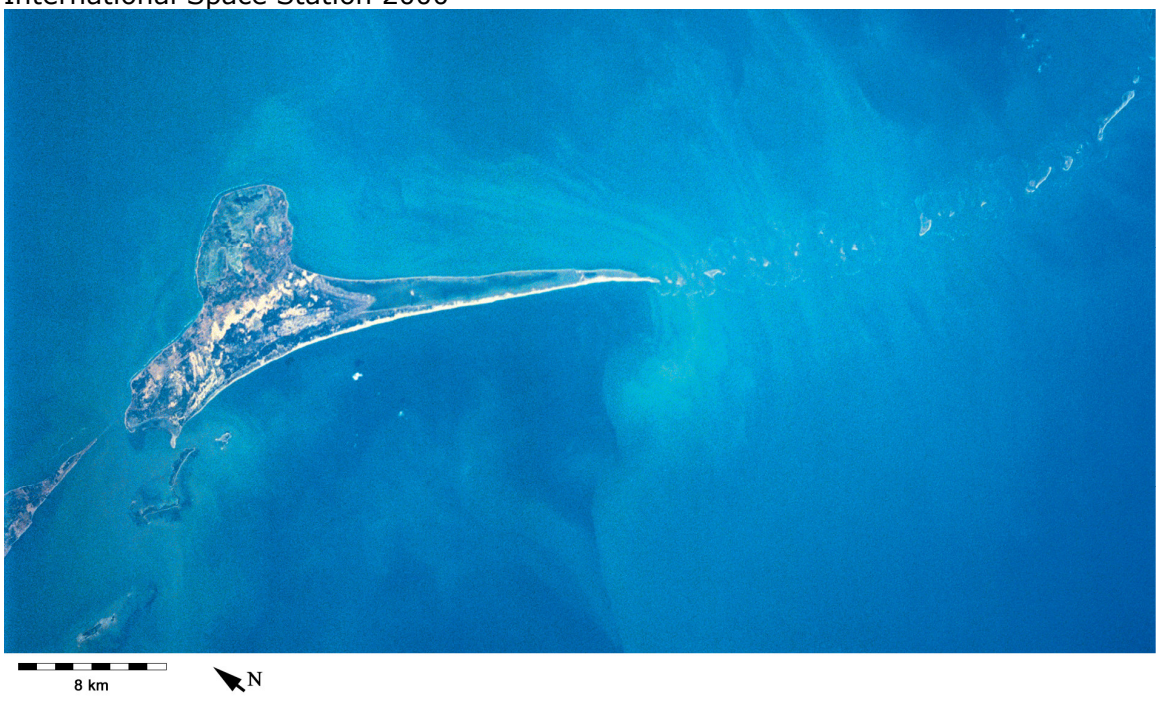
Sikh, Buddhist, Jewish, Jain, Hindu or other. Just as every Greek venerates the epics of Homer, our schools need to underline that the *Ramayana* and the *Mahabharata* are not "Hindu" texts but *Indian* classics. We have to rescue Indian history and culture from the death-grip of those who seek to compartmentalize the country into religious boxes, the way Mohammad Ali Jinnah and Jawaharlal Nehru did when they accepted the British plan for partition. The Ram Setu is extant proof of the India that was, and in its magnificence, gives a glimpse of the India that will be. For Karunanidhi, who apparently has no interest in the country as a whole but simply in a corner of it, what happens to India is not relevant, except in so far as it affects the immense wealth of the Muthuvel clan, a propensity for money that was even remarked upon by the great Conjeevaram Natarajan Annadurai, who called him "Mr Eleven Lakhs from Saidapet". Hopefully, at this stage of his long and prosperous life, Muthuvel Karunanidhi will bestow some thought to the nation that has made him, his children and his relatives so wealthy, and abstain from destroying a treasure of human culture. Sadly, even after 1947, there has not yet come to power a government that is genuinely Indian. The Nehru family was Indian only in name, being European in every other particular. Today, the family has shed all pretence about this, and has put forward a European as the head of the family, seeking once again to rule India through her. Sonia Gandhi needs to think carefully about Rama Setu. She needs to follow the example of those who settled in India from outside yet became true to this country's heritage. For, it is a fact that both Europeans and Indians are essentially part of the same civilisational stream, the way the Persians too are. For the sake of our common Indo-European civilisation, Ram Setu must be saved.

Setusamudram Channel Project – Project area

SSCP -- Environmental impact analysis and respecting sacred monuments—US Court judgement on protecting sacred structures

Environment Impact Analysis is supposed to include an evaluation of cultural impact of the project and the imperative of exploring archaeological sites. Rama Setu is part of a marine archaeological zone. Failures of NEERI are stark and call for a review of the project evaluation. Read a US Appeals court judgement on damaging a mountain sacred to Navajo in USA. A monument does NOT have to be man-made to be declared an Ancient Monument. Rama Setu should be deemed to be an ancient monument based on archaeological, textual evidences and bharatiya traditions (including the traditions of Hindu and Muslim and Christian who refer to the monument as Adam's Bridge). Whether it is Rama Setu or Adam's Bridge, both Rama and Adam are ancient; the monument is ancient. It is surprising that unlike the involvement of Archaeologists in Nagarjunasagar dam project, Narmada dam project and in Dwaraka, there has been a gross failure to involve the archaeologists (marine archaeology wing of ASI, in particular) in the evaluation of the project. Why was there a world outcry when the Taliban demolished the Buddha statue of Bamiyan? Cherishing world heritage can coexist with abhyudayam. Why is there a plea, accompanied by 25 lakh signatures of concerned citizens of Bharat sent to the Rashtrapati ji, to realign the Setu channel passage into a Setu Canal across the Dhanushkodi land stretch? It is because, such a realignment will not damage Rama Setu, a world heritage, ancient monument which is clearly seen as a dominant feature in many space images.

International Space Station 2000



ftp://eol.jsc.nasa.gov/scanned_highres_STS033_STS033-76-60.JPG Pamban island in the Gulf of Mannar. This region has some of the most important coral reefs off the mainland coast of India [STS033-76-60, 1989].
http://earth.jsc.nasa.gov/newsletter/CoralReefs/ (Taken on 24 June 2003)

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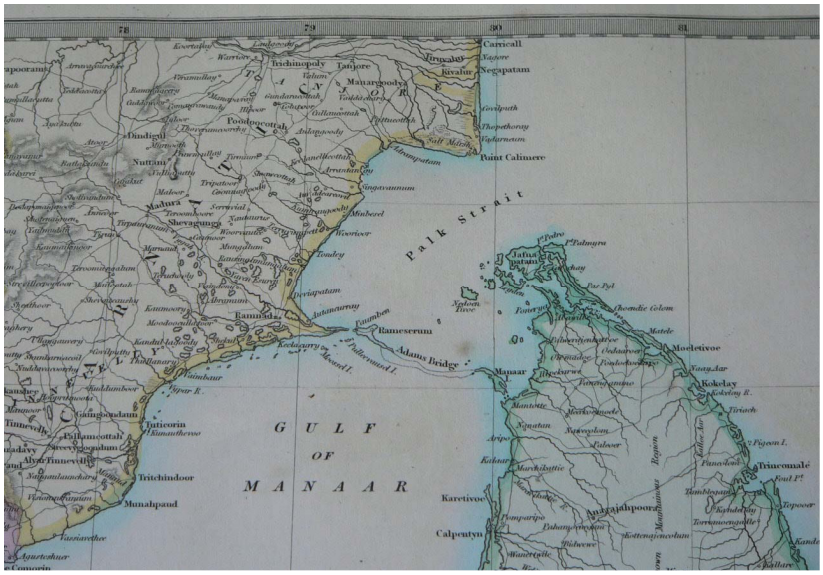
http://eol.jsc.nasa.gov/scripts/sseop/photo.pl?mission=ISS005&roll=E&frame=15982&QueryResultsFile=10858665882080.tsv

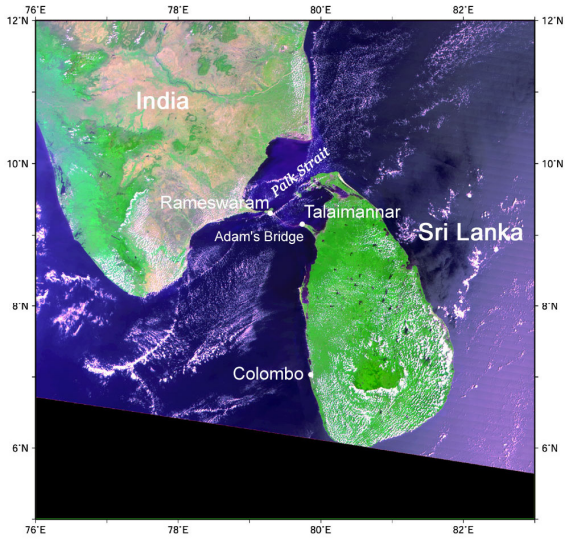


http://www.columbia.edu/itc/mealac/pritchett/00routesdata/1700_1799/coromandel/coromandelmaps/sduk1831.jpg The Palk Strait and the Gulf of Manaar, from a map by SDUK, 1831

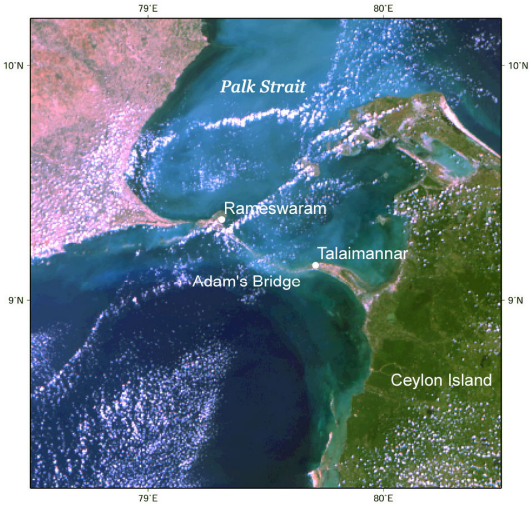
http://visibleearth.nasa.gov/view_rec.php?id=3365 Credit Jacques Descloitres, MODIS Land Rapid Response Team, NASA/GSFC The Palk Strait separates India (upper left) from Sri Lanka (center). This true-color image from the Moderate Resolution Imaging Spectroradiometer (MODIS) on May 20, 2002, shows the strait filled with bright sediment, while off the northeast tip of Sri Lanka, a dark stain in the waters could be a phytoplankton bloom. On Sri Lanka, much of the native forests have been cleared, but small pockets remain in preserves, such as that seen in the southeastern portion of the island, where dense green vegetation can be seen.

Oct. 7, 2003

Seven Islands between India and Sri Lanka



Adam's Bridge - India, Sri Lanka
ADEOS-II/GLI 250m Feb. 20, 2003 R/G/B=22/23/20



ADEOS-II/GLI 250m
Feb. 20, 2003 R/G/B=22/21/20

In the Palk Strait between southern India and Sri Lanka, seven small islands called Adam's Bridge span the 30km from Rameswaram in southern India to Tarai Mannar in Sri Lanka. The right image is a close up of Palk Strait in the left image. In the image on the right, small brown islands just like the connecting tips of peninsulas can be seen.

This area provided the backdrop for the lyric "Ramayana" based on the legend of ancient Indian hero Lord Rama. To save Princess Sita from Satan living in Lanka island, present Sri Lanka, Prince Rama made a bridge to Lanka island with the help of the monkey King. He then destroyed Satan and returned to his home country to ascend the throne. It is said that the Prince held a ceremony of purification in Rameswaram.

http://www.eorc.jaxa.jp/en/imgdata/topics/2003/tp031017.html

See also: A Historical Atlas of South Asia, ed. by Joseph E. Schwartzberg (1992)
http://dsal.uchicago.edu/reference/schwartzberg/

Palk Strait to Gulf of Mannar -- An Archaeological Exploration

T.Satyamurthy
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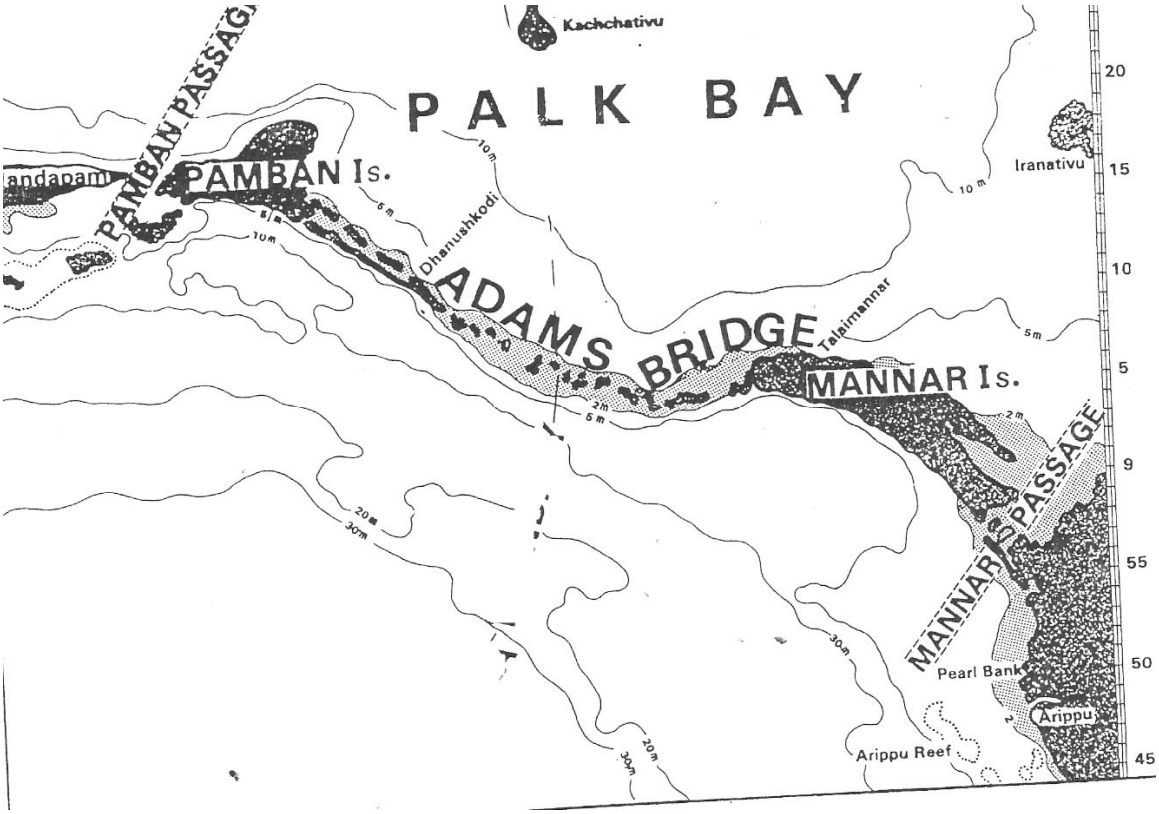
Government of Kerala.

Alexander Rea conducted archaeological excavation (1903-04) at Adichchanallur, District Tuttukudi and had recorded that the findings there were very unique and felt that all cultural assemblages in the far south had its origin or influence from here only. Scholars like Kennedy K.A.R. had discussed in detail and concluded that all such assemblages like megalithic burials can even be regarded as an overflow of from south India. According to Maloney C.T. even the experimentation in the early state formation especially between regions of the far south of the peninsular India and Sri Lanka situated on both the sides of the Palk straits have many common features.

S.K.Sitrambalam of Sri Lanka had taken for study the urn burial site of Pomparippu, south of Mannar and found striking similarity in between them and such sites in Madurai, Thirunelveli and Ramanathaouram Districts. While Pomparippu holds the Iron Age key of far South the archaeological site Mantai, District Mannar, Sri Lanka had yielded artifacts from Paleolithic Age to 17th century AD and they are analogous to the findings in the main land. The cultural oneness of Sri Lanka and the far south of India derives one to probe whether the travel route even during the Iron Age period and later was through water way or by Land. A thorough examination is made here with the available archaeological and numismatic evidences to trace the sea passages used by sailing ships in ancient times to cross the area which separate Sri Lanka from India.



Not to scale

The geographical location that connect the Indian main land and Sri Lanka which are culturally united in early period are known as Palk Strait(India) and the Gulf of Mannar (Sri Lanka).

A cursory look at the sketch map illustrates the problems of navigation in the above area. Separating the gulf of Mannar on the south from the strait on the north is chain of islands, reefs, shoals and shallows, consisting of island of Mannar,Ramar Bridge also known as Adam's bridge, the island of Pamban and Ramesvaram. Significantly the strait is flanked by two ancient temples Ramanatha temple and Thiruketesvara temple on Indian and Sri Lanka Sides respectively. In Indian side it attains importance because of its association with Ramayana epic and equally on the other side also the Mantai is significant as the place is associated with Mandothari, the daughter of Mayon the spouse of Ravana. Infact the place name Mantai may be a variation of Mandothari.

However place Mantai is found in Tamil Saiva literature especially in the songs of ThirujnanaSambandar and Sundaramuti Nayanar of 7^{th}-8^{th} century AD. Again Manickavasakar the author of Thiruvasakam refers to Siva here as conferring Boon on Vandothari (Mandothari) consort of Ravana which is found corroborated by place name already suggested. Thirujnasambandar describes Thirukedeswaram as Mattottam a mango groove on beach, but more vivid description figures in

SundaramutiNayanar songs. He mentions the place as located on the banks of the Palari River and inundated by the water of Bay of Bengal.

With the available Tamil epigraphical records both in Tamil Nadu and Sri Lanka, it can be concluded that the Cholas contributed much for the enlargement of temple there. It was known as Rajarajeswaram and the town was named as Rajajapuram. It was as good as the Brhadisvara temple at Thanjavur. Many munificent gifts of Bronzes were made by Cholas to Thirukedeswaram. The Chola inscription from Puncheri speaks much about the glory of this temple and the kings of Sri Lanka patronized it until the Portuguese and western power had empowered Sri Lanka.The European Companies had converted the Thirukedeswaram Temple and the adjoining Mantai site into a fortified defense Head Quarters. Another Siva temple referred by these Saiva saints in Tamil Tevaram hymns is the rock cut temple Thirukonesvaram at the western Sri Lanka. Sekizhar in his Periyapuranam hints about their visit to these places but had not indicated the route. As crossing the ocean was a taboo on religious grounds, the availability of land pathway cannot be ruled out.

It is clear from the above that both the ends at Palk Straits in India and the Gulf of Mannar at Sri Lanka were culturally united and could have contacts through these ends only from Ramayana period to that of late medieval period. Had they used the Ramar Palam known as Adam's Bridge or naval Boat to reach the other end? Was it possible to navigate safely in between these ends? These are some of the problems that require our probe.

Roman Gold coin hoards reported so far in Indian subcontinent show that the Roman trade activities were more in west coast through the Muzuries, the early historic Chera port. Gold coins of Roman Imperial period were unearthed from Eyyal, Valuvalley; Kumbalam from Kerala and the Western Numismatists have established that rounding the Kanyakumari to reach the east coast was not possible by Roman Sailors. Corroborating all such evidences available it was concluded that the Roman trade especially with the east coast was through the south eastern countries as the sailors could not navigate through the Palk Straits.

Nevertheless, it is important to recount what the Dutch and Portuguese writers have to say about the navigability of the Pamban channel in Indian side and Mannar on SriLanka side, because specific information from earlier sources are scanty. Baldcus the Portuguese writer , who was present at the military action of Dutch Force occupying Mannar i.e. Thirukedeswaram in Sri Lanka records in 1697 AD the Mannar Passage was so inconvenient on account of shallowness that no vessel can pass without first being unloaded. The early Portuguese Writers de Barros and do couto group all islands Pamban, Rameswaram, Adam's Bridge and Mannar island and gave a collective name "Shoals of Chilaw". They mention that in the entire area in dry weather the shallow sea was very clear and the rock bed at the bottom could be seen. They speak of "two very narrow channels at Ramesvaram and Mannar through each of which only small *SUMACA* can make its way, and that too when the sea is high.

In regard to the Pamban passage, the evidence as sequel will show, suggests that in Dutch and Portuguese times it was of lesser depth than the Mannar passage. In 1663 the Dutch Governor of Ceylon wrote that the Pamban meaning Snake River, owing to its numerous curves and windings, was hardly six feet depth at highest tide.. The Portuguese writer de Queyroz says that the Pamban channel was less than

two fathoms deep and shallower than the Mannar Channel, and that vessels going through had to "tanear", i.e., to unload their cargo.

However, it is A.M.Ferguson; the distinguished translator who unfolds the history of the Ramesvaram Channel which never existed earlier. According to Hunter's Imperial Gazeteer, XI.22, the ancient records preserved in the temple of Ramesvaram mention that "in the year 1480AD a violent storm breached the isthmus, and that, despite efforts to restore the connection, subsequent storms rendered the breach permanent". He further comments that "I cannot find that the pioneer work of the Portuguese in the cutting of the channel was carried out by joao Fernandez Correa in 1549, when the Jesuit Father, Antonio Criminal, was murdered by natives."

C.W.Nicholas raises a vital question: did the Pamaban passage exist before 1549, or was it an artificial work of that year whose construction was facilitated by the storm-made breach of 1480? Ferguson accepts the evidence that Portuguese cut first navigable passage. A straight rocky barrier, presenting a wall-like appearance on the northern side (*THE MASSES OF ROCK" of Baldaeus, the row of cliffs" of Becker, and the Great Dam" of modern charts*), based on sandstone formations and consisting of large masses of rock with a flat upper surface, now stretches for about 6,000 feet between the Indian mainland and Pamban island: through a 200 feet gap in the great dam runs the Pamban passage. The rocky barrier is a natural and partly artificial causeway over low, sandstone based isthmus.

This is also corroborated by literary reference in Sinhalese work Culavamasa wherein the Sinhalese invasion of Pandyas during the reign of Parakramabahu (1153-1186 AD) was found narrated. In the absence of Pamban passage Mantai was the embarkation point from which the troops had to operate. It is derived from the above by scholars like Nicholas that there was no navigable Pamban passage and that the isthmus was continuous from Pamban Island on both sides. During that period Mantai of Sri Lanka was a great Seaport, the Pamban passage did not exist and the only navigable seaway between Gulf of Mannar and the Palk Strait was the Mannar passage.

It is clear from the above that the obstructions in the form of geological Natural formations or man made structures prevented navigation in between Ramesvaram and Sri Lanka. A clue as to whether it existed as a walkable pathway or road is hinted by Pliny the Roman writer in the beginning of the first millennium A.D. Quoting earlier writers, Pliny says, that the sea between the Island i.e. Sri Lanka (tapobane) and India is full of shallows not more than six paces (two and a half fathoms) in depth, but in some channels so deep that no anchors can find the bottom. For this reason ships are built with prows at each end to obviate the necessity of their turning about in channels of extreme narrowness. The tonnage of these vessels is 3,000 "amphorac" (about 75 tons). The Sinhalese Ambassadors who went to Rome in the reign of Augustus are reported to have said that the seas between India and Ceylon were "of a vivid green colour and that a great number of trees grew at the bottom so that the rudders of ships frequently break their crests off by trees." The description tempts to indicate an onshore journey than off shore.

There can be no doubt that the Romans during their long period of friendly trade with Ceylon from the first century to 3rd centuries made regular use of Mannar passage on both onward and return voyages. Evidences of using the Palk striat for navigation in the ancient period could not be established. It is now obligatory for

marine archaeological Investigators to thoroughly scan the area to find out the nature of pathway in between the Palk Strait and Gulf of Mannar.

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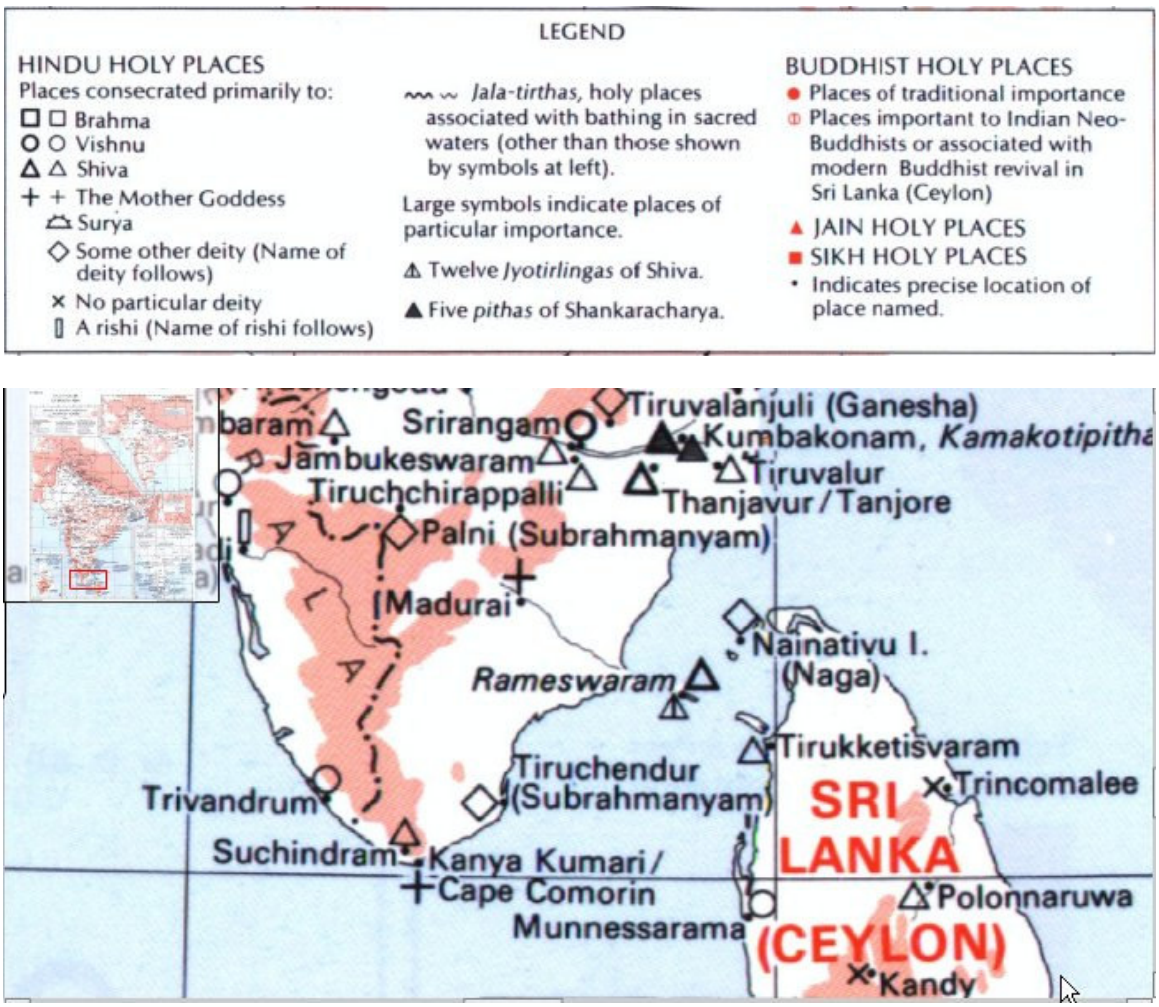
Rama Setu through the Ages

The monograph compiled by S. Kalyanaraman is an answer to the question: why should Rama Setu or Setu Bandha be deemed to be an ancient monument of national and international significance?



Holy places of South Asia
http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=136
Schwartzberg Atlas, v. , p. 99. (Joseph E. Schwartzberg, ed., 1978, *A historical atlas of South Asia,* University of Chicago Press, Chicago)

The legends shown on this map clearly demonstrate the importance of Rameswaram and the link to Tirukketisvaram (in Srilanka) as a holy tirtha. Rameswaram is recognized as one of the twelve jyotirlingas of Shiva. Srilanka gets associated with Naga.

Historical sources evidence the fact that Rama Setu was a land bridge linking Bharatam and Lanka for many millennia. The following maps and images are principally drawn from Schwartzberg Atlas, 1978.

The Epics refer to the link between Kapaata and Lanka. From the time of the pre-Mauryan and Mauryan Empire (from 6th century BCEE), the holy site called Koti gains prominence. This is the short-form of Dhanushkoti, evoking the Ramayana narration of Sri Rama confronting Samudra Raja (King of Ocean) by fixing the end of his bow at this island which links with Lanka at Tambapanni or Tamraparni (at a place called Mahatittha, meaning Maha Tirtha, or Great Tirthasthaana) through Setu Bandha. Thus, the link between Dhanushkodi and Mahatittha constitute the tirthasthaana for over two millennia.

During the Satavahana-Saka-Kusana age, c. A.D. 1-300, Rameshwaram close to Dhanushkodi gains prominence as a holy place.

Puranic India (Bharata) recognizes Setuka as the bridge connecting Bharatam (Pandyan kingdom) and Lanka (then called Simhala).

Koti (Dhanushkodi) and Mahatittha continue to be holy, religious places during post-Mauryan period, from circa 200 BCEE.

The region across the Rama Setu constitutes the limits of regions under the control of Rastrakuta during the age of the Gurjara-Pratiharas, Palas, and Rastrakutas, circa 700-975.

Naval expedition to southeast Aia leading to conquest of Srivijaya and its dependencies proceeds from Gangaikondacolapuram and contacts are also established with Maldive islands circa 1000 going through the Gulf of Mannar. An Ajanta fresco depicts the arrival of King Vijaya in this region.

During the period islamic expansion and changing Western views of South Asia, between 7th-12th centuries, the Rama Setu (bridge) between Rameswaram and Marqaya is also called Setu Bandha (evoking the Prakrit kavya written in the 6th century by King Pravarasena with the title Setu Bandha or Ravana Vaho). It is during this period, ca. 12th century that Setu gets bracketed and referred to as Adam's Bridge.

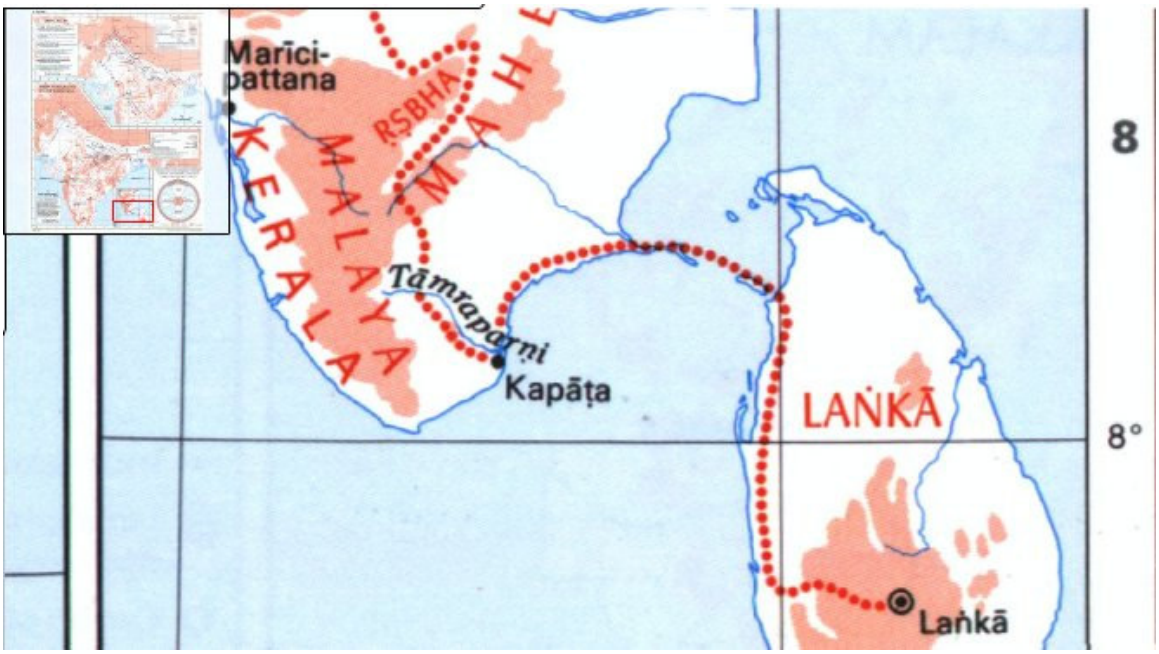
South Asia in the time of the Khaljis and Tughluqs, c. 1290-1390 shows the island on Lanka side referred to Mannara (later called Talaimannar).

In the height of the Bhakti movement and in the time of the Khaljis and Tughluqs, c. 1290-1390, the bridge area gets referred to as Setubandha Rameswaram, as a holy tirtha.

Two maps of Netherlands drawn in 16th and 17th centuries and a French map of 18th century, clearly refer to Adamsbrug (or Pont) as a functioning bridge between Rameswaram and Talaimannar.

Setu Bandha is celebrated in an early talkie-movie of the same title made by Phalke.

As NASA and Indian Space Research Organization images dramatically establish the land bridge between Bharatam and Srilanka, these historical references to Rama Setu come alive as an inalienable tradition of the Bharatiya civilization. The Gulf of Mannar region gets recognized as the first Marine Biosphere of South and Southeast Asia, in 1956.



India of the Vedas and the Epics
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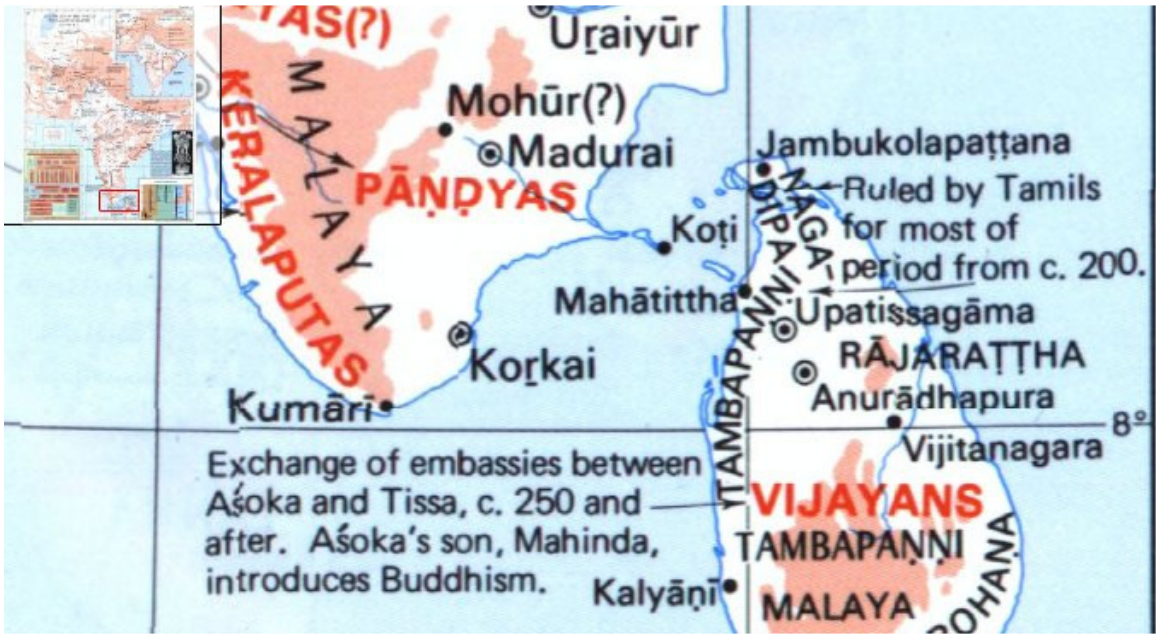
Schwartzberg Atlas, v. , p. 13.



The time of the Mauryan Empire, 321-181 B.C.
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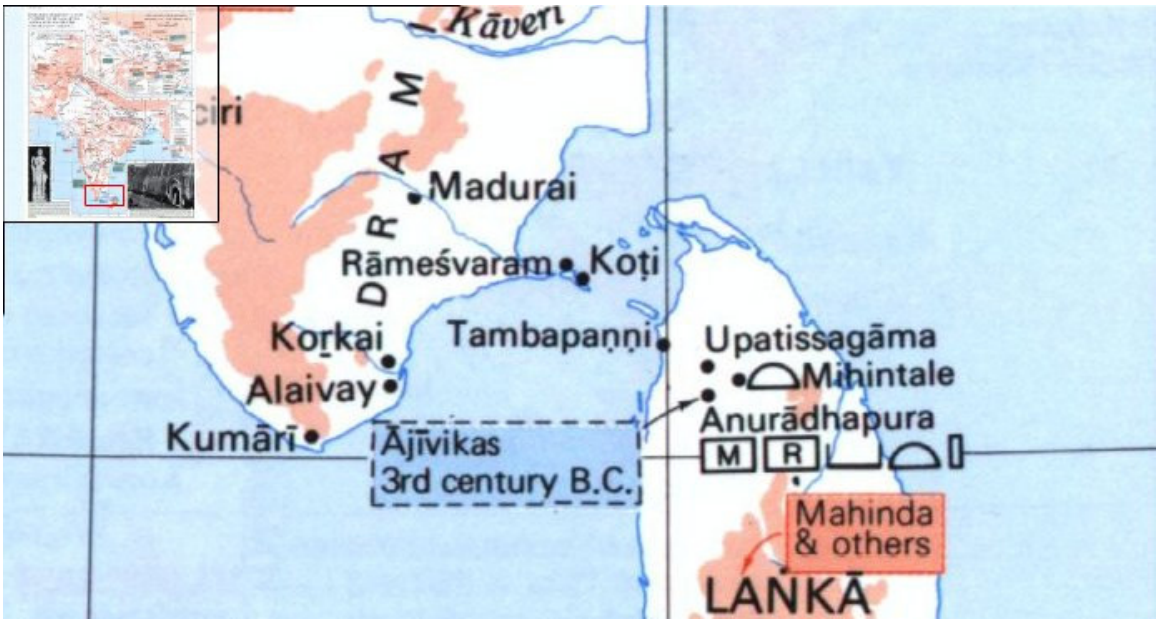
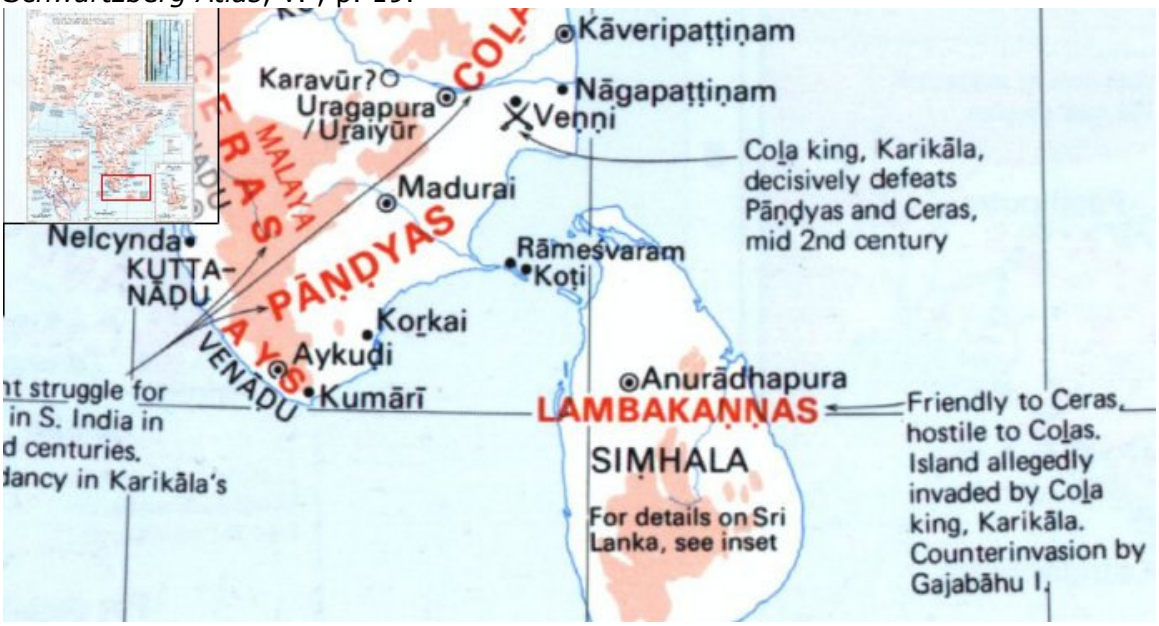
Schwartzberg Atlas, v. , p. 18.



Religious movements and culture of the pre-Mauryan and Mauryan periods, 6th-3rd century B.C. Probable migration routes of Central Asian peoples to northwestern South Asia http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=056 *Schwartzberg Atlas*, v. , p. 19.



The Satavahana-Saka-Kusana age, c. A.D. 1-300
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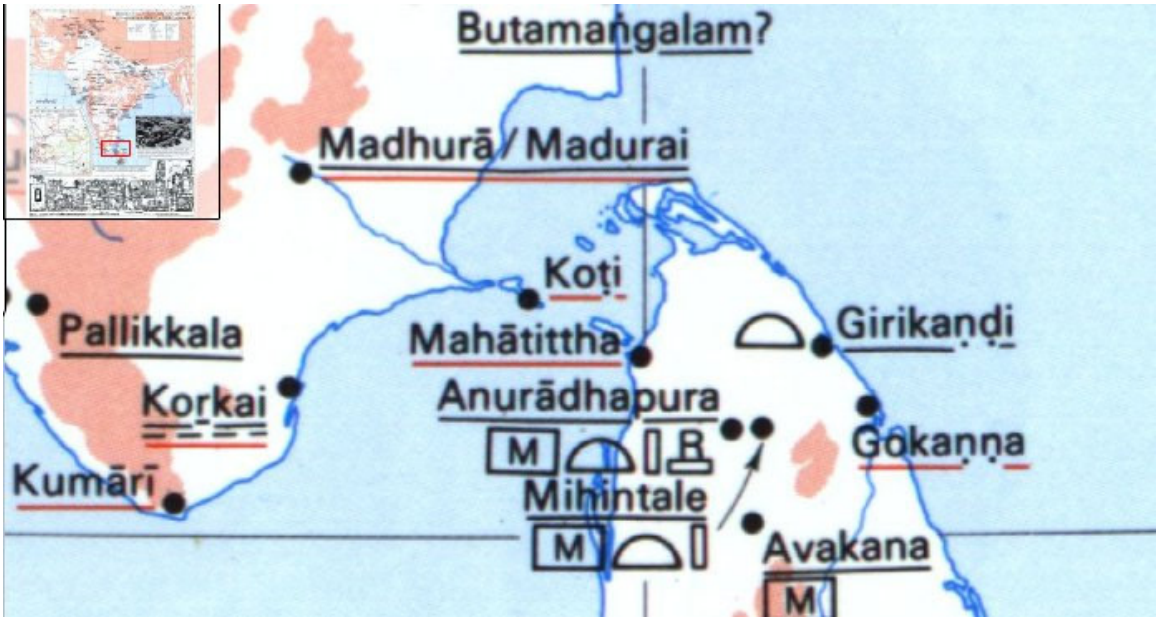
Schwartzberg Atlas, v. , p. 21.



Religious and cultural sites of the post-Mauryan period, c. 200 B.C.-A.D. 300
http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=059
Schwartzberg Atlas, v. , p. 22.
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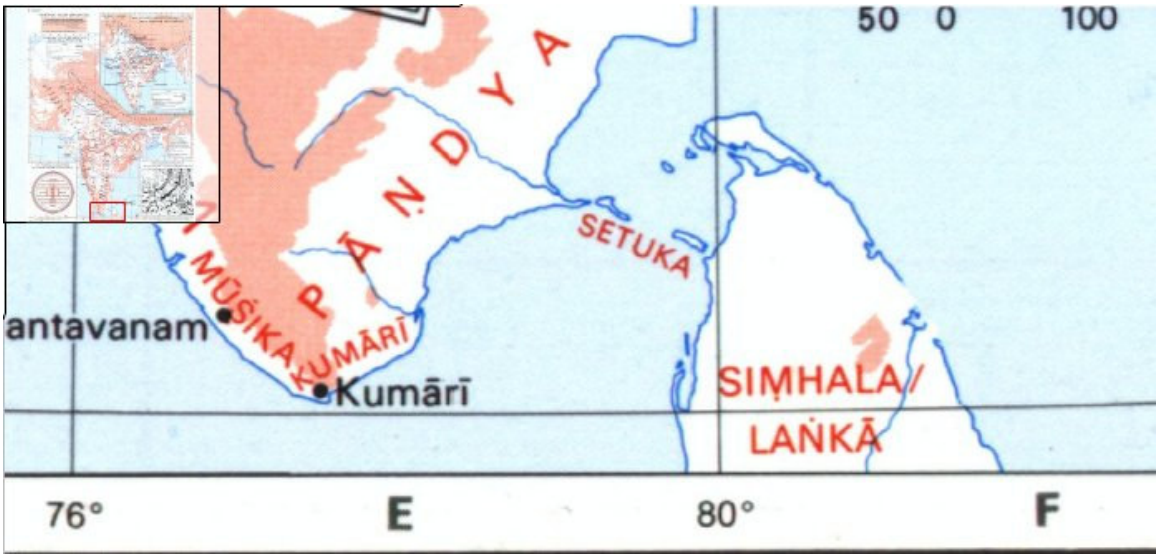
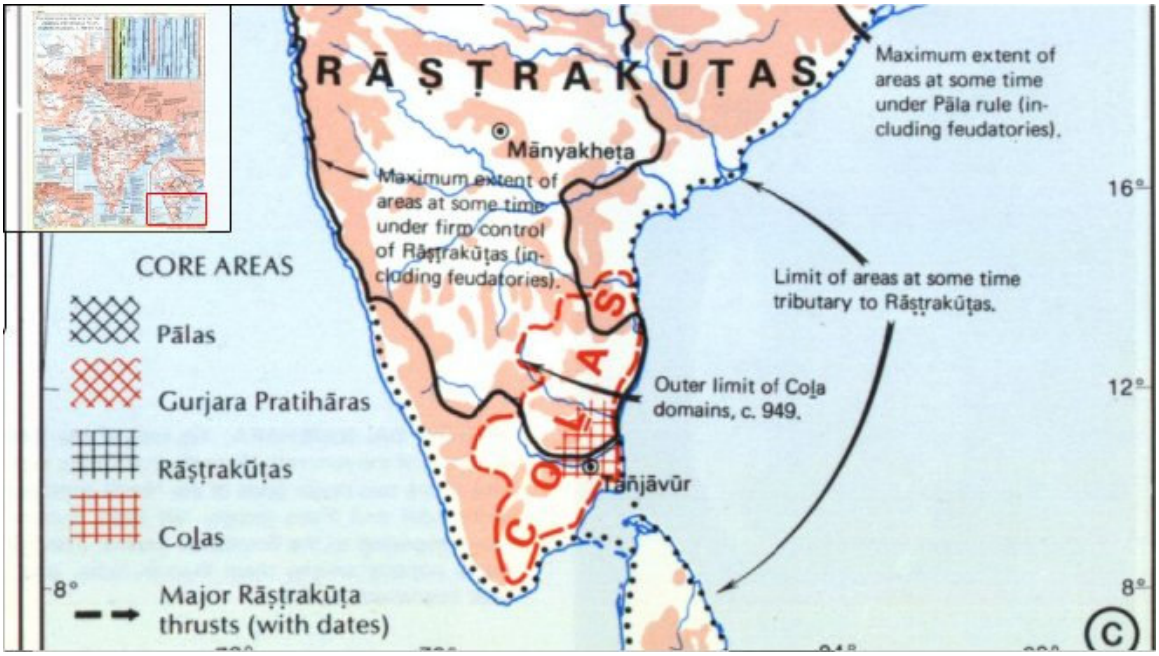
South Asia in the expanding Western view of the world, 1st-3d century A.D.
http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=061
Schwartzberg Atlas, v. , p. 24.

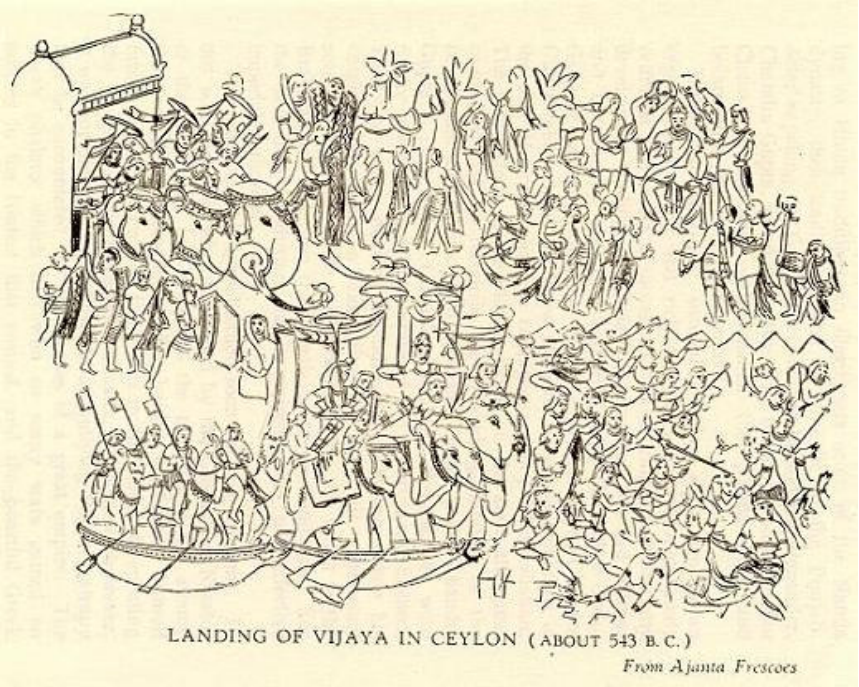


Puranic India (Bharata)
http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=064
Schwartzberg Atlas, v. , p. 27.

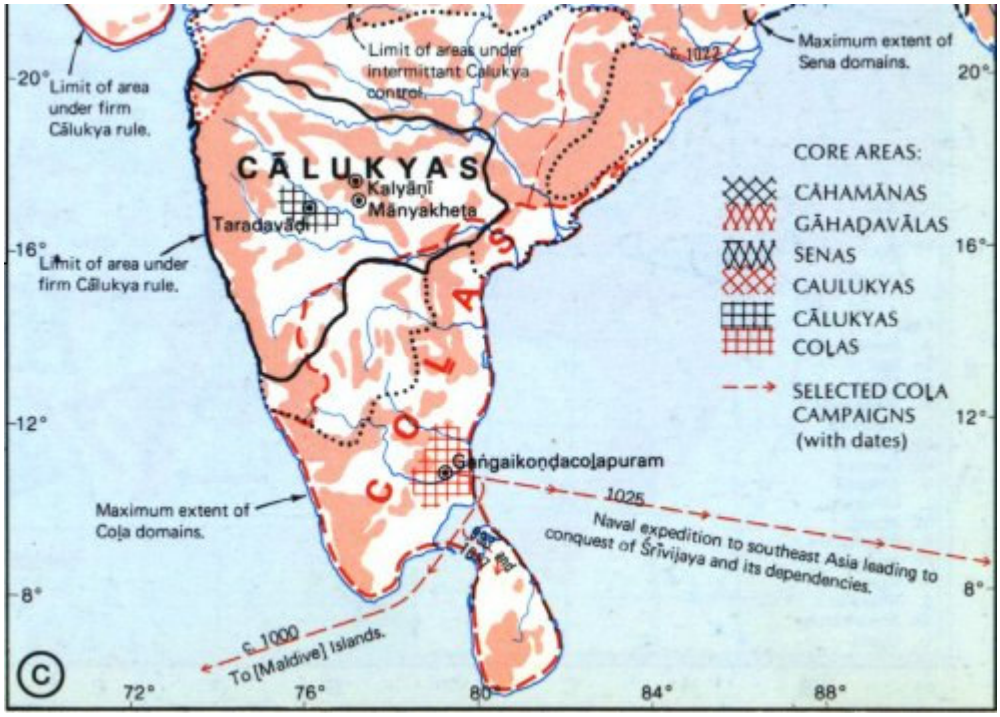


The age of the Gurjara-Pratiharas, Palas, and Rastrakutas, c. A.D. 700-975
http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=068
Schwartzberg Atlas, v. , p. 31.

Landing of King Vijaya depicted in an Ajanta fresco (painting dated to circa 5th century).



The age of the Ghaznavids, Cahmanas, Later Calukyas, and Colas, c. 975-1200



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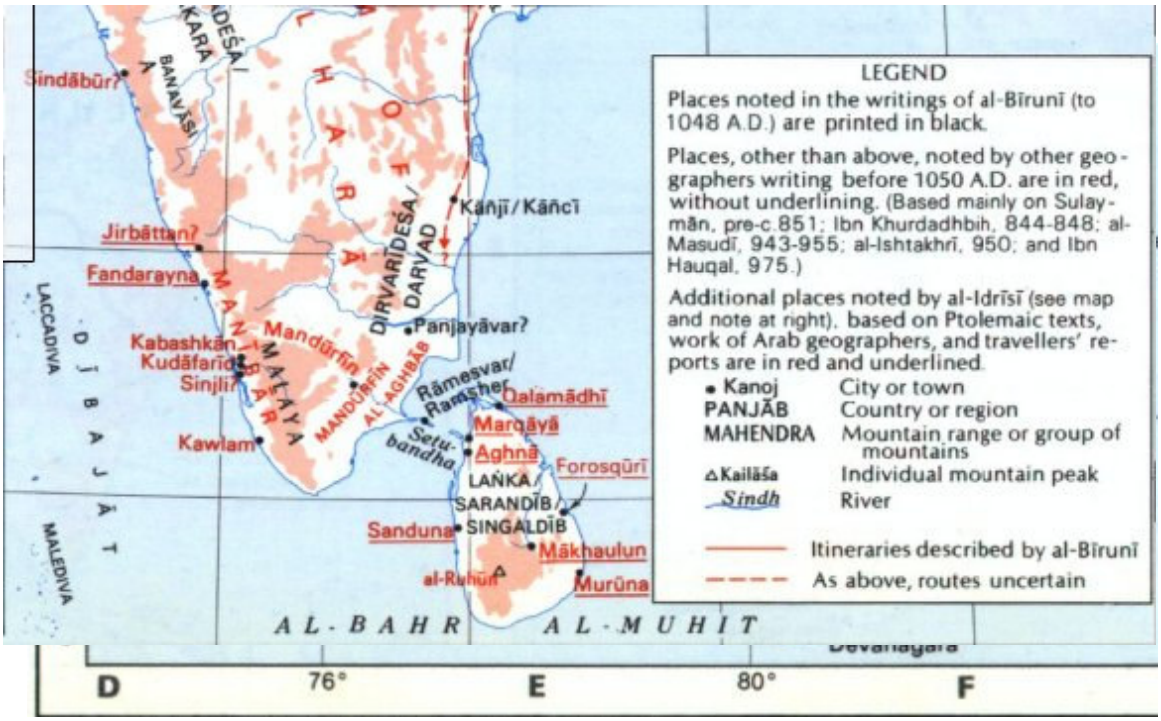
Schwartzberg Atlas, v. , p. 32.



Islamic expansion and changing Western views of South Asia, 7th-12th centuries
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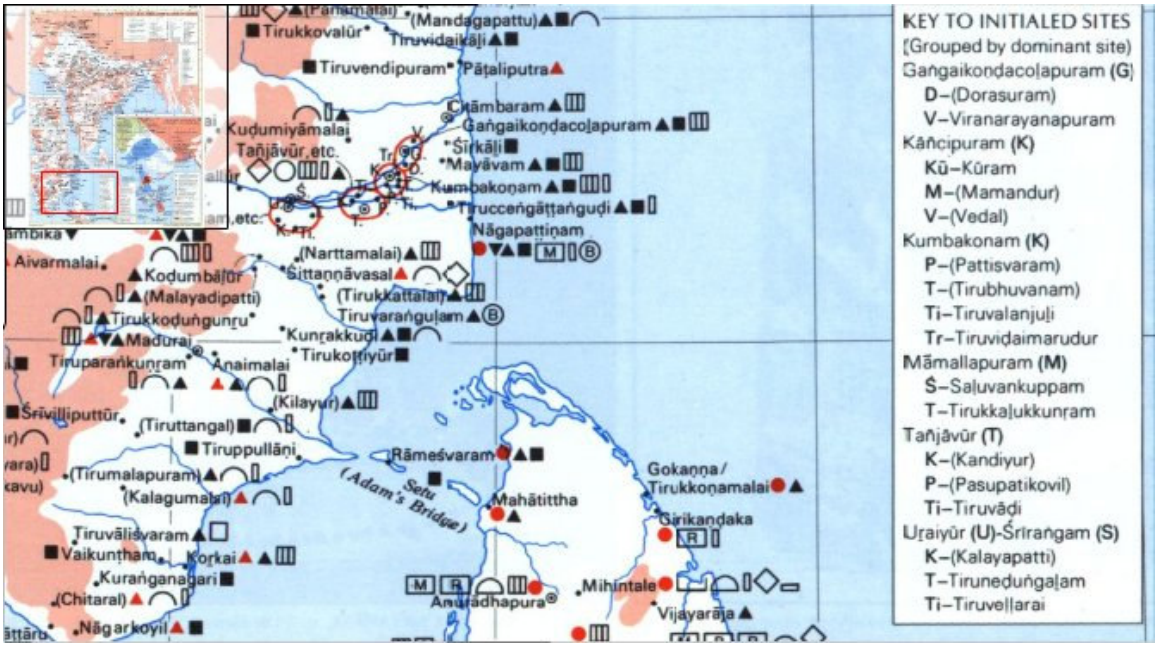
Schwartzberg Atlas, v. , p. 33.



Religious and cultural sites, 8th-12th centuries
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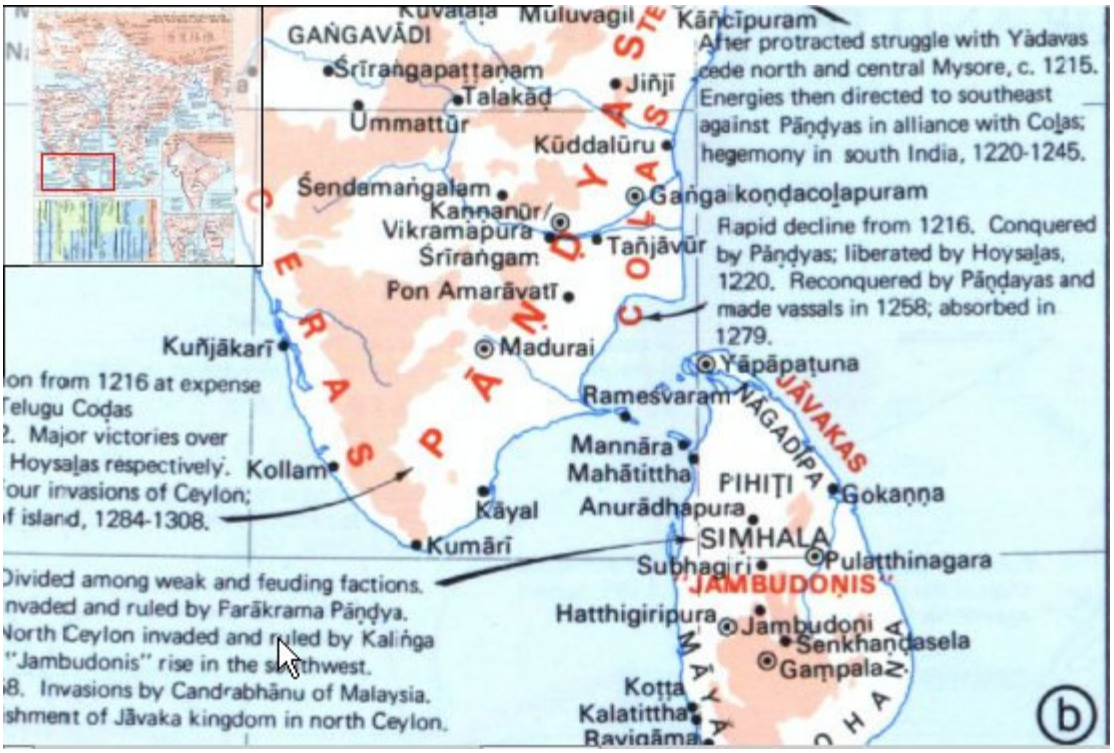
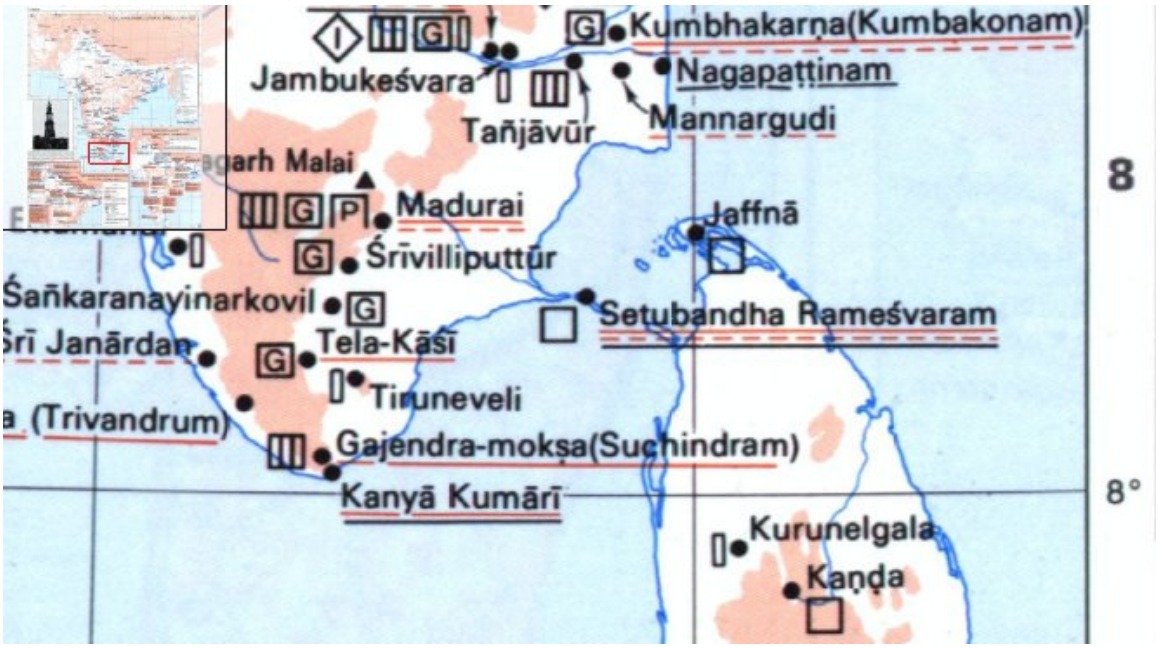
Schwartzberg Atlas, p. 34.



South Asia in the time of the Khaljis and Tughluqs, c. 1290-1390
http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=075
Schwartzberg Atlas, v. , p. 38.



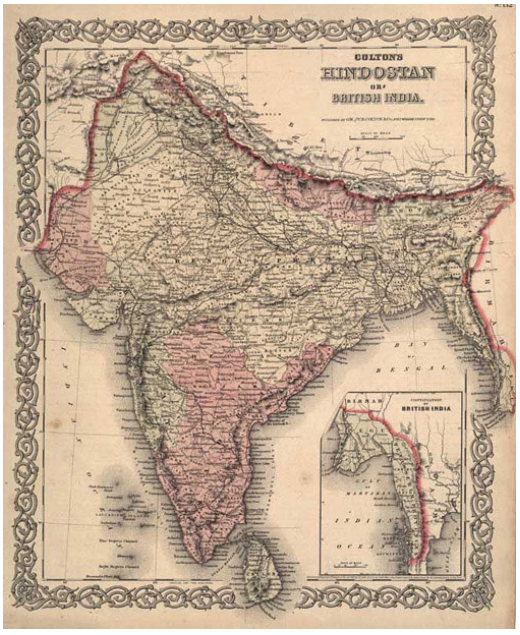
South Asia in the time of the Khaljis and Tughluqs, c. 1290-1390
http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=078
Schwartzberg Atlas, v. , p. 41.

Map of Ceylon with the Adams bridge 1656 – 1725 Ceylon is spelt as: Ceilon Title in the Leupe catalogue (NA): <Kaart van Ceilon met de Adamsbrug.>

Dated: possibly 17th century, Netherlands. 1700 – 1800 Title in the Leupe catalogue (NA): <Kaart van de zuidelijke punt van Voor-Indië met Ceilon en de Adamsbrug>.

http://www.atlasofmutualheritage.nl/detail.aspx?page=dafb&lang=en&id=3204 Atlas of Mutual Heritage

Facsimile of excerpt from the ""General Description of East India"" http://dsal.uchicago.edu/reference/schwartzberg/pager.html?object=089 *Schwartzberg Atlas*, v. , p. 52.



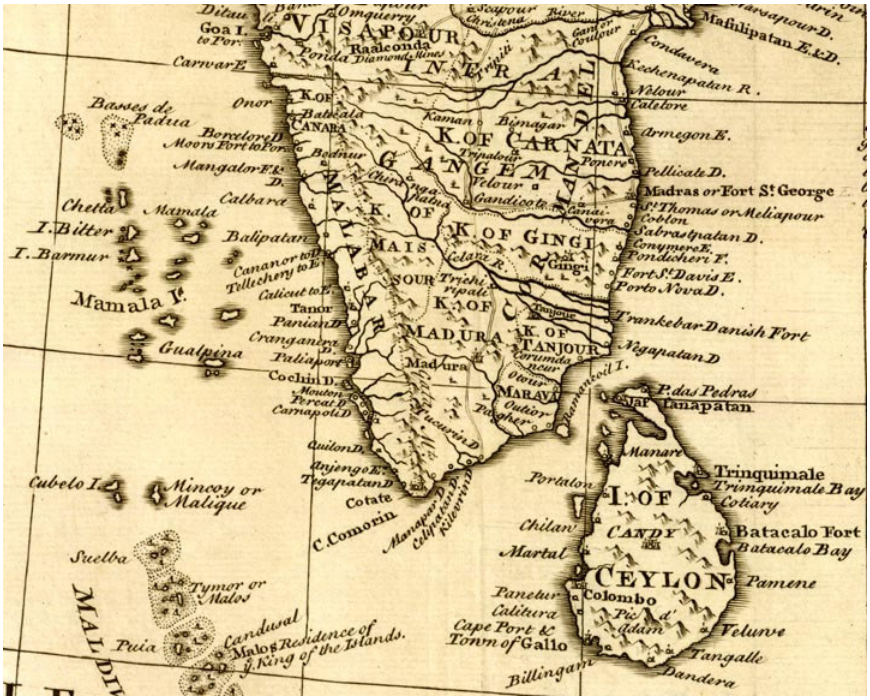
Hindostan or British India (New York: G. W. and C. B. Colton and Company, 1855).

Map of South India and Laccadives, Bowen 1747, prepared by Netherlands. Source: David Rumsey collection Ramarcoil I. is shown (Ramarcoil means: Rama's Temple)

In a 1747 map prepared by Netherlands, Ramancoil was shown near Dhanushkodi island. In a 1788 map prepared by Joseph Banks (available in Saraswati Mahal Library, Tanjavur), Rama temple and Ramar Bridge were shown. "A map of India entitled as a map of Hindoostan or the Moghul Empire from the latest authorities inscribed to Sir.

Joseph Banks Bart President of Royal Society, which was produced by Mr. J. Rennel, a pioneer in map making on 1 st January 1788. The original print of the map (112c.m x 106c.m) is available in this Library."

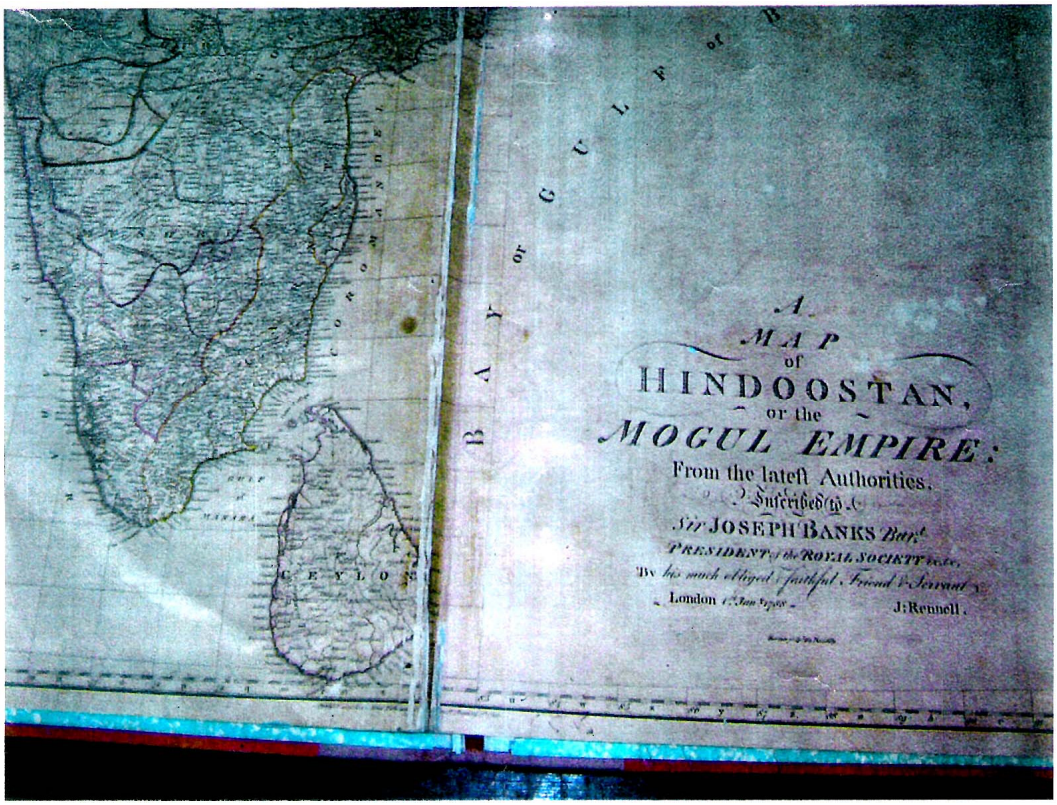
http://www.sarasvatimahallibrary.tn.nic.in/library/Art_collection/Maps___Atlas/maps___atlas.html



Map drawn by Joseph Parks, Australian Botanical explorer (1788) shows Ramar Bridge (Map in Sarasvati Mahal Lib., Thanjavur)

In a 1804 map produced by Rennel (First Surveyor General of India), the name Ramar Bridge was changed to Adam's Bridge.

"On the north-west side of the Island, where the currents are



checked by the obstruction of Adam's Bridge and still water prevails in the Gulf of Manaar, these deposits have been profusely heaped, and the low sandy pains have been proportionally extended; whilst on the south and east, where the current sweeps unimpeded along the coast , the line of the shore is bold and occasionally rocky. The explanation of the accretion and rising of the land is somewhat opposed to the popular belief that Ceylon was torn from the main land of India by a convulsion, during which the Gulf of Manaar and the narrow channel at Paumbam were formed by the submission of the adjacent land. The two theories might be reconciled by supposing the sinking to have occurred at an early period, and to have been followed by the uprising still in progress."

http://www.lankaweb.com/news/features/ceylon3.html Source: Ceylon - an account of the island by Sir James Emmerson Tennent, KCS, LLD Compiling exclusively to LankaWeb by Tilak S. Fernando, London

This structure of close to 48 kilometers which is 3 to 30 feet deep through its course and was well above the sea level till the 15th century. The oldest recorded map that mentions of Rama's Bridge is the Malabar Bowen Map of Netherlands which is supposed to have been made in 1747, where the map mentions no name to the bridge but has mention about a place Ramencoil. Further, the same place is mentioned again in a 1788 Map of Hindoostan available in the Sarasvathi Mahal Library, Thanjavur.
http://bp2.blogger.com/_Cvup3_AVyF0/RgyZDZaXfmI/AAAAAAAAAAc/UFSEN-hYbig/s1600-h/1784+Map.JPG

http://bp1.blogger.com/_Cvup3_AVyF0/RgyZYJaXfnI/AAAAAAAAAAk/w3Z1Cqo4emA/s1600-h/Copper+Plate+Map.JPG Few dating attempts have been made after that.

While the Sri Lankan Archeological Department dates the bridge to close to 2 million years old, Centre For Remote Sensing, Bharathidasan University dated it close to 3500 years old.

The fact which is clear from these historical maps is that there was a bridge and that this was associated with Sri Rama according to the Bharatiya tradition since place

names are normally assigned by the local people. The maps are based on such information gathered from local people about place and monument names.

The following map shows the 5 feet Pamban gap and Adam's bridge linking Dhanushkodi and Talaimannar.

A new map of Hindoostan, of the Bengal provinces, and of the countries lying between them and Delhi [cartographic material]: the whole exhibiting all the military roads and passes as well as the most accurate division of the British possessions in the East Indies / from the latest authorities, chiefly from the actual surveys made by May or James Rennell, Surveyor-General to the Hble. East India Company. Date: 1804. First edition published 1794. http://www.nla.gov.au/apps/cdview?pi=nla.map-rm1808-b2-sd&rgn=0.0649979814%2C0.4546038269%2C0.2264836496%2C0.6600744831&cmd=zoomin&width=400&x=247&y=372

Textual evidences for Rama Setu (or Setu bandha)

Mirrored at: http://hinduthought.googlepages.com/setuband.doc

Apart from the Ramayana which has emphatic references to the construction of Setu bandha in 85 s'lokas in a separate sarga in Yuddha kanda, Mahabharata also refers to the continued protection of Nala Setu following the command of Sri Rama. Sri Rama refers in Kalidasa's Raghuvams'a also refers to the Setu of mountains. So does Skanda Purana (III.1.2.1-114), Vishnu Purana (IV.4.40-49), Agni Purana (V-XI), Brahma Purana (138.1-40) refer to the construction of Rama Setu.

The evidences -- textual, epigraphic, scientific marine-archaeological explorations -- document Rama Setu (or, Setu bandha) as an ancient monument. A channel linking Tuticorin Port with Haldia can be designed without damaging this monument which is an object of national importance, indeed, a world heritage site with Ramayana episodes including the construction of Setu bandha by Nala venerated in many Ramayana's in many parts of the world. . Development imperative or abhyudayam can co-exist with protection of monuments, places and objects of national and international importance. Let us hope that Govt. of India will see it fit to realign the Setusamudram Channel to avoid impacting on Ram Setu, the heritage which should be immediately declared as a protected monument under the AMASR Act, 1958. This is a solemn duty of the State of Bharatam.

Mirrored at: http://hinduthought.googlepages.com/setuband.doc

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Epics and classics

- Valmiki describes the construction of Setu in detail. For an exquisite rendering of Valmiki's descriptions see: http://ramasetu.blogspot.com/2007/03/setu-bandhan-in-valmiki-ramayana.html Also: http://bridgeofram.com/

hastimaatraan mahaakaayaaH paaSaaNaamshca mahaabalaaH parvataamshca samutpaaTya yantraiH parivahanti ca Valmiki Ramayana 2-22-58
Vaanara having huge bodies, with mighty strength uprooted elephant-sized rocks and mountains and transported them by mechanical contrivances (yantraih).

- Vedavyasa refers to Nalasetu and notes how the setu was protected during Mahabharata times

nalasetur iti khyāto yo 'dyāpi prathito bhuvi rāmasyājñāṃ puraskṛtya dhāryate girisaṃnibhaḥ MBh. 3.267.45

.... which even today, popular on earth as Nala's bridge, mountain-like, is sustained out of respect for [Lord] Rama's command. (Nala was son of Vis'wakarma)

Kalidasa's Raghuvams'a (sarga 13): Rama, while returning from SriLanka in pushpaka vimaana: "Behold, Sita, My Setu of mountains dividing this frothy ocean is like the milky way dividing the sky into two parts"

There is a kavya in Prakrit by King Pravarasena II (550-600 CE) called "Setu bandha or Ravanavaho." "Dasamuha Vadha" (Setubandha Kavya) was written by the King Damodara Sen (5th Century).

Lankavatara Sutra

Lankavatara Sutra is one of the most important sutras of Mahayana Buddhism. According to the traditions of Sri Lanka, this Sutra contains the actual words spoken by Bhagwan Gautama Buddha himself, when he visited Sri Lanka. Although it is historically doubtful that Bhagwan Gautama Buddha ever physically visited Sri Lanka, nevertheless, Lankavatara, which literally means 'Arrival in Lanka', is a very important source of Mahayan Bauddha philosophy.

Dr. Daisetz Teitaro Suzuki, who has translated the Sutra from original Sanskrit into other languages, says, "As is the case with other Buddhist texts it is quite impossible with our present knowledge of Indian history to decide the age of the Sutra. The one thing that is certain is that it was compiled before 443 CE when the first Chinese translation is reported to have been attempted. Even with the text that was in existence before 443 CE we do not know how it developed, for it was not surely written from the beginning as one complete piece of work as we write a book in these modern days. Some parts of it must be older than others, since there is no doubt that it has many layers of added passages."

Lankavatara Sutra and Ramayana share several descriptions. Even ten-headed Ravana and Kumbhakarna, Ashok Vatica, Ocean and so many other points tally. In the Sutra, Ravana is described as the king of Lanka who is desirous of learning the Truth from Buddha, and invites him across the ocean into Sri Lanka.

Some parts from the first chapter of the Sutra:
...Thus have I heard. The Blessed One once stayed on the peak of Lanka in Mount Malaya on the great ocean...

...At that time, the Blessed One who had been preaching in the palace of the King of Sea-serpents came out at the end of seven days and was greeted by an innumerable host of Nāgakanyās including Śakra and Brahma, and looking at Lanka on Mount Malaya smiled...

...Blessed One said, By the Tathagatas of the past, who were Arhats and Buddhas, the fuly Enlightened Ones, this Truth was made the subject of their discourse, at Lanka on the mountain-peak of Malaya... (Referring to Rama?)

...the Truth realisable by noble wisdom in one's inmost self, which is beyond the reasoning knowledge of the philosophers as well as the state of consciousness of the Sravakas and Pratyekabuddhas. I, too, would now for the sake of Ravana, Overlord of the Yakshas, discourse on this Truth...

...After seven nights, the Blessed One leaving the ocean, the abode of the Makaras, the palace of the sea-God, now stands on the shore...

...Just as the Buddha rises, Ravana, accompanied by the numerous Apsaras and Yakshas, Suka, Sarana, and learned men, miraculously goes over to the place where the Lord is standing...and invites Him into the city of Lanka...

..."Mahamati, accept my mansion, the company of the Apsaras, necklaces of various sorts, and the delightful Asoka garden"...

..."I give myself up to serve the Buddhas and their sons; there is nothing with me that I do not give up, for their sake; Great Muni, have compassion on me!"...

...Hearing him speak thus, the Lord of the Triple World said, "King of Yakshas, this mountain of precious stones was visited by the Great Buddhas in the past. And, taking pity on you, they had discoursed on the Truth revealed in their inmost consciousness...

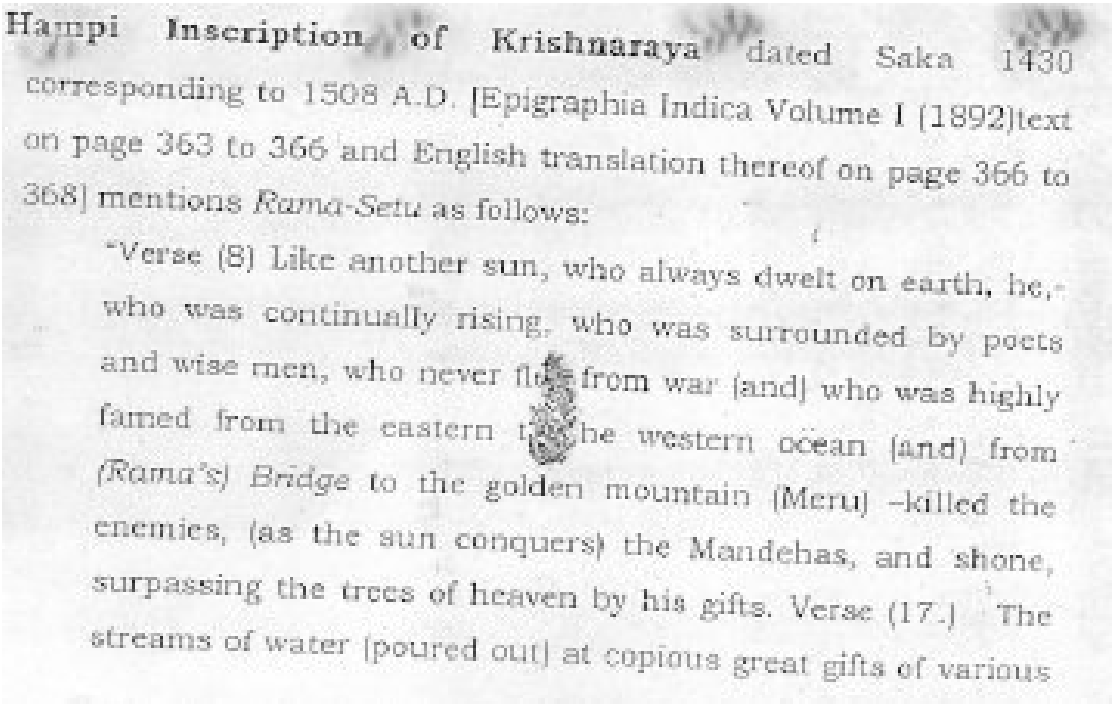
Throughout the rest of the chapters in the Sutra, examples of Ocean, Bridge, Raft, Boat etc. are richly used.

http://ramasetu.blogspot.com/2007/04/lankavatara-sutra.html

Epigraphs

"…the most common reference to Rama in early inscriptions is in a verse that begins to appear commonly at the end of land-grants from the early 9th century onwards in Rashtrakuta regions. "Common to all kings is the setu of dharma: you should abide by it moment by moment. Again and again Ramabhadra implores all future kings to do the same (Epigraphica Indica 23.212 – a record of CE 807)… Tiruvalangadu plates of Rajaraja Cola I (CE 985-1014) describe the king as surpassing Rama in military prowess and crossing the ocean with his powerful army and subduing the king of Lanka… The concept of a hill-top imprinted by the feet of Visnu is repeatedly found in the Mahabharata[24] and it is suggested that a column on the hill may have enshrined Visnupada. (Vishnupadam in Srilanka was renamed as Adam's peak just as Ramar bridge was renamed as Adam's Bridge by James Rennel in 1804 when he was the first surveyor general of British India)… In the temples of Orissa dated from 7th to 10th centuries, Rama is represented both as an avatara of Visnu as also the hero of the Ramayana narrative. In a dasavatara group, the image of Rama is sculpted along with Balarama and Parasurama at the entrance of Manibhadresvara and also at Simhanatha. Ramayana friezes occur on several temples, such as Svarnajalesvara, Sisiresvara, Varahi and Panca-Pandava. These include scenes of Rama shooting through seven trees, killing the golden deer, abduction of Sita, fight between Bali and Sugriva and building the bridge across the ocean."
http://www.ochs.org.uk/publications/multimedia/documents/HinduTemple3_Ramayana_HPRay_1006.doc

Hampi inscription of Krishnaraya Saka 1430 (1508 CE) in Epigraphica Indica refers to Rama Setu



Hampi Inscription of Krishnaraya dated Saka 1430 corresponding to 1508 A.D. [Epigraphia Indica Volume I (1892)text on page 363 to 366 and English translation thereof on page 366 to 368] mentions *Rama-Setu* as follows:

"Verse (8) Like another sun, who always dwelt on earth, he,- who was continually rising, who was surrounded by poets and wise men, who never fled from war (and) who was highly famed from the eastern to the western ocean (and) from *(Rama's) Bridge* to the golden mountain (Meru) –killed the enemies, (as the sun conquers) the Mandehas, and shone, surpassing the trees of heaven by his gifts. Verse (17.) The streams of water (poured out) at copious great gifts of various

kinds, which he performed at Gokarna, at *Rama's Bridge*, and at all other sacred places in the world, frustrated the eagerness of (Indra) the bearer of the thunderbolt, who was ardently rising to clip the wings of the mountains, which were immersed in the ocean, that was being dried up by the dust of the hoofs of the troops of his prancing horses.

Verse (29.) Seated on a jeweled throne at Vijayanagara, king Krishnaraya, whose liberality was worthy to be praised by the learned, having surpassed Nriga and other kings in wisdom, and having bestowed abundant riches on all suppliants on earth, was resplendent with fame from the eastern mountain to the slopes of the mountain of the west and from the mountain of gold (Meru) to *(Rama's) Bridge.*"

Skanda Purana (VI.101.1-44) describes the installation of threee Shiva linga at the end, middle and beginning of Rama Setu and making the same bridge submerged and thereby creating Setu-Teerth. This is also related in Kurma Purana (21.10-61). Garuda Purana (1.81.1-22) lists sacred places including Setubandh and Rameswar. Narada Purana (Uttara Bhag 76.1-20) extols the greatness of Rama-Setu.

Adam's Bridge also called Rama's Bridge, chain of shoals, between the islands of Mannar, near northwestern Sri Lanka, and Rameswaram, off the southeastern coast of India. The bridge is 30 miles (48 km) long and separates the Gulf of Mannar (southwest) from the Palk Strait (northeast). Some of the sandbanks are dry, and nowhere are the shoals deeper than 4 feet (1 m); thus, they seriously hinder navigation. Dredging operations, now abandoned, were begun as early as 1838 but never succeeded in maintaining a channel for any vessels except those of light draft. Geologic evidence suggests that Adam's Bridge represents a former land connection between India and Sri Lanka. Traditionally, it is said to be the remnant of a huge causeway constructed by Rama, the hero of the Hindu epic Ramayana, to facilitate the passage of his army from India to Ceylon (Sri Lanka) for the rescue of his abducted wife, Sita. According to Muslim legend, Adam crossed there to Adam's Peak, Ceylon, atop which he stood repentant on one foot for 1,000 years.

http://www.britannicaindia.com/duk_det_inside.asp?art_id=28

Using search terms: India, Ceylon, bridge, the Google search produces the following links.

A book by Alexander Hamilton, 1744, A New Account of the East Indies: Giving an Exact and Copious Description of the Situation, P. 338 describes his visit to 'zeloan' (alt. spelling for Ceylon) by walking on the bridge.

An article in: Asiatic Society, 1799, Asiatick Researches: Or, Transactions of the Society Instituted in Bengal, P. 52 refers to the bridge called Setband (alt. spelling, setuband like Allahband; setu-bandha), broken in 3 places. It also notes "The people

call it a bridge; or otherwise it appears to have wood growing on it, and to be inhabited."

QUESTION.

When you went to Ramiſher, at what diſtance was Lunka?

ANSWER.

We go to Ramiſher to worſhip; and at the *Setbund*, or bridge there, there is a *ling* of ſand, which I paid my reſpects to: but beyond that nobody from Hinduſtan has gone to Lunka. In the ſea, your ſhips are always ſailing about; but the current is ſuch, that they cannot get thither; ſo, how can we go there? But from *Singuldeep*, or Ceylon, we can ſee the glitterings of Lunka. There I did not go; but my Cheilas have been there, who ſaid that in *Singuldeep* is the ſeat of RAWON; and HUNOOMAN's twelve *Chokies*, or watch ſtations.

QUESTION.

Have you ſeen RAM's Bridge? If you have ſeen it, deſcribe its length and breadth, and whether it be ſtill ſound or broken.

ANSWER.

Ram's Bridge, which is called *Setbund*, is aſcertained by the *Védas* to be ten *jojun* broad, and one hundred *jojun* long; but in three places it is broken. The people call it a bridge; or otherwiſe it appears to have wood growing on it, and to be inhabited.

Why did Rama build a bridge? In slokas 2-22-25 to 2-22-28, the King of Ocean says, *"O, beloved Rama! Earth, wind ether, water and light remain fixed in their own nature, resorting to their eternal path. Therefore, I am fathomless and my nature is that it is impossible of being swum across. It becomes unnatural if I am shallow. I*

am telling you the following device to cross me. O, prince! Neither from desire nor ambition nor fear nor from affection, I am able to solidify my waters inhabited by alligators. O, Rama! I shall make it possible to see that you are able to cross over. I will arrange a place for the monkeys to cross me and bear with it. As far as the army crosses me, the crocodiles will not be aggressive to them."

Valmiki describes construction of this bridge between Slokas 2-22-50 and 2-22-72

"I am a son born of Visvakarma's own loins. I am equal to Viswakarma. This god of Ocean has reminded me. The great ocean spoke the truth. Being unasked, I have not told you my details earlier. I am capable of constructing a bridge across the ocean. Hence, let the foremost of monkeys build the bridge now itself. Then, being sent by Rama, hundreds and thousands of monkey heroes jumped in joy on all sides towards the great forest. Those army-chiefs of monkeys, who resembled mountains, broke the rocks and trees there and dragged them away towards the sea. Those monkeys filled the ocean with all types of trees like Sala and Asvakarna, Dhava and bamboo, Kutaja, Arjuna, palmyra,Tilaka, Tinisa, Bilva, Saptaparna, Karnika, in blossom as also mango and Asoka. The excellent monkeys, the forest animals lifted and brought, like Indra's flag posts, some trees with roots intact and some others without roots. From here and there the monkeys brought Palmyra trees, pomegranate shrubs, coconut and Vibhitaka, Karira, Bakula and neem trees. The huge bodied monkeys with mighty strength uprooted elephant-sized rocks and mountains and transported them by mechanical contrivances. The water, raised up due to sudden throwing of mountains in the sea, soured upward towards the sky and from there again, gushed back. The rocks befalling on all sides perturbed the ocean. Some others drew up strings a hundred Yojanas long (in order to keep the rocks in a straight line.) Nala on his part initiated a monumental bridge in the middle of the ocean. The bridge was built at that time with the cooperation of other monkeys, of terrible doings. Some monkeys were holding poles for measuring the bridge and some others collected the material. Reeds and logs resembling clouds and mountains, brought by hundreds of monkeys, lead by the command of Rama, fastened some parts of the bridge. Monkeys constructed the bridge with trees having blossom at the end of their boughs. Some monkeys looking like demons seized rocks resembling mountains and peaks of mountains and appeared running hither and thither. Then, a tumultuous sound occurred when the rocks were thrown into the sea and when mountains were caused to fall there. On the first day, fourteen Yojanas of bridge were constructed by the monkeys speedily, thrilled with delight as theywere, resembling elephants. In the same manner, on the second day twenty Yojanas of bridge were constructed speedily by the monkeys of terrific bodies and of mighty strength. Thus, on the third day twenty-one Yojanas of the bridge were constructed in the ocean speedily by the monkeys with their colossal bodies. On the forth day, a further of twenty-two Yojanas were constructed by the dashingmonkeys with a great speed. In that manner, on the fifth day, the monkeys working quickly constructed twenty-three yojanas of the bridge up to the other seashore. That Nala, the strong and illustrious son of Visvakarma and an excellent monkey built the bridge across the sea as truly as his father would have built it. That beautiful and lovely bridge constructed by Nala across the ocean the abode of alligators, shone brightly like a milky way of stars in the sky."

Dr Subramanian Swamy has, in April 2007, written to Mrs. Ambika Soni, Union Minister for Culture, in connection with the status of the Rama Setu under the Ancient Monuments and Archeological Sites and Remains Act, and raising fundamental legal, administrative, quasi-judicial and cultural issues. He has urged

Ambika Soni to initiate action in order to notify officially the Rama Setu as an Ancient Monument. The Rama Setu is a formation of shoal stones of 30 kilometers long and 3 kilometers wide which served for many centuries as foot-bridge from Dhanushkodi on the coast of Tamilnadu to Sri Lanka. It is a very old historic formation, and hence would come within the expression 'ancient monument'. The Brahma Sarovar at Kurukshetra was on a similar consideration declared by the Punjab and Haryana High Court as an ancient monument. Judged by Ambika Soni's answer to an Unstarred Question in Rajya Sabha in the current Budget Session, it is clear that the Government have so far not conducted any study to determine the nature, antiquity, and heritage value of the Rama Setu. However, at the non-governmental level, as also on the basis of Hindu scriptures, it is a widely held opinion that Rama Setu facilitated Sri Rama and his army to cross the Palk Strait, as described in Valmiki Ramayana and other scriptures. That such a formation per se exists has been admitted by Ambika Soni in answer to the said Rajya Sabha Unstarred Question, which answer is confirmed by US National Aeronautics and Space Agency through satellite mapping and imaging.

The Punjab and Haryana High Court in a historic order delivered in 1993 declared the Brahma Sarovar at Kurukshetra as an 'Ancient Monument'. They declared Brahma Sarovar as a very, very old historic formation and hence qualified for notification as an Ancient Monument. The cultural, spiritual and religious considerations had weighed with the Punjab and Haryana High Court in passing this order of timeless significance. These considerations seem to be irrelevant to the Islam-embracing, Christianity-coveting, Hindu-hating and Nation-destroying minority UPA Government in New Delhi nominally led by an unelected and nominated Prime Minister.

Among the holiest of water tanks in India, the Brahma Sarovar in Kurukshetra is an important national and international tourist centre in Haryana State. It has been the cradle of Indian civilization from times immemorial. Any responsible Union Minister for Culture, who respects the cultural, spiritual and religious traditions, feelings and sentiments of more than 800 millions of Hindus in majority in India, would have declared the Rama Setu Bridge as an Ancient Monument on par with Brahma Sarovar in Kurukshetra on the same analogy and for similar and equally forceful and valid reasons.

http://www.sulekha.com/groups/postdisplay.aspx?cid=731607&forumid=756919

Britannica Encyclopadia: Adam's Bridge also called Rama's Bridge, chain of shoals, between the islands of Mannar, near northwestern Sri Lanka, and Rameswaram, off the southeastern coast of India. The bridge is 30 miles (48 km) long and separates the Gulf of Mannar (southwest) from the Palk Strait (northeast). Some of the sandbanks are dry, and nowhere are the shoals deeper than 4 feet (1 m); thus, they seriously hinder navigation. Dredging operations, now abandoned, were begun as early as 1838 but never succeeded in maintaining a channel for any vessels except those of light draft. Geologic evidence suggests that Adam's Bridge represents a former land connection between India and Sri Lanka. Traditionally, it is said to be the remnant of a huge causeway constructed by Rama, the hero of the Hindu epic Ramayana, to facilitate the passage of his army from India to Ceylon (Sri Lanka) for the rescue of his abducted wife, Sita. According to Muslim legend, Adam crossed there to Adam's Peak, Ceylon, atop which he stood repentant on one foot for 1,000 years.

Early coins and copper plate inscription of ca. 900 CE refers to 'setu'

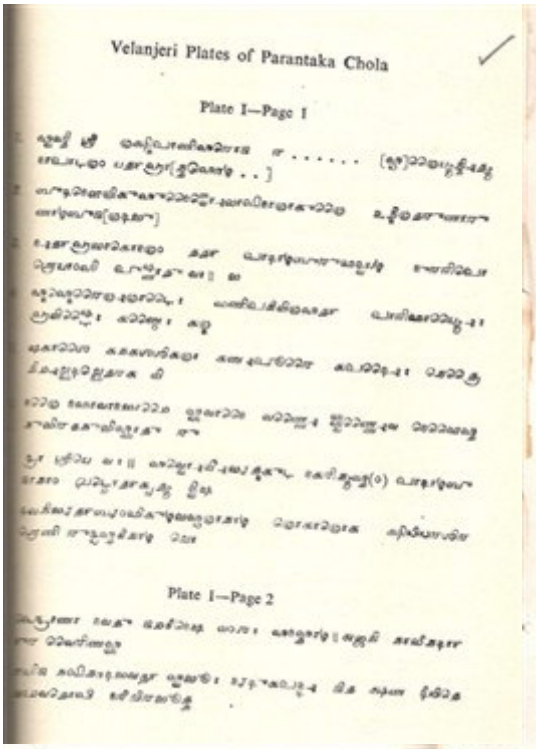
There is remarkable epigraphical and numismatic evidence authenticating the tradition of referring to Rameswaram as Setubandha Rameswaram, that is, as the place from where the Setu was built to link Bharatam and Srilanka in the days of Sri Rama.

The earliest epigraphic reference to Murukan in Tamilnadu is found in the Tiruttani (Velanjeri) plates of Pallava Aparajitavarman (c. 900 Common Era). Subrahmanya who was probably the original *mūlavar* in the Tiruttani temple at the time of Aparājitavarman, but now kept in the *prākāra* of the main shrine (c. 9th cent. AD). This is 'early Chōla' according to L'Hernault F. (Nagaswamy R. 1979. *Thiruttani and Velanjeri Copper Plates*. State Dept. Of Archaeology, Tamilnadu. Madras. See: L'Hernault F. 1978. *L'Iconographie de Subrahmanya au Tamilnad*, Institut Francais d' Indologie. Pondichery, p.111, ph. 63.) The copper plates indicate that Aparajitavarman went to Setutirtha.

Translation of Section 14 of Velanjeri copper plate of Paraantaka Chola I issued in the 25th year (that is, about 930 Common Era) is as follows:

"This ruler (Paraantaka) performed tulaabhaara with gold acquired by his valour, at the beautiful Sriraamatirtha, where the ablest of monkey flocks built the bridge; at the Kanyaatirtha which subdued the southern quarters, and at Srirangam beautiful by the areca groves, where Sri Vishnu reclines on his serpent couch."

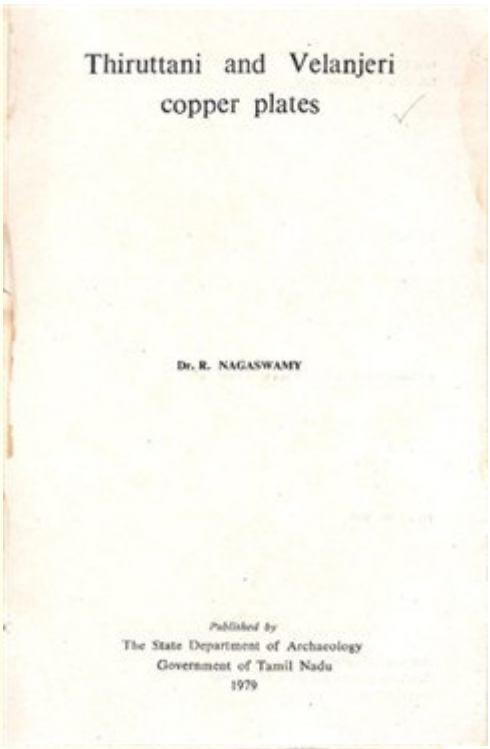
Sanskrit text in grantha script of this section reads as follows:
"ramie sriramatirthe kavivara nikaraih baddhasetu prabandhe kanyaatirthe jitaanaamadaritamapi dis'e mandane dakshinasyaah srirange caahis'alyaas'ayitamurabhidi s'yaamapoogaabhiraame hemnaaviryaancitena kshitipatikarot yastulaabhaarakarma"



Velanjeri Plates of Parantaka Chola

Plate I—Page 1

Plate I—Page 2



Thiruttani and Velanjeri copper plates

Dr. R. NAGASWAMY

Published by
The State Department of Archaeology
Government of Tamil Nadu
1979

The seal of Aparajita's copper plate

The seal of Parantaka chola's copper plate

Vrshabantika Siva with Devi Parvati
found at Velanjeri village, near Thiruttani, District Chengalpattu
10th century A.D.

Udayendiram plates of Cola king Parantaka I (AD 907-955) refer to his adoption of the title Samgramaraghava like Rama.

Pre-modern coinage of Srilanka (Ceylon)

Setu is a word inscribed on some coins, clearly indicating that the ruler was expected to safeguard the setu 'Rama's bridge'.

Traditional design of Lanka standing King Type copper massa of the Jaffna Arya Chakravartis circ 1284-1410, of Codrington **SETU type I (1)**

SPECIFICATIONS	
Denomination	One massa
Alloy	Copper
Type	Struck
Diameter	18.2 mm
Thickness	mm
Weight	4.0 gms
Shape	Round
Edge	Plain
DieAxis	O°

Codrington 88 ;Mitchiner #860

Obverse : Standing king with hanging Lamp or trident on left and group of spheres on right, surmounted by crescent.
Reverse : Seated king on left facing right with Tamil legend **SETU** vertically below his arm.

Setu coins were previously atributed to the Setupati princes of Ranmnad. Codrington attributes them strongly to the Jaffna Arya Chakravartis. This type I(1) is allied to the late Chola copper coin with Tamil *Setu* being substituted for the Nagari *Sri Rajaraja*

See also other SETU type I (3) coin and later during decline of kingdom - 1462-1597 - type II (6) coin.

Text edited from
* Ceylon Coins and Currency: H. W. Codrington, Colombo, 1924.
Chapter VI Medieval Lanka - "Setu" Coins - Type I(1), Page 75
* Oriental Coins: Michael Mitchiner, London, Hawkins Publications, 1978.

The coin was scanned at 600dpi and displayed at 300dpi. It was obtained in 2000 August from Rajah Wickremesinhe an Author and collector in Colombo, Lanka.

http://lakdiva.org/coins/medievalindian/setu_I-1_massa_cu.html Traditional design of Lanka standing King Type copper massa of the Jaffna Arya Chakravartis circ 1462-1597, of Codrington **SETU type II(6)(iii)*variant*** a debased Type with several variations indicative of the decline of the kingdom.

SPECIFICATIONS	
Denomination	One massa
Alloy	Copper
Type	Struck
Diameter	19.0 mm
Thickness	mm
Weight	4.03 gms
Shape	Round
Edge	Plain
DieAxis	O°

Codrington 95 ;Mitchiner #868

Obverse : Standing king with crown consisting three dots, line and dot ; body broad, arms raised. Below body a line following the contour at each end of which is a dot. Below and separated from this line hangs the *Dhoti* To the left two semicircles with dot above each disposed virtically ; to right lamp, the stem of which consists of a large ball between two smaller balls, and the head of a horizontal line curved upwards at either end enclosing a flame. On either side of figure two dots. All within cicle of dashes.
Reverse : Bull couchant facing left. Crescent and sun above. Tamil legend **SETU** below ; large *kombu*. To right and left of bull a group of three dots.

See also earlier SETU - 1284-1410 - type I (1) coin and type I (3) coin.

Text edited from
* Ceylon Coins and Currency: H. W. Codrington, Colombo, 1924.
Chapter VI Mediaeval Lanka - "Setu" Coins - Type II(3)(iii)-Varient, Page 77
* Oriental Coins: Michael Mitchiner, London, Hawkins Publications, 1978.

The coin was scanned at 300dpi and displayed at 300dpi. It was obtained in 2001 December from O. M. R. Sirisena an expert collector in Colombo, Lanka.

http://lakdiva.org/coins/medievalindian/setu_II-6_massa_cu.html

Sethu Bull coins

In the book, 'Yaalpana Iraachchiyam' (1992), Prof. S. Pathamanathan in his article on 'Coins' notes:

" நாணயங்களிலே வரும் **சேது** எனும் மொழி **சேதுகாவலன்** என்ற விருதின் சுருக்கமே எனச் சிந்திக்கலாம். "i.e. "The word **Sētu** in the coins could be considered as the shortened form of the epithet **Sētukāvalan.**"
As seen earlier, the word **Sētu** has the meanings The & Great in addition to a number of other meanings.

Early kings of Jaffna, sometimes referred to as Ariyacakravarti, used names such as Segarajasekaran and Pararajasekaran, and used the epithets Singaiyariyan (Lord of Singaingar, the earlier capital of the Kingdom of Jaffna), Setukavalan (Guardian of Setu or Rameshavaram) and Gangainadan (belonging to the country of the Ganga).

Their emblems were a recumbent bull -*nanthi*-, a Saiva symbol, and the expression *Setu*, indicating the place of their origin, Rameshvaram. The term setu was also used as an expression of benediction. http://www.rootsweb.com/~lkawgw/jaffna.html

Several types of coins categorised as Sethu Bull coins are found in large quantities in the northern part of Sri Lanka. Three types of this series are illustrated below. The obverse of these coins have a human figure flanked by lamps and the reverse has the Nandi (bull) symbol, the legend *Sethu* in Tamil with a crescent moon above. The obverse is similar to the contemporary *Massa* coins issued by the Kalinga and Pandyan rulers of the central Sri Lankan kingdom of Dambadeniya. The reverse of the Massa coins have the image of a seated man with the ruler's name such as Vijayabahu, Nissankamalla, Parakramabahu etc in Devanagari characters.

A Setu coin

The reverse of the Setu coin

A Setu Bull coin

The reverse of the Setu Bull coin

A Setu Bull coin

The reverse of the Setu Bull coin

http://en.wikipedia.org/wiki/Jaffna_Coinage

Setupati coinage, 16th and 17th century
Obverse: Sri Ganapati, seated.
Reverse, in Tamil, Se-Tu-Pa-(Ti missing).

Other textual references on Rama's bridge

Marco Polo, 1854, The travels of Marco Polo, the Venetian: the translation of Marsden revised…, H.G. Bohn, p.380, foot note 3. (Title of the Marsden's edition was: "The travels of Marco Polo, a Venetian, in the thirteenth century; being a description, by that early traveler, of remarkable places and kings in the eastern parts of the world. Translated from the Italian, with notes, by William Marsden, FRS, London…"

[3] The name of this country, which both in the Bâsle edition and the older Latin is Maabar, and Moabar in the epitomes, is Malabar in the text of Ramusio, of which the former has been supposed a corruption; but the reverse is the case, for circumstances unequivocally point to the southern part of the coast of Coromandel as the place where the fleet arrived after leaving Ceylon; and what puts the matter beyond all doubt is, that the province of Malabar is afterwards distinctly mentioned in its proper place. Maàbar, signifying a "passage, ferry, ford, trajectus" (see the dictionaries of Meninski and Richardson), was an appellation given by the Mahometans to what we call the Tinevelly, Madura, and, perhaps, Tanjore countries—from their vicinity, as it would seem, to the celebrated chain of sand-banks and coral reefs named Rama's or Adam's bridge. It is has now fallen into disuse, but is to be found in the works of all the oriental geographers and historians who have treated of this portion of India.

Rama's bridge is also called Setu-bandha is clear from the reference to Setabund-Rameswara in the following account of the formation of the bridge:

Thomas Horsfield, 1851, A catalogue of the mammalian in the Museum of the Hon. East-India Company, East India Company Museum, p.5

Professor Wilson has kindly supplied the following valuable remarks on the ancient history of Hănŭmān, whose name is applied to the *Semnopithecus entellus*, and on the estimation in which this Monkey is now held by the Hindus.

***Hanumán* is called the son of *Pavana*, or the wind. He was one of the Monkeys of the Monkey kingdom in the southern forests, the king of which, *Báli*, was killed by *Rama*, who placed his (Báli's) brother, *Sugriva*, on the throne; thereon a numerous host of monkeys aided Rama in his invasion of Lanka or Ceylon. By their superhuman strength, ponderous rocks were cast into the sea opposite to Manar, and a bridge of rocks was formed. The rocks in the straits are still called Setabund-Rameswara, from the island Ramisseram, in which is a large temple dedicated to Rama. Hanumán particularly distinguished himself in the conflicts that ensued with Rávana's giants.**

That Rama's bridge was used as a reference point to define the expanse of Bharatam (as in the log Aasetu Himachalam used by Survey of India) is clear from the following quote:

William Jones, 1801, Discourses delivered before the Asiatic society, p. 29; also mirrored at: Asiatick Researches: Or, transactions of the society instituted in Bengal, for inquiring into…, Calcutta, Asiatic Society, p. 423

The *characters*, in which the languages of *India* were originally written, are called *Nágarí*, from *Nagara*, a city, with the word *Déva* ſometimes prefixed, becauſe they are believed to have been taught by the Divinity himſelf, who preſcribed the artificial order of them in a voice from heaven. Theſe letters, with no greater variation in their form by the change of ſtraight lines to curves, or converſely, than the *Cusick* alphabet has received in its way to *India*, are ſtill adopted in more than twenty kingdoms and ſtates, from the borders of *Cashgar* and *Khoten*, to *Ráma's* Bridge, and from the *Sindhu* to the river of *Siam*. Nor can I help believing,

Arnold Hermann, 1833, Historical researches into the politics, intercourse, and trade of the principal nations of antiquity, Translated from the German, Oxford University, p.89

six years before Christ[d]. The particular object of this inscription is to record the liberality of a certain renowned conqueror named Deb Pal Deb, who overran all India, from the sources of the Ganges to Rama's bridge at Ceylon, which is celebrated in the Ramayana.

William Yates, 1846, A dictionary of Sanscrit and English, designed for the use of private students and of Indian colleges and schools, Baptist Mission Press, p.821

समुद्रा|ष(रः) 1. *m.* A shark, a whale; *Ráma's* bridge. [time.

समुद्रिय (यः-या-यं) *a.* Marine, mari-

The entry, samudraaru or samudraarah is given the meaing: Rama's bridge.

William Fordyce Mavor, 1807, Universal history, ancient and modern, Oxford University,
p.216

The northern parts of Ceylon are chiefly left to the natives; but the town of Jafna, in a detached isle, was a Dutch settlement. The great pearl-fishing is conducted in the gulf of Manár; a miserable place in a sandy district, to which water is brought from Aripoo, a village four miles to the south; the shoals near Rama's bridge supply inexhaustible stores of this valued production.

A.J. Valpay, 1825, The Classic Journal, Vol. XXXI, Cl.Jl., No. LXII, Oxford, p.26

Sir W. Jones, in his excellent mythological essay, remarks, that Hanumán, the prince of monkies, or satyrs, is said to have constructed a bridge of rocks over the sea, part of which, say the Hindoos, yet remains; and it is probably the series of rocks which bears the name of Adam's (and should be Rama's) bridge.

Charles O'Conor, British Museum, Earl of Bertram Ashburnham, 1819, J. Seeley,
p.107

Sir William adds, that the characters called "Nagari," in which the languages of India were originally written, with no greater variation in their forms, by the change of straight lines to curves, or conversely, than the Cufic characters received in their way from Arabia, "are still "adopted in more than twenty-eight kingdoms, from the borders of Cashgar and Khoten, to "Rama's bridge, and from the Sindhi to the river of Siam;" that the square Chaldaic letters in

(1) Sir William Jones's Works, 4to. Lond. 1799, vol. 1, p. 26. Mr. Halhead's Letter was written twenty years before. Sir William however quotes it no where.

Clements Robert Markham, 1862, Travels in Peru and India: While superintending the collection of chinchona plants and seeds in…, J. Murray, p.423

Tamil race. The *Vellaler* or agricultural caste comes next, and then the *Maravar* and *Kallar*, or robber castes. The Prince of Ramnad, who is hereditary guardian of Rama's bridge, belongs to the Maravars, and the Rajah of Tondiman to the Kallars. Below the robber castes are the *Shanars* or

Charlotte Speir Manning, George Scharf, 1856, Life in Ancient India, Oxford University, p. 117:

Rama and all the allied forces marched down to the Coromandel coast, and making a bridge by casting rocks into the sea passed quickly into Lanka.* Vestiges of Rama's bridge may still be seen, occasioning much inconvenience to navigators, who are obliged to lighten heavy-burdened vessels before they can pass the rocks and sandbanks of the Straits of Manaar. After fighting a few battles, the

Lodovico de Varthema, George Percy Badger, John Winter Jones, 1863, The travels of Ludovico di Varthema in Egypt, Syria, Arabia Deserta and Arabia Felix, in Persia, India…, Published for the Hakluyt Society, (Translated from the original Italian edition), p.185

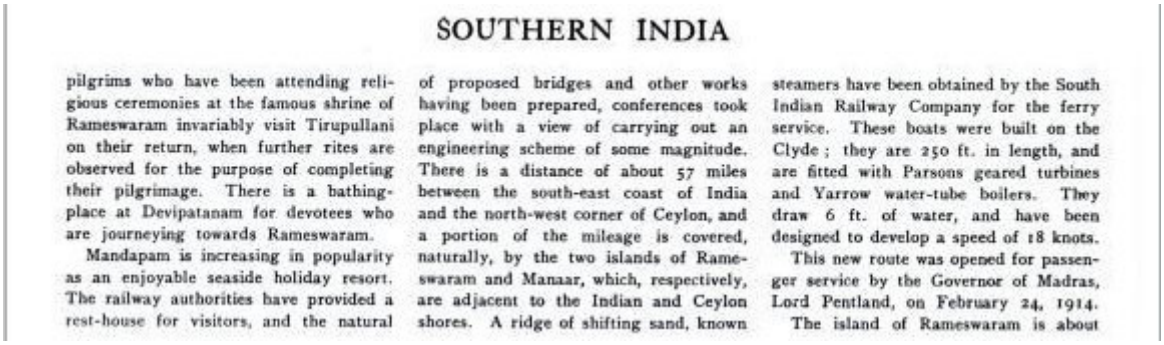
I am surprised that Dr. Vincent, who was well acquainted with Ramusio's Collection, has made no reference to this *Cael* or *Coil* in his identification of the *Kolkhi* of the author of the *Periplus* with the *Kôru* and *Calligicum* of Ptolemy and the *Kôlis* of Dionysius, as the existence of a town of that name, and in the locality occupied by *Cael*, seems to supply the only desideratum for removing the doubt which attaches to his deductions. I quote his argument in full, leaving the reader to form his own judgment on my suggestion :—" Ptolemy has still another particular which is very remarkable ; for as he places the northern point of his Tapróbane opposite to a promontory named Kôru, so he has an island Kôru between the two, and a Tala-Côri on Ceylon ; and Kôry, he says, is the same as Calligicum...The expedition of Ram to Ceylon, and his victory over Rhavan or Rhaban, king of that island, is one of the wildest fables of Hindoo mythology, but he passed into the island at the strait, since called, by the Mohamedans, Adam's Bridge. The whole country round, in consequence of this, preserves the memorial of his conquest. There is a Ramanad-buram on the continent close to the bridge ; a Rami-Ceram, or country of Ram, the island close to the continent ; [*Rameswaram*, called *Rammanana Kojel* by Baldæus, and *Ramonan Coil* by D'Anville ;] and a Point Rama on the continent. The bridge itself, formed by the shoals between Rami-ceram and Manaar, is Rama's Bridge ; and in Rami-ceram is Raman-Koil, the temple of Ram. This Koil or temple [*Koil* means a temple in Malayalim] is undoubtedly the origin of Kôru ; and the repetition of it three times in Ptolemy is in perfect correspondence with the various allusions to Ram at the present

Entry: INDIA, INDIES In a copperplate of the 11th century, by the Chalukya dynasty of Kalyāna, we find the expression "from the Himālaya to the Bridge" (*Ind. Antiq.* i. 81), *i.e.* the Bridge of Rāma, or 'Adam's Bridge,' as our maps have it. And Mahommedan definitions as old, and with the name, will be found below. Under the Hindu kings of Vijayanagara also (from the 14th century) inscriptions indicate all

India by like expressions. (Henry Yule, Hobson-Jobson, a glossary of colloquial anglo-indian words and phrases) http://dsal.uchicago.edu/cgi-bin/philologic/getobject.pl?c.1:1:191.hobson

Tiruvalangadu plates of Rajaraja Cola I (AD 985-1014) describe the king as surpassing Rama in military prowess and crossing the ocean with his powerful army and subduing the king of Lanka.(David T. Sanford, Ramayana Portraits, Vidya Dehejia edited, *The Legend of Rama*, Marg Publications, 1994: 54.)

Deopara Inscription (ca. 1100 CE) records that Samantasena, the head-garland of the Brahma-Ksatriyas proceeded towards Rameshvara-Setubandha and subdued the wicked despoilers of the Laksmi (Wealth) of Karnata. (Metcalfe in the *Journal of the Asiatic Society of Bengal*, Vol XXXIV, part 1, and afterwards critically edited by Prof Kielhorn in *Epigraphia Indica*, Vol 1.307-11).



SOUTHERN INDIA

pilgrims who have been attending religious ceremonies at the famous shrine of Rameswaram invariably visit Tirupullani on their return, when further rites are observed for the purpose of completing their pilgrimage. There is a bathing-place at Devipatanam for devotees who are journeying towards Rameswaram.

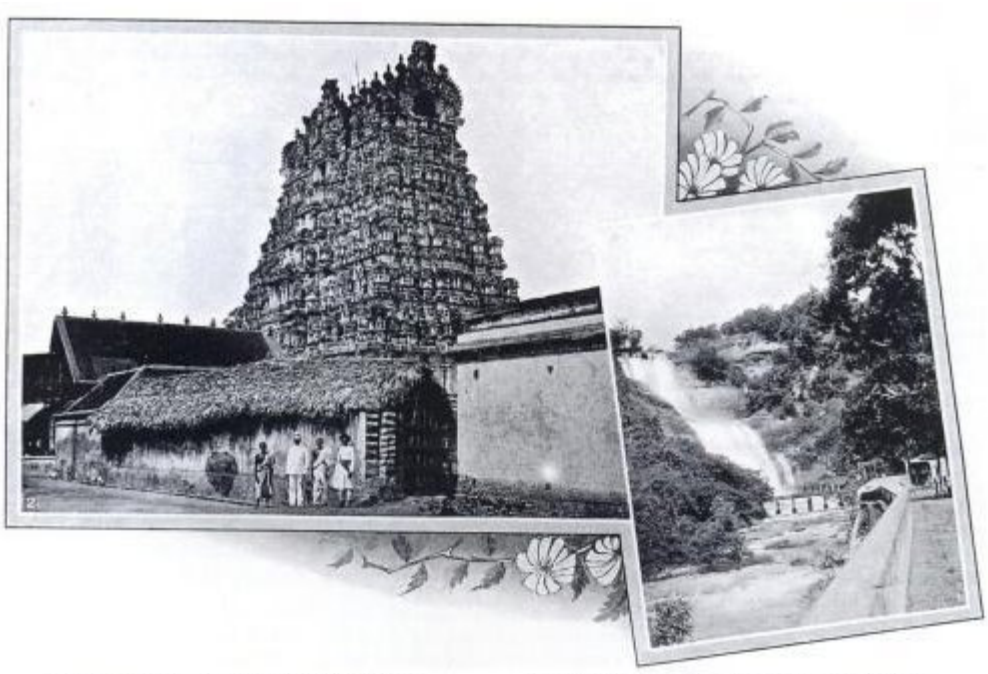
Mandapam is increasing in popularity as an enjoyable seaside holiday resort. The railway authorities have provided a rest-house for visitors, and the natural

of proposed bridges and other works having been prepared, conferences took place with a view of carrying out an engineering scheme of some magnitude. There is a distance of about 57 miles between the south-east coast of India and the north-west corner of Ceylon, and a portion of the mileage is covered, naturally, by the two islands of Rameswaram and Manaar, which, respectively, are adjacent to the Indian and Ceylon shores. A ridge of shifting sand, known

steamers have been obtained by the South Indian Railway Company for the ferry service. These boats were built on the Clyde; they are 250 ft. in length, and are fitted with Parsons geared turbines and Yarrow water-tube boilers. They draw 6 ft. of water, and have been designed to develop a speed of 18 knots.

This new route was opened for passenger service by the Governor of Madras, Lord Pentland, on February 24, 1914.

The island of Rameswaram is about



1. WATERFALL, KUTTALAM, TINNEVELLY. 2. GOPURAM OF THE TEMPLE, TINNEVELLY.

Photo by Nicholas & Co.

attractions of the village, coupled with possibilities of recreation in sailing, sea-fishing, bathing, and shooting, are tempting enough to lure the seekers after change from the heat and dust of the inland towns.

The old route between Tuticorin and Ceylon has always been a most trying experience: one had to endure an hour's journey of 6 or 7 miles in a small and frequently unsteady tugboat before the steamer which awaited passengers could be reached; and then there was a sea-trip of no less than twelve hours to the harbour at Colombo. For many years past, however, negotiations have been in progress to effect a change, and plans as Adam's Bridge, lies between the two islands. In the first place the South Indian Railway Company constructed a metre-gauge line across the island of Rameswaram; then a steel viaduct was built between Mandapam and the island, thus enabling passengers to continue their train journey to Dhanushkodi, which is the terminus of the line. A proposal is on foot to erect bridges along the course of Adam's Bridge in order that trains may run uninterruptedly into Ceylon territory. At present, however, there is a ferry service of about 22 miles between Dhanushkodi and the island of Manaar, which has been connected with the Ceylon main system of railways. Three turbine 25 miles in length, and it is some 6 miles in width in the western portion, while the remainder is merely a strip of sand stretching towards the island of Manaar. The chief town bears the same name as the island, and the houses—with the exception of those in the immediate vicinity of the temple—are of exceedingly primitive design. There is no shrine in the whole of India which is more highly venerated than the great temple at Rameswaram, and for hundreds of years pilgrims from all parts have congregated there for worship. It is generally believed that it was founded by Rama, and that it was erected by the Setupatis of Ramnad. The building stands in a

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Lady Marjorie Pentland, 1928, The Rt. Hon. John Sinclair, Lord Pentland, GSCI: A memoir, Methuen (Reprinted in 2004 as JW Bond, Somerset Playne, Arnold Wright, Playne Wright Somerset Staff, Southern India: its history, people, commerce, and industrial resources, Asia Educational Services).

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International Conference - Chennai

Sri Rama Sethu

in Literature- A truth

Sri. T.V. RENGARAJAN
South Zone Organizing Secretary,
Itihasa Sankalan Samiti -Tamilnadu

12 – 05 – 2007
Mylapore, Chennai.

Sri Rama's Sethu in Literature- A truth

Annal Kakutthan Aazhpunal Sethuvai,
Kanninal orukal Kanda manavan
Ennil Velvi Tavam Punal Yattirai,
Panni Muttriya Panpudaiyan Aro !!

- Sethu Puranam - Sethu Sarukkam -

Verse 16

"One who sees the 'sethu' built by the great Rama, who is also called Kakutthan once, will perform countless yagnas, tapas and tirtha yatras and will remain a man of great strength and character", says Sethu Purana.

1.1. The word 'sethu' means 'anai', 'seikarai'[1]. Tamil Akaramudali gives the meaning 'anaikkattu' (dam) to the word 'sethubandhanam'[2]. Kamban, who wrote the Tamil classic 'Kamba Ramayanam' also refers as 'sethubandhanappadalam'[3]. All these points make it clear that this was built by human beings.

1.2. 'Sethu' is the waterbody in which SriRama purified himself from 'Brammahatti dosha' on his return from Lanka after killing Ravana. It is located in the sea in Rameshwaram area near 'sethubandhanam'. Abhidhanakosam[4] calls 'Sethubandhanam' as 'Tiruvanai' - a dam or bridge built by Sri Rama and the Vanara Sena (Monkey's army) in the sea to cross over it and reach Sri Lanka. Further, Rameshwara Talapuranam calls all these happenings as "Sethu Puranam".

1.3. 'Somalay'[5], a great Tamil scholar says 'sethu' was the dam built by Sri Rama in order to crossover to Srilanka with his huge vanara sena (monkey army) with the help of monkey leaders.

1.4. 'Tiruppullani' - which is at a distance of 6 miles from Ramanathapuram (Ramnad) is known as 'Pullaranyam', 'Pullanai', 'Adisethu', 'Tiruvanai' and 'Sethukkarai'[6]

1.5. 'Namadheepa Nikhandu' names 'seikarai' as 'seikarai', 'kurambu', 'sethu', and 'kulai'[7]. It also names Rameshwaram as 'Sethupuram' and 'Ramasuram'[8].

1.6. The area surrounding 'sethu' - the dam built by Sri Rama on sea is called as 'sethunadu'. Kalaikkalangiyam (Tamil encyclopedia) [9] refers to 'Ramanathapuram district' as 'Sethu Nadu'.

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1. Tamil - Tamil Akaramudali - Editor M.Shanmukam Pillai - Tamil Nadu Text Book Society, A Government of Tamil Nadu Publication - First Edition - Jine 1985.
2. Valmiki Ramayanam - Yuddha Kandam - Sarukka 22 - Sethubhandha
3. Kamba Ramayanam - Yuddha Kandam - Sethubhandhanappadalam
4. Abhidanakosam - The Tamil Classical Dictionary - Yazhppanattu Manippai A.Muthuthambi Pillai - Asian Educational Services - First Published 1902
5. Namadu Tamil Nadu Series 9 - Ramanathapuram Mavattam - Somalay - Pari Nilayam Chennai, May 1972 - P.33
6. Pullai Andati - Thanjai Saraswati Mahal Publication 116 - 1967- P.2,Price 1.25
7. Namadeepa Nikandu - Idavargam - P.159 - verse 54 (Nurpa 530)
8. Namadeepa Nikandu - Idavargam - P.153 - verse 33 (Nurpa 509)
9. Kalaikkalangiyam - Volume 5 - Tamil Valarcci Kazhakam, Chennai - First edition - 1958 - P.207

Sethu bandhanam in epics

2.1. Valmiki[10] describes the construction of 'Sethu', which was built in a record time of 5 days under the leadership of Nala, the son of Viswakarma, in his Ramayana in 25 verses. Rama asks Nala to construct a dam on the sea to Srilanka, as advised by Samudraraja. Nala agrees and Vanaras who looked like high mountains went in all directions and brought mountain like rocks and stones. They brought trees, either cut or uprooted.

The vanara sena uprooted rocks which resembled huge elephants, using machines and brought them to the seashore with the help of carrier vehicles. "The dam constructed by Nala who was as skilled and talented as his illustrious father, looked like milky way" says Valmiki. The joyous roar raised by the vanaras on completion of the dam silenced even the deadliest noise of the mighty ocean.[11]

2.2. Valmiki further describes in another verse in the words of Rama returning with Sita in a Pushpaka Vimana in 'Yuddha Kanda' of Adyatma Ramayanam as follows:
"Here is the Sethubandhana worshipped by three worlds. It is a holy place. It has the ability to relieve all the greatest of sins. It is here 'Mahadeva ' [Lord Siva] extended his whole hearted support to me earlier."[12]

2.3. After initiating the construction of Sethu, Rama installed the idol of 'Rameshwara', and worshipped. Then he said, "Those who worship Rameshwara by observing fasting and prayer, those who perform 'abhiseka' with the holy water of Ganga brought by them from Kasi - all their sins will be thrown in to the mighty ocean. They will attain 'moksha' (Mukti) without any doubt", says Adhyathma Ramayanam about Sethu bandhanam and its holiness.[13]

2.4. Ananda Ramayanam[14] describes the beginning of the construction of the dam as follows: 'Rama, who hails from Raghu Dynasty, installed the idol of Lord Vinayaka after explaining about the dam to Nala. Then Rama worshipped the 9 stones installed by Nala, representing the 9 planets. He then conveyed his willingness to Hanuman about installing a wonderful linga in his name where the three seas meet.

2.5. "The mountain like dam 'Nalasethu' was built as per the orders of Rama" says Vyasa in his Mahabharatha[15].

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10. Hastimathran Mahakaya: Basha Namsa Mahabala: Parvathamsa Samuthpatya yanthrai: parivahantisa - Valmiki Ramayanam - Yuddha Kandam Sarukkam 22 - Verse 58
11. Valmiki Ramayanam - Sarukkam 22 - Slokas 51 - 75
12. Yetat drushyate tirtham sagarasya mahatmana:
    Sethubhandha idikyathan Trilokyenapi poojitham\\
    Yetat pavitram paramam mahapataka nasanam
    Atra purvam Mahadeva: Prastha Maharotaprabhu: - Valmiki Ramayanam - Yuddha Kandam - 126.20.1
13. Adyathma Ramayanam - Yuddha Kandam
14. Ananda Ramayanam - Sarakandam (Sarukkam 10 - verse 69)
15. Mahabharatham 3.267.45

Puranas

3.1. Bhagavatha Puranam says that Balarama went to the dam which can purify even the greatest sins. 'Samudhram Se Mahamath Mahapataka Nasanam', Says Bhagavatha[16].

3.2. Padma Puranam[17] says, "this sethu was built by me within 3 days with the help of Vanara Sena."

3.3. Skanda Purana [18] says the mere vision of Rama Sethu will relieve one from Samsara bandhas.

Thus, Epics and Puranas say that the dam Sethu was built in the middle of the sea by Rama and say that it is a holy one.

Literature

4.1. There is a reference to Sethu in Tamil Sangam classic Akananuru [19] which compares the sound made in a village to that of the sound heard from the sea near 'Thriuvanaikkarai (Adi Sethu), in Pandya Kingdom which was built by Rama, the great warrior.

4.2. Periyavaccan Pillai, one of the Vaishnava Acharyas, writes as

"Malaiyal Anaikatti Marukarai eri"[20] in his Pasurappadi Ramayanam.

4.3. 'Sethu Puranam' also known as 'Sethu Mahatmiyam' - a sangam classic which contains45 Sarukkas and 3438 verses and which was written by Niramba Alagiya Singar (16th Century) and Verified by Nallur Arumuga Navalar of Jaffna and published by Chidambaram Saivapprakasa Vidyasala Dharmaparipalakas. Sri Ponnusamy Thevar of Ramanathapuram Samasthanam took up the efforts to publish this work to which Sodashavadanam Subbiraya Chettiyar, a deciple of Tiricirapuram Mahavidvan Meenatchisundaram Pillai has contributed the 'Sirappuppayiram'. In that, he has sung in
praise of Sethu as - ' Titara oduum Sethu Manmiyatthai'. Another poet Kumarasami Pillai has mentioned as 'Sethumanyamana vadanul thannai'. In the prayer song of ' Sethu Puranam' the dam built by sri Rama has been mentioned as "Tuya Seer Ramasethu".

Sethu's greatness and its holiness has been sung in 64 verses in the chapter 'Sethu Sarukkkam'. The necessity to built Sethu for Sri Rama has been explained in Sethu Vanda Sarrukkam'. After explaining' 'Sethu Madhava Sarukkam', Sethu Yatthirai Sarukkam', the benefits reaped in merely thinking about Sethu and taking the holy dip are detailed in 151 verses. Tala Puranam [21] (Volume I) in Tamil literature also mentions about 'Sethu puranam'.

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16. Bhagavathapuranam 10th Skandam - Sarukkam 79
17. Padmapuranam - Srustikandam - Sarukkam 38
18. Skandapuranam - Sethu Mahatmiya Kandam - Sarukkam 1
19. Venverkavuriyar tonmudukodi
    Muzhangirum Bouvam Irangum Mundrurai
    velpor Raman arumaraik kavittha
    Palvizh alampola oliyavindandru iv vazhungal ure - Akananuru - Kalirt - Padal 70

20. Vizhineer Ilankai aruli, saranpukka kuraikadalai
adalampal marukaeidu, tollai vilangu ani seyya
malayal anaikatti marukarai eri Pasurappadi Ramayanam - Yuddhakandam - Periyavaccan Pillai

21.Tamizhil Talapuranangal (Part 1) Dr.V.R.Madhavan - Tamil University - Thanjavur - P.193 - Tirumala Tiruppati Devasthana Aid - 1995

4.4. It remained a traditional practice of Tamilians to give lectures in praise of 'Sethu Puranam'. Arumuga Navalar, who was one among those, has also written it in manuscripts. It was printed and published by Sri M.R.M.S. Ramalinga Pillai of Rameshwaram for 12 anas in the name of 'Sethu Makattuvam' (Rameshwara Manmiyam). This "Sethu Puranaprasangam' which begins with Suta Puran is narrating the story to Sounakadi Rishis in Naimisaranyanm is a dialogue based one[22].

4.5. "Anaiyalai Sulkadal Andradainadu Vazhiseithavan" [23] says Thiru Gnana Sambandar in his Tevaram.

4.6. Thirunavukkarasar in his Tevaram sings the construction of the dam by Sri Rama as " Kadalidai Malaikal Tammal Adaittu Mal Karumam Muttri".[24]

All the above references from epics puranas and literature - written in different languages, in different times stand testimony to the fact that the dam 'Sethu' was built as per the orders given by Sri Rama to Nala.

5.1. **Sethu Nadu:** The Samashthana of Ramanathapuram (Ramnad) was called as 'Sethu Nadu only
because of the very existence of 'Sethu'. The king of this samashthana was known as Sethupati [25], 'Sethu Kavalar [Lord of the Cause way]. Thirupullani which is at a distance of 6 miles southeast of 'Ramnad' is known as Adisethu. Ramayana says Sri Rama appointed people from Maravar community to protect 'Sethu' and the people who come to take a holy bathe in it. One of the kings of 'Sethupati dynasty' constructed a town near 'Thirupullani'.

It was named as "Mugavai" as it stood as the gateway to reach 'Sethu'. Later it became Ramanathapuram[26]. It is obvious that the kings of 'Sethu'had longcherished tradition. Among them, :
Adiraghunatha Sethupati, Jeyatunga Raghunatha Sethupathi,Ativeera Rahunatha Sethupati Varaguna Raghunatha Sethupati and 6 others are mentioned as the earliest ones of the Sethupati dynasty[27].

The names 'Rahunatha' and 'Sethupati' are attached to them, because of their relationship with Sri Rama [Who is also called Raghunatha] and the dam built by him. All the kings of this dynasty are called as ' Sethupati' by the people of successive generations. It stands as a clear testimony to the existence of Rama Sethu and also to the point that all the kings of the 'Sethupati' dynasty ruled this area with great devotion and dedication[28].

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22. Inaiya Sethu Neeradinum, teendinum, idutanai egngnandru ninaivu
seikinum kankinum, ketpinum, neengidun tuyarellam anaiyum
atthanmayidum mayavan arul seyyum ac Sethutanai
nikarppatondrillaiyam - tavaneri tazhaikkum andanarkalo - Sethubhandhana Makattuvam
23. Sanpanta Tevaram - verse 6
24. Thirunavukkarasar Tevaram - verse 3
25. Kalaikkalangiyam Volume 5 Tamil Valarccikkazhakam, Chennai - First Edition 1958
26. Rameshwaram (The Sacred Island) by Major H.A.Newell - Indian army - II edition
27. Abhidana Cintamani - A.Singaravelu Mudalaiyar - V.1628 The Setupatis of Ramnad - Page 126, by S.Thiruvenkatachari
28. Kizhavan Setupati - M.Manoharan, 1983, Setupatikal Varalaru - Chiranjeevi 1981

5.2. Things have changed dramatically since the inception of Ramanathapuram district in 1910. The finalization of manual about the political, geographical, industrial, agricultural, economical growth, besides information about population its distribution, transport, revenue, ports, holy places got a final shape after passing through several stages in 1968. It was released only in 1972 after making necessary changes.

The foreword to the district manual of Ramanathapuram released by the then Chief Minister of Tamilnadu, Sri M. Karunanidi is note worthy.

"The task of collecting and publishing the district manuals was given top priority after independence and was given preference in the five year plans. The District manual of today is not only a guide furnishing mear information. It is of great help containing several important topics and can be used very much as a source of great reference. A manual throws light on our age and traditions and long cherished culture. It serves as a mirror which reflects our society. Once having a thorough knowledge of the manual we can march forward keeping our head high and be proud of our well nurtured culture and traditions, which has been passed on to

the successive generations by our ancestors. Only the passage of time will reveal the necessity of such manuals, which help us to know about our country and people.

By publishing the district manual of Ramanathapuram district, a commendable work has been completed. It is all the more commendable since it contains detailed information about the district and its people. I am sure that this manual will be of immense help to the rulers and people who are involved in welfare projects and research work. -M. Karunanidhi
14.06.1972

The above cited literary and historical evidences prove the existence and the greatness of 'Rama Sethu', which are acceptable to even today's politicians. Once knowing its greatness it becomes a necessity to take all steps to protect it.

ஓம்

அகிலக் கருத்தரங்கு, சென்னை

இலக்கியங்களில்
ஸ்ரீ ராம சேது – ஓர் உண்மை

திரு.வீர. ரெங்கராஜன்

தென்மண்டல அமைப்பாளர்

இதிஹாஸ சங்கலன சமதி

தமிழ்நாடு.

12-05-1907

மைலாப்பூர், சென்னை.

: 1 :

இலக்கியங்களில் ஸ்ரீ ராமர் சேது – ஓர் உண்மை

அண்ணல் காகுத்தன் ஆழ்புனல் சேதுவை, கண்ணினால் ஒருகால் கண்ட மானவன்
எண்ணில் வேள்வி தவம் புனல் யாத்திரை, பண்ணி முற்றிய பண்புடையான் அரோ!!

- சேது புராணம் - சேது சருக்கம் - பாடல் 16

"பெரியோனாகிய காகுஸ்தன் எனப்படும் இராமன் ஆழமான கடலே கட்டிய சேதுவை கண்ணினால் ஒருமுறை கண்ட மனிதன், எண்ணற்ற யாகங்கள், தவம், தீர்த்த யாத்திரைகள் செய்து, முதிர்ந்த பண்புடையாளன் ஆக விளங்குவான்" என்று சேது புராணம் கூறுகிறது.

1.1 சேது என்ற சொல்லுக்கு அணை, செய்கரை [1] என்பது பொருள் "சேது பந்தனம்" [2] என்றால் "அணைக்கட்டு" என்பது பொருள் என்று, தமிழ் அகரமுத கூறுகிறது. வால்மீகி ராமாயணம், "சேது பந்தா" : (சேது பந்தனம்) என்றே கூறும். தமிழில் ராமாயணம் எழுதிய கம்பரும் "சேது பந்தனப் படலம்" [3] என்றே கூறியிருக்கிறார். எனவே இது மனிதனால் கட்டப்பட்ட அணை என்பது தெளிவு.

1.2 மேலும் "சேது" என்பது "ஸ்ரீராமர் ராவண வதம் முடித்து மீண்டகாலத்தில் பிரம்மஹத்தி நீங்கும் பொருட்டு ஆடிய தீர்த்தத்துறை. இது சேதுப்பந்தனத்தருகே ராமேஸ்வரத்தைச் சார்ந்த சமுத்திரத்திலுள்ளது" எனவும், "சேது பந்தனம்" என்பது திருவணை அது கடலைக்கடந்து இலங்கைக்கு செல்லவேண்டிய ராமனும் வாநர சேனையும் கடலைத் தூர்த்திட்ட அணைப்பாதை " எனவும் அபிதான கோசம் [4] கூறும்.

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1 - தமிழ் - தமிழ் அகரமுத - தொகுப்பாசிரியர் மு. சண்முகம்பிள்ளை தமிழ்நாட்டு பாடநூல் நிறுவனம், சென்னை - தமிழ் நாட்டு அரசு வெளியீடு முதல் பதிப்பு - ஜூன் 1985

2. - வால்மீகி இராமாயணம் - யுத்தகாண்டம் - 22-வது சர்க்கம் - சேதுபந்தா :

3. - கம்பராமாயணம் - யுத்தகாண்டம் - சேதுபந்தனப்படலம்.

4. - அபிதானகோசம் - The Tamil Classical Dictionary - யாழ்ப்பாணத்து மானிப்பாய்

மேலும் அது சேது புராணம் என்பது - ராமேச்சரதலபுராணம் என்றும் கூறுகிறது.

1.3 இராமபிரான் தம் பெரும்படையுடன் இலங்கை செல்லவேண்டிய வானரத்தலைவர்களை கொண்டு கட்டவித்த திருவணையே சேது எனப்படும் என தமிழ் அறிஞர் சோமலெ [5] அவர்கள் கூறுகிறார்கள்.

1.4 இராமநாதபுரத்திருந்து 6கல் தொலைவிலுள்ள திருப்புல்லாணி எனும் தலம் - புல்லாரண்யம் எனவும், புல்லனை எனவும் ஆதிசேது எனவும், திருஅணை எனவும், சேதுக்கரை எனவும் வழங்கப்படுகிறது [6].

1.5 செய்கரையின் பெயர் - செய்கரை, குரம்பு, சேது, குலை என நாமதீப நிகண்டு கூறகிறது [7]. மேலும் இராமேச்சுரத்தின் பெயர்களாக சேதுபுரம் ; இராமச்சுரம் எனவும் நாமதீப நிகண்டு கூறுகிறது [8].

1.6 சேதுநாடு என்பதற்கு சேது என்பது இராமபிரான் கடல் மேட்ட அணை. இச்சேதுவை சார்ந்த நாடுசேது நாடு என வழங்கப்படுகிறது. இராமநாதபுரம் மாவட்டம் சேது நாடு எனக் கலைக்களஞ்சியம் [9] கூறுகிறது.

இதிகாசங்கள் கூறும் சேது பந்தனம்

ஆ.முத்துதம்பிப்பிள்ளை Asian Educatioal Services - First Published : 1902.

5, - நமது தமிழ்நாடு வரிசை.9 - இராமநாதபுரமாவட்டம் - சோமலெ - பாரிநிலையம், சென்னை, மே 1972 - பக்கம் 33.

6. - புல்லைஅந்தாதி - தஞ்சை சரஸ்வதி மஹால் வெளியீடு 116 - 1967 பக்கம் 2, விலை 1.25

7. நாமதீப நிகண்டு - இடவர்க்கம் - பக்கம் 159 - பாடல் 54 (நூற்பா 530)

8. நாமதீப நிகண்டு - இடவர்க்கம் - பக்கம் 153 - பாடல் 33 (நூற்பா 509)

9. கலைக்களஞ்சியம் - தொகுதி 5 - தமிழ்வளர்ச்சிக் கழகம், சென்னை - முதற்பதிப்பு 1958 - பக்கம் 207

10 - ஹஸ்திமாத்ரான் மஹாகாயா : பாஷா நாம்ஸ்ச மஹாபலா : ! பர்வதாம்ஸ்ச

2.1 சமுத்திரராஜனின் சொற்படி நளனிடம் கடடையே இலங்கைக்கு அணைக்கட்ட வேண்டுமெனக் கூறியவுடன், நளன் இசைவு தெரிவிக்கிறான். மலை போன்ற தோற்றமுடைய வானரங்கள் பல்லாயிரவர் நாலா திசைகளிலும் சென்று மலைகளைக் கடற்புறத்திற்கு இழுத்துவந்தனர். மரங்களை உடைத்தும் வேறுடன் பிடிங்கியும் எடுத்து வந்தனர். யானை அளவான் பாறைகளையும் மலைகளையும் பெயர்-த்தெடுத்து இயந்திரங்களின் உதவியால் வாகனங்களில் கடற்புறத்திற்கு எடுத்து வந்தனர் என்கிறார் வால்மீகி [10]. ஐந்து நாட்களில் வானரசேனை நளன் தலைமையில்கட்டிய அணை பற்றி வால்மீகி 25 பாடல்களில் விவரிக்கிறார். நளன் விஸ்வகர்மாவின் மகன். தகப்பனைப் போலவே திறமைசா. அவனால் கட்டி முடிக்கப்பட்ட அணை வானத்தில் பால்வெளிபோல் இருந்தது என்று வால்மீகி கூறுகிறார். அணை கட்டிமுடிக்கப்பட்டவுடன் வானரங்கள் எழுப்பிய ஒ கடல் ஒயை அமுக்கிவிட்டது என்கிறார் [11].

2.2 புஷ்பகவிமானத்தில் சீதையுடன் வரும் இராமர் கூறுவதாக வால்மீகி ராமாயணத்தில் ஒரு பாடல் - மூன்று உலகங்களும் தொழும் சேதுபந்தனம் இப்பெருங்கடல் இதோ காண்கிறது. இது மிகப் புனிதமான இடம். மிகப்பெரும் பாவங்களையும் அழிக்கும் வல்லமை வாய்ந்தது. இதுதான் முன்னம் மஹாதேவர் (சிவன்) எனக்கு நன்மை புரிய திருவளம் கொண்டஇடம் என்று இராமர் கூறுவதாக வால்மீகி கூறுகிறார் [12].

2.3 அத்யாத்ம இராமாயணம் (யுத்தகாண்டம்)

சேது கட்ட தொடங்கியவுடன் இராமேஸ்வரரை பிரதிஷ்டைசெய்து வணங்கினான் பிறகு உலக நன்மை கருதி அவர் கீழ்கண்ட சொற்களை திருவாய் மலர்ந்தருளினார். யார் இந்த சேது பந்தனத்தையும், இராமேஸ்வரரையும் பணிந்து வணங்குகிறார்களோ, யார் விரதம், வேண்டுதல் முதயவற்றைக் கடைப்பிடித்து வணங்குகிறார்களோ யார் காசி சென்று கங்கை நீர் கொண்டுவந்து அதனால் இராமேஷ்வரருக்கு அபிசேகம் செய்கிற ார்களோ அவர்களின் பாவ மூட்டையானது கடலுள் தூக்கி எரியப்படும், எந்த சந்தேகமும்

சமுத்பாட்ய யந்த்ரை : பரிவஹந்திச - வால்மீகி - இராமா - யுத்தகாண்டம் 22வது சர்க்கம் - பாடல் 58

11. வால்மீகி - இராமா - சர்க்கம் 22 சுலோகம் 51-75

12. - ஏதத் த்ருஷ்யதே தீர்த்தம் ஸாகரஸ்ய மஹாத்மன :
சேதுபந்த இதிக்யாதன் த்ரைலோக்யேனாபி பூஜிதம் !!
ஏதத் பவித்ரம் பரமம் மஹாபாதக நாஸனம்
அத்ர பூர்வம் மஹாதேவ : ப்ராஸ்த மகரோதப்ரபு :

வால்மீகி - இராமா - யுத்தகாண்டம் - 126.20.1

இல்லாமல் அவர்கள் முக்தி அடைவர் என்று இராமர் கூறுவதாக அத்யாத்ராமயாணம் சேது பந்தனம் பற்றியும் - அதன் புனிதம் பற்றியும் கூறுகிறது [13].

2.4 ஆனந்த இராமாயணம்

இரகுவம்சத்தவனான இராமன் அணைபற்றி நளனுக்கு ஆணையிட்டான். அணை கட்டத் துவங்கும்போழுது விநாயகரை பிரதிஷ்டை செய்தான். பிறகு நளன் கடலுள் 9 கிரகங்களுக்கென நாட்டுவித்த 9 கற்களை வழிப்பட்டான். பிறகு கடல்கள் சங்கமிக்கும் இடத்தில் ஓர் அற்புதமான ங்கத்தை, தன் பெயரிலேயே பிரதிஷ்டை செய்ய முடிவெடுத்து அனுமனிடம் கூறலுற்றான் [14] என்று ஆனந்தராமாயணம் ராமன் கடலுள் அணைகட்ட தொடங்கிய விவரத்தை வர்ணிக்கிறது.

2.5 மஹாபாரதம்

இன்று புவியில் "நளசேது" என்று பிரபலமான மலைபோன்ற அணையானது இராமர் ஆணையால் கட்டப்பட்டது என மஹாபாரதத்தில் வியாஸர் குறிப்பிடுகிறார் [15].

புராணங்கள்

3.1 பாகவதபுராணம்

பலராமர் மிகப்பெரிய பாவங்களை போக்கும்தன்மையுடைய கடல் அணைக்குச் சென்றார் என்று பாகவதபுராணம் கூறுகிறது.

ஸமுத்திரம் ஸே மகமத் மஹாபாதக நாஸனம் என்கிறது பாகவதம் [16].

3.2 பத்மபுராணம்

வருணாலயமான சமுத்திரத்தினுள் இந்த சேதுவானது என்னால் கட்-டப்பட்டது. குரங்குக் கூட்டத்தால் மூன்றே நாட்களில் இது கட்டி முடிக்கப்பட்டது என்று மூன்று நாட்களில் கட்டபட்டதென பத்மபுராணம் கூறுகிறது [17].

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13. - அத்யாத்ம இராமாயணம் - யுத்தகாண்டம்

14. - ஆனந்தராமாயணம் - சரகாண்டம் (சர்க்கம் 10 - பாடல் 69)

15. - மஹாபாரதம் 3.267.45

16. - பாகவதபுராணம் 10வது ஸ்கந்தம் - 79வது சர்க்கம்

3.3 ஸ்கந்தபுராணம்

ராம சேதுவைக் கண்டாலே அவர்கள் சம்ஸாரபந்த்திருந்து விடுபடுவார் என்று ஸ்கந்தபுராணம் கூறுகிறது [18] .

இவ்வாறு இதிகாசங்களும், புராணங்களும் கடல் நடுவே அணையானது ராமபிரானால் ஏற்படுத்தப்பட்டது எனவும் அது மிகவும் புனிதமானது எனவும் கூறுகின்றன.

இலக்கியங்கள்

4.1 அகநானூறு

" வேலையுடைய பாண்டியரது மிக்க பழைமையுடைய திருவணைக் கரையின் (ஆதி சேது) அருகில், முழங்கும் இயல்பினதான, பெரிய கடன் ஒக்கின்ற துறை முற்றத்தில் வெல்லும் போரினில் வல்ல இராமன் அரிய மறையினை ஆய்தற் பொருட்டு புட்களின் ஒ இல்லையாகச் செய்த பல விழுதுகளையுடைய ஆலமரம்போல இவ்வூரில் எழும் ஒ அவிந்து அடங்கியது" என்று சங்க இலக்கியமான அகநானூற்றில்[19] உவமை கூறப்பட்டுள்ளது.

4.2 பாசுரப்படி இராமாயணம்

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17. - பத்மபுராணம் - சிருஷ்டிகாண்டம் - 38வது சர்க்கம்

18. - ஸ்கந்தபுராணம் - சேது மஹாத்மிய காண்டம் - சர்க்கம் 1

19. - வென்வேற்கவுரியர் தொன்முதுகோடி
முழங்கிரும் பௌவம் இரங்கும் முன்றுறை
வெல்போர் இராமன் அருமறைக் கவித்த
பல்விழ் ஆலம்போல
ஒயவிந்தன்று இவ் வழுங்கல் ஊரே - அகநானூறு. களிற். பாடல் 70

20. - விழிநீர் இலங்கை அருளி , சரண்புக்க குரைகடலை
அடலம்பால் மருகஎய்து, தொல்லை விலங்கு அணி செய்ய

வைணவ ஆச்சார்யர்களுள் ஒருவரான பெரியவாச்சான்பிள்ளை எழுதிய பாசுரப்படி இராமாயணத்திலும் "மலையால் அணைகட்டி மறுகரை ஏறி" [20] என்று குறிப்பிடுகிறார்.

4.3 சேது மஹாத்மியம் எனப்படும் சேது புராணம்

45 சருக்கங்களையும் 3438 பாடல்களையும் உடைய தமிழ் இலக்கியம் சேது புராணம் என்பதாகும். சேது புராணம் என்னும் இவ்விலக்கிய நூல் - நிரம்பஅழகியசிங்கர் (16ம் நூற்றாண்டு) என்பவரால் எழுதப்பட்டு, யாழ்ப்பாணத்து நல்லூர் ஆறுமுகநாவல-ரால் பரிசோதிக்கப்பட்டு, சிதம்பரம் சைவப்பிரகாச வித்யாசாலை தருமபரிபாலகர்களால் வெளியிடப்பட்டது. இராமாநாதபுரம் சமஸ்தானம் ம.ள.ள.ஸ்ரீ பொன்னுசாமி தேவரவர்கள் இதற்கான முயற்சிகளை மேற்கொண்டார். இந்த நூலுக்கு திரிசிரபுரம் மஹாவித்வான் மீனாட்சிசுந்தரம்பிள்ளையின் மாணக்கராகிய சோடசாவதானம் சுப்பிராய செட்டியார் சிற ப்புப்பாயிரம் அளித்துள்ளார். அதில் தீதற ஓதுரம் சேது மான்மியத்தை - என்று சேதுவின் மாஹாத்மியத்தை எடுத்துக் கூறுவதாக பாடியிருக்கிறார். மற்றோரு சிறப்புப்பாயிரம் பாடிய குமாரசுவாமிபிள்ளை என்பவர் "சேதுமான்மியமான வடநூல் தன்னை" என்று குறிப்பிட்டிருக்கிறார். சேதுபுராணம் என்றே நூல் செய்துள்ளார். அதன் கடவுள் வணக்-கமான காப்புச் செய்யுளில் " தூயசீர் இராமசேது" என்ற வார்த்தைகள் மூலம் இராமரால் கட்டப்பட்ட அணையைக் குறிப்பிடுகிறார்.

சேது சருக்கம் என்ற அத்தியாயத்தில் சேதுவின் புண்ணியப் பெருமைகளை 64 பாடல்களில் குறிப்பிடுகிறார்.

சேது வந்த சருக்கத்தில் இராமபிரான் சேது கட்டவேண்டிய அவசியம் நேர்ந்ததை விவரிக்கிறார். சேதுமாதவச் சருக்கம் சேது யாத்திரைச்சருக்கம் ஆகியன விவரித்துப்

மலையால் அணைகட்டி மறுகரை ஏறி
- பாசுரப்படி இராமாயணம் - யுத்தகாண்டம் - பெரியவாச்சான்பிள்ளை

21. - தமிழில் தலப்புராணங்கள் (முதல் பகுதி). டாக்டர் வே.இரா.மாதவன் - தமிழ் பல்கலைகழகம், தஞ்சாவூர் - பக்கம் 193 - திருமலா திருப்பதி தேவஸ்தான உதவி - 1995

பின் சேதுபலச் சருக்கத்தில் சேதுவை நினைப்பதாலும், அதில் குளிப்பதாலும் கிடை-க்கும் பேறுகளை 151 பாடல்களில் விவரிக்கிறார். இந்த சேதுபுராணம் பற்றி தமிழில் தலபுராணங்கள் [21] (முதற்பகுதி) என்ற நூலும் விவரிக்கிறது.

4.4 சேது மகத்துவம்

70 ஆண்டுகளுக்கு முன்பு சேது மகத்துவத்தைப் பாமரமக்களும் அறியும்படி சேது புராணம் பிரசங்கம் செய்வது தமிழக மக்களின் வழக்கமாக இருந்துவந்தது அப்படி சொற்போழிவாற்றியவர்களின் சோற்போழிவுகளை ஆறுமுக உபாத்தியாயர் என்பவர் ஏட்டுபிரதியாக எழுதிவைத்திருந்தார். அதை 1957ல் ராமே-ஸ்வரம் புத்தக வியாபாரம் - எம்.ஆர்.எம்.எஸ். இராமங்க பிள்ளை என்பவர் புத்தகமாக அச்சிட்டு பன்னிரெண்டணாவிற்கு " சேது மகத்துவம் " என்ற பெயரில் (இராமே-ஸ்வர மான்மியத்தை) வெளியிட்டார். சூத புராணிகள் சௌனகாதி ரிஷிகளுக்கு நைமிசாரண்யவனத்தில் கூறியதாகத் தொடங்கிச் சொல்லப்படும் இச்சேது புராண பிரசங்கம் என்பது ஒரு வசன நூலாகும் [22] .

4.5 திருஞானசம்பந்தர் தேவாரத்தில் கடல் இராமன் அணை அமைத்ததை "அணையலை சூழ்கடல் அன்றடைந்து வழிசெய்தவன்" [23] என்கிறார்.

4.6 திருநாவுக்கரசர் தம் தேவாரத்தில் இராமன் அணை அமைத்ததை கடடை மலைகள் தம்மால் அடைத்து மால் கருமம்முற்றி [24] என்று கூறுகிறார்.

இங்ஙனம் இதிஹாஸங்கள் புராணங்கள், இலக்கியங்கள் எனப் பல மொழிகளிலும், வேவ்வேறு காலகட்டங்களிலும், கடல் இராமர் ஆணையால், நளன் தலைமையில் ,

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22. - இணைய சேது நீராடினும், தீண்டினும், இதுதனை எஞ்ஞான்று நினைவு செய்கினும் காண்கினும், கேட்பினும், நீங்கிடுந் துயரெல்லாம் அனையும் அத்தனுமாயிடும் மாயவன் அருள் செய்யும் அச்சேதுதனை நிகர்ப்பதொன்றில்லையாம் - தவநெறி தழைக்கும் அந்தணர்களோ ! என்று சேது பந்தன மகத்துவம்.

23. - சந்பந்தா தேவாரம் - பாடல் 6. 24. - திருநாவுக்கரசரர் தேவாரம் - பாடல் 3

25. - கலைக்களஞ்சியம் - தொகுதி 5 - தமிழ் வளர்ச்சிக்கழகம், சென்னை - முதற்பதிப்பு 1958

26. - Rameswaram (The Sacred Island) by Major H.A. Newell - Indian Army - II Edition.

குரங்கினங்கள் அணை அமைத்ததுபற்றிக் தெளிவாகக் கூறப்பட்டுள்ளன.

5.1 சேது நாடு

இந்த சேது இருப்பதனாலேயே இராமாநாதபுரம் சமஸ்தானம் சேது நாடு எனப்பட்டது. இந்நாட்டின் தலைவர் சேதுபதி எனப்பட்டார் [25]. (Lord of the Cause Way) சேது காவலர் எனவும் அழைக்கப்பட்டனர். இராமாநாதபுரத்திருந்து தென்கிழக்கே 6 கல் தொலைவில் உள்ள திருப்புல்லாணி - " ஆதிசேது" எனப்படுகிறது. இராமர் சேதுவைக் காக்கவும் சேது நீராடவரும் பக்தர்களை காக்கவும் மறவர் இனத்தைச் சேர்ந்தவரை சேதுபதியாக நியமித்தாக - இராமாயணம் கூறுகிறது. இந்தச் சேதுபதி பரம்பரையில் வந்தவர் சேதுவைக்காக்க திருப்புல்லாணி அருகே ஒரு நகரம் உருவாக்கினர். சேதுவை அடைய அதுவே தலைவாயில் போல இருந்தால் " முகவை " என்று பெயரிட்டனர். பிற து அது இராமநாதபுரமாயிற்று [26].

சேது நாட்டின் அரசர்களாக விளங்கிய சேதுபதிகள் நீண்டதெரு பாரம்பரியமிக்க வம்சா வளியினர் என்பது தெளிவு. மிக மூத்த தலைமுறையைச் சேர்ந்த சேதுபதிகளாக ஆதிரகுநாதசேதுபதி, ஜெயதூங்கரகுநாத சேதுபதி, அதிவீரரகுநாத சேதுபதி, வரகுணரகுநாத சேதுபதி முதய 10 சேதுபதிகள் குறிக்கப்படுகிறார்கள் [27].

இராமரோடும் அவரால் எழுப்பப்பட்ட அணையோடும் தொடர்புடையவர்கள் என்பதால் இரகுநாத என்ற சொல்லும் அவர்கள் பெயரிலே இடம் பெற்றிருக்கிறது. இப்படி மன்னர்கள் சேதுபதி என்ற பெயரிலேயே பரம்பரையாக - காலம் காலமாக அழைக்கப்பட்டுள்ளனர். இது " ராமசேது" இருப்பதற்கும் இவர்கள் பரம்பரையாக இந்த பகுதியை திறம்படவும் பக்திபூர்வமாகவும் ஆண்டு வந்தனர் என்பதற்கும் சான்றுகள் பகர்கின்றன [28].

5.2 இராமநாதபுரமாவட்ட விவரச்சுவடி

இராமநாதபுரமாவட்டம் 1910ல் புதிதாக உருவாக்கப்பட்பின் பல மாற்ற

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27. - அபிதான சிந்தாமணி - ஆ. சிங்காரவேலு முதயார் - வி. 1628

The Setupatis of Ramnad - Page 126, by S. Thiruvenkatachari

28. - கிழவன் சேதுபதி - மீ. மனோகரன் 1983

சேதுபதிகள் வரலாறு - சிரஞ்சீவி 1981

ங்கள் நிகழ்ந்துவிட்டன. இராமநாதபுரத்தின் தொழில், வாணிபம், பொருளாராரம், மக்கள் தொகை, மக்கள் தொகை அமைப்பு, புனிதத்தளங்கள், துறைமுகங்கள், நில அமைப்பு, அரசியல், வருவாய் போக்குவரத்து, பாரம்பரியம், திட்டங்கள் முதயன பற்றி விவரச் சுவடி தாயாரிக்கும்பணி பல கட்டங்களை கடந்து 1968ல் கையெழுத்துபடியாக உருப்பெற்ற து. அதிலும் மாற்றங்கள் செய்யப்பட்டு 1972ல் வெளியிடப்பட்டது. அப்பொழுது முதலமைச்சராக இருந்தவர் மாண்புமிகு கலைஞர் கருணாநிதி அவர்கள். அவர்கள் இராமநாதபுர விவரச்சுவடிக்கு அளித்துள்ள முன்னுரை படித்து இன்புறுவதற்குரியது.

"நம் நாடு சுதந்திரம் அடைந்ததும் மாவட்ட விவரச்சுவடிகளைத் திருத்தியும், புதுக்கியூம் விரித்திட எழுத வேண்டியது இன்றியமையாததாகக் கருதப்பட்டது. எனவே அப்பணி ஐந்தாண்டுத் திட்டங்களில் அடங்கிய பண்பாட்டு நிகழ்ச்சிநிரல் சிறப்பிடம் பெற்றது.

இக்காலத்து விவரச்சுவடி ஒரு வழிகாட்டி ஏடு அல்லது தகவல் குறிப்பு மட்டுமன்று . அது ஏராளமான முக்கியமான தலைப்புகளை அடக்கிய மேற்கோள் நூலாகப் பயன்படத்தக்கது. ஒரு விவரச்சுவடிச் நமது பாரம்பரியத்தையும், தொன்மை நாகரிகத்தையும் புலப்டுத்தும் ஒளிவிளக்காகும். நமது சமுதாயத்தைப் படம்பிடித்துக் காட்டும் கண்ணாடி அதை படித்து வாழையடிவாழையாக நாம் வளர்ந்து வந்துள்ள பண்பாட்டை உணர்ந்து நாம் பெருமிதம்கொண்டு நம்பிக்கையுடன் வருங்காலத்தில் அடியெடுத்து வைக்கலாம். விவரச் சுவடிகளின் தேவை, காலம் செல்லச் செல்லத்தான் தெரியவரும். நாட்டையும், மக்களையும் இன்னும் நன்றாக நாம் தெரிந்துகொள்ளவும், புரிந்து கொள்ளவும் இந்த விவரச்சுவடிகள் துணை செய்கின்றன.

இராமநாதபுர மாவட்ட விவரச் சுவடியை வெளியிட்டிருப்தின் வாயிலாக இந்த மாவட்டத்தின் சமூக வரலாற்றை ஆய்வதற்கு பயனுடையதொரு பணி நிறை வேற்றப்பட்டிருக்கிறது. அது மிகவும் விரிவாக அமைந்திருப்பததோடு மாவட்டத்து

மக்களின் வாழ்க்கையின் குறிப்பிடத்தக்க, கூறுகளைப்பற்றி, விளக்கமான செய்திகள் தாங்கியதாகவும் உள்ளது. மாநிலத்தில் ஆட்சியாளர்களுக்கும், நலப்பணிகளிலும், ஆராய்ச்சி வேலைகளிலும் ஈடுபட்டிருப்பவர்களுக்கும் இந்த விவரச்சுவடி பெரிதும் பயன்படும் என்று நான் நம்புகிறேன்.

14-06-1972

மு. கருணாநிதி

இங்ஙனம் இலக்கியங்களும் வரலாறும் தற்கால அரசியல் தலைவர்களும்கூட ஏற்கும் வண்ணம் உள்ள வரலாற்று சான்றுகளை ஏற்று இராமசேதுவின் உண்மையையும் பெருமையையும் உணர்ந்து அதைப் பாதுகாக்கவேண்டிய அனைத்து நடவடிக்கைகளையும் எடுக்க வேண்டிய அவசியம் இருக்கிறது.

Rama Setu in sculptures (9th and 10th centuries CE)

Stone steles from the Ramayana wall carvings at Prambanan Temple, Java, Indonesia (built during the ninth and tenth centuries Common Era). Classical Javanese dance performances of the Ramayana are held seasonally at Prambanan temple. A 2006 earthquake in Central Java, however, caused considerable damage to the World Heritage Site.

Devi Sita talking to Sri Hanuman

Vaanara Sena carrying stones, in their arms and on their heads, to build Rama Setu, followed by Sri Rama, carrying a sword.

Fish and other sea creatures handling stones from Rama's bridge to Lanka, during the construction of Nala Setu (Rama Setu).

Source:
http://www.learnnc.org/lp/multimedia/2616

Prambanan (Brahma Vana) temple complex, Indonesia.

Tabing

(painting) depicting the *Bridge to Langka*, E74168 Local ochres, *kincu* (Chinese vermilion) and ink on bark cloth Gelgel, Bali, Indonesia, 1800-1850

http://www.amonline.net.au/collections/asia/forge.htm

Rama Setu in sculptures (Gupta period 6th cent., Prambanan, Java, 9th cent.)

"A still more eloquent proof of the high level of efficiency of civil engineering of the day is afforded by the construction of the Bridge across the ocean in Lanka (fig.93, 97,98). In building the bridges across this infinite depth and breadth in time, remarkable speed and dexterity must have been displayed by the Vanara forces. Engines or cranes were used for uprooting trees and crags and transporting them to the edge of the water. Sutras (measuring lines) were used by the builders to be sure that the rocks were laid out in a straight line. Dandas or measuring rods were also used. Small stones, grass, creepers and sticks (kaashtha) were used as building material. The Vanaras threw the huge tree first, then weighted them with rocks and used small stones, sticks, grass and creepers as materials for filling the crevices. The co-operation and co-ordination between the different workers was so perfect that within five days the marvelous structure stood complete and finished (VI.22.56-76). The vehicles used for carrying, and conveying, men and goods from one place to another were known as yaana (II.92.35)"

Shantikumar Nanooram Vyas, 1967, India in the Ramayana Age – a study of the social and cultural conditions in ancient India as described in Valmiki Ramayana, Delhi, Atma Ram and Sons, pp. 252-264)
Vanaras building the bridge to Lanka: Gupta, c. fifth-sixth century (Courtesy: Bharat Kala Bhawan, Varanasi)(After fig. 93)

Vanara army carrying blocks of rocks for building a bridge over the ocean; Prambanan, Java, ninth century (Dept. of Archaeology, Govt. of India)(After fig. 98)

Rama, Lakshmana and Sugriva with the vanara army march over the bridge to Lanka; Prambanan, Java, ninth century (Dept. of Archaeology, Govt. of India)

Arguments for Setubandha as a sacred monument

Many textual evidences, Asiatic researches, epigraphs prove Setubandha as a monument sacred in Bharatiya tradition.

Responsibility of Govt. of India to protect monuments, to protect Rama Setu

It will be a dereliction of responsibility and a violation of the law of the land, if the Govt. of India fails to protect Rama Setu which is an ancient monument. Article 49 of the Constitution of Bharat, that is India enjoins Protection of monuments and places and objects of national importance as a Directive Principle of State Policy.

The following sections of ASI's website describe the provisions of the AMASR Act, 1958. The evidences -- textual, epigraphic, scientific marine-archaeological explorations -- document Rama Setu (or, Setu bandha) as an ancient monument. A channel linking Tuticorin Port with Haldia can be designed without damaging this monument which is an object of national importance, indeed, a world heritage site with Ramayana episodes including the construction of Setu bandha by Nala venerated in many Ramayana's in many parts of the world.

Let not the Govt. of India act like the Taliban who demolished the Bamian Buddha. Development imperative or abhyudayam can co-exist with protection of monuments, places and objects of national and international importance. Let us hope that Govt. of India will see it fit to realign the Setusamudram Channel to avoid impacting on Ram Setu, the heritage which should be immediately declared as a protected monument under the AMASR Act, 1958. This is a solemn duty of the State of Bharatam.

[quote] Monuments

The Ancient Monuments and Archaeological Sites and Remains Act, 1958 defines an ' Ancient Monument ' as follows:-

Ancient Monument means any structure, erection or monument, or any tumulus or place of interment, or any cave, rock-sculpture, inscription or monolith which is of historical, archaeological or artistic interest and which has been in existence for not less than 100 years and includes—

1. Remains of an ancient monument,
2. Site of an ancient monument,
3. Such portion of land adjoining the site of an ancient monument as may be required for fencing or covering in or otherwise preserving such monument, a
4. The means of access to, and convenient inspection of, an ancient monument;

The section 2(d) defines archaeological site and remains as follows:

Archaeological site and remains means any area which contains or is reasonably believed to contain ruins or relics of historical or archaeological importance which have been in existence for not less than one hundred years, and includes—

1. Such portion of land adjoining the area as may be required for fencing or covering in or otherwise preserving it, and
2. The means of access to, and convenient inspection of the area;

Protection of monuments

The Archaeological Survey of India (ASI) under the provisions of the AMASR Act, 1958 protects monuments, sites and remains of national importance by giving a two-month's notice for inviting objections, if any in this regard.

After the specified two-month's period, and after scrutinizing the objections, if any, received in this regard, the ASI makes decision to bring a monument under its protection.

There are at present more than 3650 ancient monuments and archaeological sites and remains of national importance. These monuments belong to different periods, ranging from the prehistoric period to the colonial period and are located in different geographical settings. They include temples, mosques, tombs, churches, cemeteries, forts, palaces, step-wells, rock-cut caves, and secular architecture as well as ancient mounds and sites which represent the remains of ancient habitation.

These monuments and sites are maintained and preserved through various Circles of the ASI spread all over the country. The Circles look after the research on these monuments and conservation activities, while the Science Branch with its headquarters at Dehradun carries out chemical preservation and the Horticulture Branch with its headquarters at Agra is entrusted with the laying out gardens and environmental development. [unquote]

http://asi.nic.in/asi_monuments.asp

Glossary entry: Adam. …"Narrow ridge of sand and rocks mostly dry, nearly closing the Gulf of mannar on the north and north-east. Western extremity joins the eastern point of Rameshwaram island; eastern extremity joins the eastern point of Mannar island; with these two islands it almost connects Ceylon with peninsula. Called the bridge of Rama by Bramins, as along it Rama sided by Hanooman with his his host of monkeys marched when invading Ceylon. It really joined Ceylon to India until 1480, when a breach was made through rocks during a storm. A subsequent storm enlarged this and foot traffic then ceased…Partly above and partly below water; but when covered has now here above three or four feet of water… " (Source: CD Maclean (ed.), 1903, Manual of the Administration of the Madras Presidency, Vol. III, Glossary, Madras, Superintendent Government Press; repr. AES, 1983, New Delhi).

Save Rama Setu:
Appeal by Dr. S.R. Rao,
Founder of Marine Archaeology Society in India

Protection of Ram Sethu as Underwater Cultural Heritage

- S.R. Rao, President, Society for Marine Archaeology

Submerged sites and towns as well as ship-wrecks constitute a very important cultural heritage of mankind; which the UNESCO wants the states to explore, list and protect them under a UN convention approved by the U.N. The ICOMOS International committee on Underwater Cultural Heritage (ICUCH) consisting of underwater Archaeologists and others (of which I was a member), has defined "Underwater Cultural Heritage". The ILA's definition on underwater Cultural Heritage includes all underwater traces of human existence, which are of historical or cultural importance including sites, buildings, shipwrecks, together with their archaeological and natural context. The Ram Sethu comes under this category. It is referred to in the Epic Ramayana and in the Puranas. At the site known as Ram Sethu, the natural rock and the 'piles of stone' laid on it have been submerged with the rise in sea level over 5000 years or more. This rise of sea level was not confined to Dvaraka of Mahabharata period in Saurashtra. The under water exploration by Marine Archaeology Centre (MAC) of NIO Goa along west coast has revealed that the protohistoric ports of Somanath and Prabhasa were also submerged as is evident from the submerged channel way laid for bringing ships and the presence of anchors and mooring stones in it. In the Elephanta Island, the early historic brick structures of 1st Century B.C. to 3rd Century A.D. have been submerged. The Buddhist period port of Sopara is also submerged. On the east coast of India, traces of Poompuhar port town have been found in the sea as well as intertidal zone. The rock of Ram Sethu must have been in the then intertidal zone and some stones must have been piled up to enable the army to cross the sea easily. Over thousands of years small size stone blocks of bridge must have been transported by waves and currents. The frequent textual references to Ram Sethu are not to be dismissed as myths. Even submergence of Dvaraka was considered a myth until the submerged buildings were discovered.

The National Institute of Oceanography in cooperation with ASI should be asked to undertake the survey listing and protection of important underwater sites and shipwrecks. This work must be undertaken by the Government of India and State Governments as laid down in UN convention on Protection of Underwater Cultural Heritage. Ram Sethu must not be damaged but saved and protected.

The MAC had initiated certain steps for survey and listing of underwater cultural Heritage of India and even published a tentative map showing shipwreck sites and submerged parts. Before further damage is done by nature and man to this vast under water heritage of India, immediate survey and listing of sites with a brief note on each wreck or site should be done, giving highest priority to Ram Sethu.

MESSAGE

But for reasons of health I would have gladly participated in the International Seminar on Protection of Ram Sethu Movement at Chennai on the 12th May 2007.

I wish the Seminar all success and hope that the movement will gather momentum so that this unique underwater Cultural Heritage is saved and developed into a Tourist spot. An alternate route for ship movement may be considered by the Government

Bangalore
11-5-2007

Sd/-
S.R. Rao
Former Scientist Emeritus
President – Society for Marine
Archaeology in India

Rameswaram Ram Setu Protection Movement is privileged to publish this letter of 30 March 2007 from Dr. S.R. Rao addressed to Hon'ble Minister for Shipping and Transport, Govt. of India.

Dr. S.R. Rao is Former Advisor, Marine Archaeology Centre, National Institute of Oceanography, Goa, Member of UNESCO-sponsored International Committee for

Underwater Cultural Heritage (ICUCH) and President of Society for Marine Archaeology (Goa).

In this remarkable letter, Dr. SR Rao earnestly request the Hon'ble Union Minister to save the traditionally-known Rama Setu mentioned in various Puranas as a bridge built by the legendary Hero of Ramayana. He notes that it is of great emotional value as a sacred tirtha. He argues that both from marine archaeological and traditional points of view Rama Setu deserves to be declared as an UNDERWATER WORLD HERITAGE SITE.

Dr. Rao sites the archaeological and technological criteria for recommending Rama Setu to be a World Heritage site consistent with the criteria listed on page 77 of the Journal of Marine Archaeology 1997-98 for structures of archaeological as well as memorial significance (copy of the excerpt attached).

Dr. Rao requests the Hon'ble Union Minister to see that the cutting of the rock or any kind of damage to the rock is avoided and adds, "It is no less important than Swami Vivekananda Rock where a memorial is built. Alternate routes suggested by experts (vide Route 4 in Fig. 1 enclose) may kindly be considered in the interest of saving the Underwater Cultural Heritage of India namely Rama Setu or Adam's Bridge. My study of the submergence of Poompuhar shows that most of the ancient sites on east coast are being swallowed by the sea. The latest victim is the shore temple at Tarangambadi. During my two visits to Sri Lanka, as a member of the ICUCH I visited the Rama Setu site and had discussions with Commander Devendra Somasiri, another member of ICUCH from Sri Lanka about its importance as a Heritage site."

The copy of Dr. S.R. Rao's letter with attachments is reproduced below.

Dr. S.R. RAO
Former Advisor
Marine Archaelogy Centre
NATIONAL INSTITUTE OF OCEANOGRAPHY, Goa
Member, UNESCO-Sponsored
International Committee
For Underwater Cultural Heritage

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E-mail : ~~rao_s_r@hotmail.com~~
gsrs @ airtelbroadband.in

Date : 30-3-2007

To:
The Hon'ble Minister for
Shipping and Transport,
Government of India,
New Delhi

Sub : Preventing damage to the ancient Ram – Sethu.
(Adam's Bridge) and declaring it as "UNDERWATER WORLD HERITAGE" Site under the UNESCO CONVENTION.

Sir,

I, as President of the Society for Marine Archaeology, National Institute of Oceanography, Goa and also as a former elected member of the UNESCO-sponsored ICOMOS International Committee for Underwater Cultural Heritage, earnestly request you kindly to save the traditionally known Ram-Sethu mentioned in various Puranas, as a bridge built by the legendary Hero of Ramayana. This natural rock connecting the Mannar Island with Rameswaram island is now submerged in the sea owing to the rise in sea level during the last 4000 years or more but it was perhaps in the Intertidal zone and not unlikely to have been further raised by piling up of rubble to enable Rama's followers to reach Lanka. Hence it is of great emotional value as a sacred tirtha. But as a marine archaeologist, I feel it is of great historical importance too. We found at Dwarka a natural rock was dressed suitably as a wharf for berthing ships about 3600 years ago. Similarly rock (Adam's Bridge) connecting Mannar and Rameswaram must have been used by piling up rubble manually on it to enable the Vanaras to reach Lanka. For the ancient marine engineers who could build a tidal dock at Lothal in 2300 B.C. and modify a ridge for berthing ships at Dwarka, the piling up of stones on the so called Adam's bridge for an army to reach Lanka was on easy task. Hence both from marine archaeological and traditional points of view

Dr. S.R. RAO
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Rama-Sethu deserves to be declared as an UNDERWATER WORLD HERITAGE SITE. I cite below the archaeological and technological criteria for recommending Rama-Sethu to be a World Heritage site are as per the annexure I (p.77 of the Journal of Marine Archaeology 1997-98 published by marine Archaeology Society – Copy enclosed), which includes structures of archeological as well as memorial significance.

Sir, I would request you kindly to see that the cutting of the rock or any kind of damage to the rock is avoided. It is no less important than Swami Vivekananda Rock where a memorial is built. Alternate routes suggested by experts (vide Route 4 in Fig.1 enclosed) may kindly be considered in the interest of saving the Underwater Cultural Heritage of India namely Rama Sethu or Adam's Bridge. My study of the submergence of Poomphar shows that most of the ancient sites on east cost are being swallowed by the sea. The latest victim is the shore temple at Tarangambadi.

During my two visits to Sri Lanka, as a member of the ICUCH I visited the Ram Sethu site and had discussions with Commander Devendra Somasiri, another member of ICUCH from Sri Lanka about its importance as a Heritage site.

With highest regards,

Yours sincerely,

Dr. S.R. Rao
President,
Society for Marine Archaeology (GOA).

Copy to Sri. S. Kalyan Raman

Encl : 2

text requires discussion as to which principles are legally binding between States. Accordingly, the Secretariat was asked to study different approaches to selecting the particular principles that would be incorporated into the legally binding text of the general Convention.

VII. CLOSURE OF THE MEETING

67. The Chairperson thanked all the experts and observers for their co-operation and their many contributions to the work of the meeting, and declared the meeting closed.

ANNEXES

ANNEX 1

Submission to Unesco by The National Maritime Museum, Greenwich, London (March 1996).

2. Comments on the ILA/UNESCO draft

2.1 Definition of underwater cultural heritage

The ILA draft Convention defines underwater cultural heritage as all underwater traces of human existence including: (a) sites, structures, buildings, artifacts and human remains, together with their archaeological and natural contexts: and (b) wrecks such as a vessel, aircraft, other vehicle or any part thereof, its cargo or other contents, together with its archaeological and natural context. The Convention is to protect underwater cultural property at least 100 years old and States can opt to protect more recent property.

There is some feeling that this definition is too broad and inclusive. It was questioned whether all underwater remains of human existence should receive protection unless they are or may prove to be of historical or cultural importance.

However, a definition which depends on judgements of importance or significance (distinguishing underwater cultural heritage from the generally of underwater cultural property) would need to be supported by detailed criteria, taking into account the potential historical, archaeological, artistitic, scientific, ethnographic and memorial significance of underwater cultural property. Such criteria have not yet been formulated for underwater sites although models exist for land sites.

ANNEX 2

ILA Draft

Article 2: Scope of the Convention

1. This Convention applies to underwater cultural heritage which has been lost or abandoned and is submerged underwater for at least 100 years. Any State Party may, however, protect underwater cultural heritage which has been submerged underwater for less than 100 years.

ANNEX 3

UNCLOS (United Nations Convention on the Law of the Sea)

PART II. TERRITORIAL SEA AND CONTIGUOUS ZONE,

SECTION 3, INNOCENT PASSAGE IN THE TERRITORIAL SEA,

SUBSECTION C, RULES APPLICABLE TO WARSHIPS AND OTHER GOVERNMENT SHIPS OPERATED FOR NON-COMMERCIAL PURPOSES

Article 29: Definition of warships

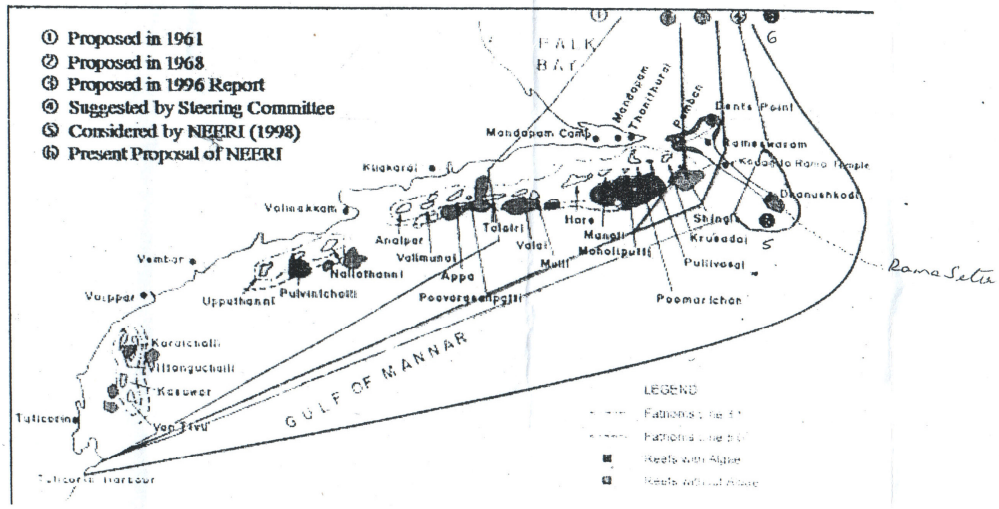
For the purposes of this Convention, "warships" means a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and manned by a crew which is under regular armed forces discipline.

ANNEX 4

International Convention on Salvage

Article 4: State-owned vessels

1. Without prejudice to article 5, this Convention shall not apply to warships or



Note : 1. We have <u>No Objection</u> for Alignment Number 1,2 & 4.
2. <u>We object</u> alignment Number 3 because it uproots Lord Kodhanda Rama Temple.
3. <u>We object</u> alignment 5 & 6 because it cuts Rama Sethu (Adams Bridge).
4. We Suggest alignment number 4 because it is a vast stretch of waste land available between Kodhanda Rama Temple and Dhanushkodi.

Rama Setu protection: responsibility of the state and citizens

Mahabharata is the sheet anchor of Bharatiya itihaasa. This text notes that mountain-like Nala Setu (Setu bandha) is sustained out of respect for Sri Rama's aajna (command).

It is the responsibility of the state and all citizens to respect this command of vigrahavaan dharmah and to protect the Setu made by Nala.

> nalasetur iti khyāto yo 'dyāpi **prathito bhuvi** rāmasyājñāṃ puraskṛtya dhāryate girisaṃnibhaḥ *MBh.* 3.267.45
> .... which even today, popular on earth as Nala's bridge, mountain-like, is sustained out of respect for [Lord] Rama's command. (Nala was son of Vis'wakarma)

In the aranyaparva of Mahabharata, the account of the construction of Setu bandha (Nala Setu) is recounted by Rishi Markandeya in his conversation with Yudhishthira in Ramopa_khya_nam of 20 chapters:

...And that mighty army, protected by Nala and Nila and Angada and Kratha and Mainda and Dwivida, marched forth for achieving the purpose of Raghava. And encamping successively, without interruption of any kind, on wide and healthy tracts and valleys abounding with fruits and roots and water and honey and meat, the vanaras at last reached the shores of the briny sea.

And like unto a second ocean, that mighty army with its countless colours, having reached the shores of the sea, took up its abode there. Then the illustrious son of Dasaratha, addressing Sugriva amongst all those foremost vanaras, spoke unto him these words that were suited to the occasion, 'This army is large. The ocean also is difficult to cross. What way, therefore, commends itself to thee for crossing the ocean?'

At these words, many vain-glorious vanaras answered, 'We are fully able to cross the sea.' This answer, however, was not of much use, as all could not avail of its meaning. Then, some of the vanaras proposed to cross the sea in boats, and some in rafts of various kinds.

Rama, however, conciliating them all, said, 'This cannot be. 'The sea here is a full hundred Yojanas in width. All the vanaras, ye heroes, will not be able to cross it. This proposal, therefore, that ye have made, is not consonant to reason. Besides we have not the number of boats necessary for carrying all our troops. How, again, can one like us raise such obstacles in the way of the merchants? Our army is very large. The foe wilt make a great havoc if a hole is detected. Therefore, to cross the sea in boats and rafts doth not recommend itself to me. I will, however, pray to the Ocean for the necessary means. Foregoing food, I will lie down on the shore. He will certainly show himself to me. If, however, he doth not show himself, I will chastise him then by means of my great weapons that are more blazing than fire itself and are incapable of being baffled!'

Having said these words, both Rama and Lakshmana touched water and duly laid themselves down on a bed of kusa grass on the seashore. The divine and illustrious

Ocean, that lord of male and female rivers surrounded by aquatic animals, then appeared unto Rama in a vision. And addressing Rama in sweet accents, the genius of the Ocean, surrounded by countless mines of gems, said, 'O son of Kausalya, tell me what aid, O bull among men, I am to render thee! I also have sprung from the race of Ikshwaku and am, therefore, a relative of thine!'

Rama replied unto him, saying, 'O lord of rivers, male and female, I desire thee to grant me a way for my troops, passing along which I may slay the Ten-headed (Ravana), that wretch of Pulastya's race! If thou dost not grant the way I beg of thee, I will then dry thee up by means of my celestial arrows inspired with mantras!'

And hearing these words of Rama, the genius of Varuna's abode, joining his hands, answered in great affliction, 'I do not desire to put any obstacle in thy way. I am no foe of thine! Listen, O Rama, to these words, and having listened, do what is proper! If, at thy command, I get a way for the passage of thy army, others then, from strength of their bows, will command me to do the same!

In thy army there is a Vanara of the name of Nala, who is a skilled engineer. And endued with great strength, Nala is the son of Tashtri, the divine artificer of the Universe. And whether it is wood, or grass or stone, that he will throw into my waters, I will support the same on my seabed, and thus wilt thou have a bridge over me, through which to reach Lanka!'

And having said these words, the genius of the Ocean disappeared. And Rama awaking, called Nala unto him and said, 'Build thou a bridge over the sea! Thou alone, I am sure, art able to do it!'

And it was by this means that the descendant of Kakutstha's race caused a bridge to be built that was ten Yojanas in width and a hundred Yojanas in length. And to this day that bridge is celebrated over all the world by the name of Nala's bridge.

http://ramasetu.blogspot.com/2007/03/setu-in-mahabharat.html

Setu Bandhan/Bridging the Ocean

1932, India, 35mm on DVD, b/w, sound, 9 min.

Lord Rama and his army of apes and other creatures attempt to cross the sea to reach Lanka - the domain of Ravana - to rescue the abducted Sita. To do so a bridge of pebbles and stones is built by squirrels, and Sita is rescued.

Interestingly this was the beginning of the era of the talkies, and Phalke was unaware that Alam Ara the first talkie was being made. Originally shot as a silent film and post-synchronised with sound, Setu Bandhan is a metaphor for the bridge between the silent and the talkie era.

http://www.em-arts.org/edition_06/films_06/setubandhan.html

What did Hon'ble Mu. Karunanidhi say about cultural significance of Ramar Paalam?

Excerpts from an article of April 13, 2007 by Rama. Nambinarayanan

இராமநாதபுரம் மாவட்ட விவரச் சுவடி கூறுவது என்ன?

" மக்களுடைய சமூக, அரசியல், பொருளாதார, பண்பாட்டு வாழ்க்கை பற்றி அறிய விரும்பும் ஆட்சியாளர்களுக்கும் அறிஞர்களுக்கும் பொது மக்களுக்கும் பயன்படத்தக்க, மிக நம்பகமான தகவல் களஞ்சியமாக இருப்பவை மாவட்டவாரியாக எழுதித் தொகுக்கப் பெற்றுள்ள விவரச் சுவடிகளே.

... இராமநாதபுர மாவட்ட விவரச் சுவடியை வெளியிட்டிருப்பதன் வாயிலாக, இம் மாவட்டத்தின் சமூக வரலாற்றை ஆராய்வதற்குப் பயனுடையதொரு பணி நிறைவேற்றப்பட்டிருக்கிறது. அது மிகவும் விரிவாக அமைந்திருப்பதோடு, மாவட்டத்து மக்களின் வாழ்க்கையின் குறிப்பிடத்தக்க கூறுகளைப் பற்றி விளக்கமான செய்திகள் தாங்கியதாகவும் உள்ளது. மாநிலத்தில் ஆட்சியாளர்களுக்கும், நலப்பணிகளிலும் ஆராய்ச்சி வேலைகளிலும் ஈடுபட்டிருப்பவர்களுக்கும் இந்த விவரச் சுவடி பெரிதும் பயன்படும் என்று நான் நம்புகிறேன்."

இப்படி தமிழக முதல்வர் திரு. மு. கருணாநிதி அவர்களால் 14.6.72 அன்று முகவுரை எழுதப்பட்டு தமிழக அரசினால் வெளியிடப்பட்ட இராமநாதபுரம் மாவட்ட விவரச் சுவடியில் சேது பாலத்தைப் பற்றி தெரிவிக்கப்பட்டுள்ள தகவல்கள்:
" ஆதாம் பாலம் - ஆதாம் பாலம் என்ற பெயர் இசலாமிய மரபை நினைவூட்டுகிறது. சொர்கலோகத்திலிருந்து விரட்டப்பட்ட ஆதாம் இந்தப் பாலத்தின் வழியாக இலங்கைக்கே நடந்தாராம். வடமொழியில் இது நள சேது என்றும் தமிழில் திருவணை என்றும் சொல்லப்படுகிறது. இராமசேது என்றும் சொல்லுவர். ஆதிசேது என்ற பெயரும் உண்டு.

இது மதுரையிலிருந்து கிழக்கு தென் கிழக்குத் திக்கில் 110 மைலிலும், இராமநாதபுரத்திலிருந்து அதே திக்கில் 43 மைலிலும் இருக்கிறது. இராமேஸ்வரத்திலிருந்து இது கிழக்கே 15½ மைல். இது மணலும் பாறையும் கலந்த பாலம். இதனுடைய மேற்குக் கோடி இராமேஸ்வரம் தீவுடனும், கிழக்குக் கோடி மன்னார் தீவுடனும் சேருகிறது. இந்த இரண்டு தீவுகளுடனும் சேர்ந்து, அது இலங்கையையும் இந்தியாவையும் இணைக்கிறது. அனுமாரின் தலைமையில் அமைந்து குரங்குப் படையின் துணையுடன் இராமர் இலங்கையைப் படையெடுத்ததால் இதை இராமர் பாலம் என்று சொல்லுகிறார்கள். 1480 வரை இந்தப் பாலம் இலங்கையை இணைத்தது. பிறகு ஒரு கடும்புயல் ஏற்பட்டு, இடைவெளி 30 மைல் நீளமாகவும் 1¼ மைல் அகலமாகவும் ஆயிற்று. இது தென்கிழக்கிலிருந்து வடமேற்கு வரை செல்லுகிறது. இந்த மணற்பாலம் சில

இடங்களில் தண்ணீருக்கு மேலும் வேறு சில இடங்களில் தண்ணீருக்க கீழும் உள்ளது. மூடியிருக்கும்போது தண்ணீரின் ஆழம் 3 அல்லது 4 அடி. மணல் திட்டுகள் மாறிக் கொண்டே போகின்றன. அவற்றுக்கிடையே வாய்க்கால்களும் உள்ளன. தென்மேற்கு பருவகாலதத்தில் கடுமையான கொந்தளிப்பு ஆதாம் பாலத்தைத் தாக்குகிறது. இந்தியாவில் கிழக்கு, மேற்குக் கரைகளிடையே செல்லுவதற்கு உரிய தொலைவைக் குறைக்க ஆதாம் பாலத்தின் குறுக்கே ஒரு கால்வாய் வெட்டி மன்னார் குடாவையும் பாக் குடாவையும் இணைக்க வேண்டும் என்ற திட்டம் யோசனையில் இருந்து வருகிறது."
- சுதேசி செய்தி, மார்ச் 2007

Translation:
What does Ramanathapuram District Gazetteer say?

"To those policy-makers, scholars and public interested in ascertaining authentic and reliable information related to social, political, economic, and traditional lives, this district-wise gazetteer has been compiled as an encyclopaedic reference…By publishing this Ramanathapuram District Gazetteer, a means will be provided for researches on this district's social history. This is exhaustive and detailed and provides significant historical details about the lives of the people of this district. I believe that this encyclopaedic documentation will be of immense help t.To the State administrators, and to those engaged in social service and research." This is how Hon'ble Chief Minister Shri Mu. Karunanidhi writes on 14 June 1972 in the Preface of the document published by Tamilnadu Government. In this document, the details provided about Setu bridge (Setu Paalam) are: " Adam's Bridge. Adam's Bridge is a name which evokes Islamic traditions. Adam banished .from heaven, traveled walking on this bridge to reach Srilanka.This is also referred to as Nala Setu and as Tiruvan.ai (Sacred dam) in Tamil. This is also referred to as Rama Setu. There is also another name called Adi Setu.

"This bridge is 110 miles east-south-east of Madurai, 43 miles along the same direction from Ramanathapuram. The bridge is 15.5 miles east of Rameswaram. This bridge is composed of sand and stone. The western edge of this bridge links with Rameswaram and eastern end links with the island of Mannar. Bridging these two islands (of Rameswaram and of Mannar), this bridge links Srilanka and India. This is called Ramar Paalam because this bridge was built under the leadership of Hanuman and with the participation of Vaanara Sena (Kuranguppadai) and facilitated the crossing by Rama to reach Srilanka and to attain victory. Upto 1480, this bridge had served as a land bridge to Srilanka. Thereafter, a severe cyclone created fissures changing the dimensions to 30 miles long and 1.25 miles wide. This stretches from south-east to north-west. This sand bridge (of shoals) is seen above the ocean waters in some places and below the ocean waters in some other places. When submerged, the depth of the ocean-waters is 3 or 4 feet. The sand shoals keep shifting. There are also canals interspersed. During the south-west monsoon season, severe ocean currents and surges impact on the Adam's Bridge. A project is under planning to link the west-coast harbours with east-coast harbours with a view to reducing the navigational distance by creating a channel across the Adam's Bridge and linking Gulf of Mannar and Palk Straits." – Sudesi News, March 2007.

ராமர் பாலத்தை இடிக்க முயற்சி

ஜனாதிபதி, பிரதமர் தலையிட கோரிக்கை

ஜெயலலிதா அறிக்கை

சென்னை, மே. 2:

நமது புராதன சின்னமான ராமர் பாலத்தை இடிக்கும் முயற்சியை தடுத்து நிறுத்த வேண்டுமென்று ஜனாதிபதி, பிரதமர் ஆகியோருக்கு அதிமுக பொதுச் செயலாளர் ஜெய லலிதா வேண்டுகோள் விடுத்திருக் கிறார். மத்திய அரசு இதில் தலையிட்டு நடவடிக்கை எடுக்காவிட்டால் அதிமுக சட்ட ரீதியான நடவடிக்கையை எடுக்கும் என்றும் அவர் கூறியிருக் கிறார். சொந்த ஆதாயங்களுக்காக இத்தகைய பழமையான சின்னத்தை அழிக்கக் கூடிய நெஞ்சழுத்தம், மமதை ஆகியவை திமுகவினரை தவிர வேறு யாருக்கும் வராது என்று கடுமையாக விமர்சித் திருக்கிறார்.

ஜெயலலிதா விடுத்துள்ள அறிக்கை ஒன்றில் கூறியிருப்பதாவது: நம்நாட்டின் புகழ்பெற்ற இதிகாச காவியம் ராமாயணம். ராமர் பாலம் உள்ளது என்ற இதிகாச உண்மையை நாசா ஆராய்ச்சி மையம் உறுதி செய்து செயற்கைகோள் மூலம் எடுக்கப்பட்ட படத்தையும் வெளியிட்டுள்ளது. ராமர் காலம் 17,50,000 ஆண்டுகள் பழமையானது என்றும் நாசா கூறியுள்ளது. நாம் இந்த பாலத்தை ராமர் பாலம் என்று அழைக்கின்றோம்.

ஆங்கிலேயர்கள் இதனை ஆடம்ஸ் பிரிட்ஜ் என்று அழைக்கிறார்கள். ஆக இதன் உண்மையை நாசாவே துல்லியமான புகைப்படங்கள் மூலம் உறுதி செய்திருக்கிறது. ஆங்கிலேய ஆட்சியாளர்கள் உருவாக்கிய வரை படங்களிலும், சர்வே டிபார்ட்மென்ட் வரைபடங்களிலும் இந்தப் பாலம் இருப்பது உறுதி செய்யப்பட்டுள்ளது. ராமேஸ்வரம், தனுஷ்கோடிக்கு பிறகு இலங்கை வரை உள்ள கடல் பகுதியில் புள்ளிகள் இடப்பட்டு ஆடம்ஸ் பிரிட்ஜ் என்று எழுதப்பட்டு இருப்பதை தேசப் படத்தில் இன்றும் காணலாம்.

மிகப் பழமையான இந்தப் பாலம் பல யுகங்களாக இருந்து வருகிறது. உலகத்தின் புராதன சிலைகள், பொக்கிஷங்கள் என்று இப்படிப்பட்ட பழமையான சின்னங்களை (உலக பாரம்பரிய தலம்) என்று வகைப் படுத்தி உலகம் முழுவதும் பாது காக்கப்பட்டு வருகின்றன. இந்தியா வில் தான் இத்தகைய பழமை வாய்ந்த ராமர் பாலம் உள்ளது. வருங்கால சந்ததியினர் தெரிந்து கொள்ளும் வகையில் இந்தியாவில் உள்ள மிகப் பழமையான ராமர் பாலத்தை பாதுகாக்க வேண்டியது நம் அனை வரின் கடமை.

சொந்த பொருளாதார ஆதாயங்களுக்கு ஆசைப்பட்டு இப்படிப்பட்ட பழமை யான புராதன சி ன்னத்தை அழிக்கக் கூடிய நெஞ்சழுத்தம், ஆணவம், மமதை, திமிர் ஆகியவை திமுகவினரைத் தவிர வேறு யாருக்கும் வராது. சேது சமுத்திர கால்வாய்த் திட்டத்தை நிறைவேற்றி ஒப்பந் தக்காரர்களிட மிருந்து ஆயிரக்கணக்கான கோடி ரூபாய் கமிஷன் பெற வேண்டும் என்ற சுயநலப் பேரசை யில், போற்றி பாது காக்கப்பட வேண்டிய ராமர் பாலத்தை கருணாநிதியின் திமுக கும்பல் இடிக்க முற்பட்டுள்ளது. அதிமுகவும், பிஜேபி யும் மற்ற கட்சித் தலைவர்களும், பிற கட்சிகளும், பொதுமக்களும் இவ்வகை செயலுக்கு கடும் எதிர்ப்பு தெரிவித்துள்ளனர்.

இவ்வளவு எதிர்ப்பையும் மீறி டி.ஆர்.பாலு பணத்தாசையால் நாசா ஆராய்ச்சி மையம் ராமர் பாலம் உளளது என்று உறுதிப்படுத்தியதை மறுக்கிறார். இவ்வகை பாலமே இல்லை என்று பொய் சொல்கிறார். இருப்பதையே இல்லை என்று இவ்வளவு பெரிய பொய்யை சொல்ல, உலக மகா பொய்யர் கருணாநிதியின் சிஷ்யராகிய பாலு வுக்குத்தான் இவ்வளவு துணிச்சல் வரும். திமுகவினரைத் தவிர வேறு யாருக்கும் இந்த துணிச்சல் வராது.

இதோடு நில்லாமல் ராமர் பாலம் இல்லை என்று தான் சொன்னதை உண்மையாக்கிவிட வேண்டும் என்ற முயற்சியில், அரிய வரலாற்று ஆவணங்களை சேகரித்து வைத்துள்ள உலக பிரசித்தி பெற்ற சரஸ்வதி மகால் நூலகத்திற்கு டி.ஆர்.பாலு 30.4.2007 அன்று சென்று ராமர் பாலம் குறித்த வரலாற்று தகவல்களை அடியோடு அழிக்கும் முயற்சியில் ஈடுபட்டதாக தொலைக்காட்சி மற்றும் பத்திரிகை செய்திகள் மூலம் தெரிய வருகிறது.

அங்கு பணிபுரியும் அதிகாரிகளையும் இது குறித்து டி.ஆர்.பாலு மிரட்டிய தாக தெரிகிறது. இது மன்னிக்க முடியாத ஒரு கொடும் செயலாகும். மத்திய அமைச்சராக இருப்பவர் இதுபற்றி தகவல் வேண்டும் என்று கேட்டாலே அந்த நூலகத்து அதிகாரி கள் அது குறித்த எல்லா விவரங் களையும் கொடுத்து விடுவார்கள். ஆனால், காவல் துறைக்குக் கூட தகவல் தெரிவிக்காமல் ரகசியமாக டி.ஆர்.பாலு அந்த நூலகத்திற்கு சென்று சுமார் நான்கு மணி நேரம் இது குறித்து ''ஆலோசனை'' செய்த இருப்பதை பார்த்தால், இவர் விவரங்களை சேகரிக்க சென்றதாக தெரியவில்லை. இருக்கின்ற ஆதாரங் களை அழிக்க முற்பட்டதாகத்தான் தெரிகிறது.

இதற்கு முன் டி.ஆர்.பாலு தன் வாழ்நாளில் இதுவரை எந்த நூலகத்திற்கும் சென்றதாக எந்தத் தகவலும் இல்லை. திடீரென்று முதன் முதலாக நூலகத்திற்குள் காலடி வைத்திருப்பது நல்ல காரியத்திற்காக இல்லை என்பது தெளிவு. வாழ்நாள் முழுவதும் கடைபிடித்த நுலக புறக்கணிப்பு பழக்கத்தை தொடர்ந்து டி.ஆர்.பாலு கடைப்பிடிப்பது நல்லது. ஒரு சிலர் திடீரென்று சில நல்ல பழக்கத்தை ஆரம்பிப்பது கூட எவ்வளவு ஆபத்தானது என்பது இதன் மூலம் தெரிய வருகின்றது.

இடிக்கப்பட்ட பாலத்தின் கற்கள் அக்வேரியஸ் என்ற கப்பலின் மூலம் ரகசியமாக எடுத்து செல்லப்படும் காட்சிகள் தொலைக்காட்சிகள் மூலம் வெளியாகியுள்ளன. குடியரசுத் தலை வரும், பாரதப் பிரதமரும் உடனடியாக இதில் தலையிட்டு ராமர் பாலம் மேலும் இடிக்கப்படுவதை நிறுத்து வதற்கு நடவடிக்கை எடுக்க வேண் டும் என்று கேட்டுக் கொள்கிறேன். இது குறித்து உடனடியாக நடவடிக்கை எடுக்கா விட்டால், இதற்கான சட்ட ரீதியான நடவடிக் கைகளை அதிமுக எடுக்கும் என்ப தைத் தெரிவித்துக் கொள்கிறேன். இவ்வாறு அவர் கூறி இருக்கிறார்.

http://www.maalaisudar.com/0205/hed_news_2.shtml

Baalu bluffing on Ramar bridge: Jaya

NT Bureau
Chennai, May 2:

AIADMK general secretary J Jayalalithaa today accused Union Minister for Shipping and Surface Transport T R Baalu of bluffing and trying to hide the truth on the Ramar bridge issue.

In a strongly worded statement here, Jayalalithaa said NASA, the American space agency had corroborated the existence of Ramar Bridge mentioned in

Ramayana, by its satellite pictures. It has also made it clear that the bridge was 17,50,000 years old. 'The Britishers called it the Adambs bridge and the fact that a bridge existed was contained in the survey department records made during the English rule. It is the duty of us all to protect such an ancient heritage symbol and pass it on to the future generations,' the AIADMK chief said and alleged that the DMK had ventured to destroy this ancient monument for 'selfish monetary considerations'.

The AIADMK, BJP and leaders of several other political parties, besides the general public, have strongly objected to the demolition of Ramar bridge. 'Despite evidences, Baalu is denying the existence of Ramar bridge and is lying that such a structure was never there,' Jayalalithaa said.

She also alleged that in an effort to make true his theory that there was no bridge, the Union Minister had gone to the Saraswathi Mahal library at Thanjavur. 'It appears that he had tried to destroy old documents related to the existence of the Ramar bridge and had also intimidated officials of the library,' the AIADMK chief alleged and added that it was an unpardonable act.

Television channels have also shown images of stones of the Ramar bridge being taken away stealthily in a ship.

The leader of the opposition also appealed to the President and Prime Minster to immediately stop further damage to the ancient Ramar bridge.

'If no action is taken immediately, the AIADMK would take legal steps to halt the destruction of Ramar bridge,' Jayalalithaa said.

http://newstodaynet.com/02may/ld4.htm

U.S. court backs Indian tribe on sacred mountain

By Adam Tanner

Here's how a US court deals with desiccation of a sacred mountain in USA:

http://www.signonsandiego.com/news/nation/20070312-1046-environment-navajos.html

REUTERS 10:46 a.m. March 12, 2007

SAN FRANCISCO – An Arizona ski resort's plan to use treated sewage to make snow on a mountain sacred to several Native American tribes violates religious freedom laws, a U.S federal appeals court ruled Monday.

"We hold that the Forest Service's approval of the proposed expansion of the Snowbowl, including the use of treated sewage effluent to make artificial snow, violates RFRA," a three-judge panel of the 9th U.S. Circuit Court of Appeals wrote.

The Religious Freedom Restoration Act, or RFRA, holds that the federal government may not "substantially burden a person's exercise of religion."

The dispute is one of the most prominent in recent years pitting the religious beliefs of American Indians against local economic interests.

According to the Navajo Nation, the San Francisco Peaks are sacred to more than 13 Native American nations.

"They walked all over our dignity," Navajo Nation President Joe Shirley Jr. said in 2005. "You're committing genocide; you're demeaning us." The Arizona Snowbowl ski resort, 150 miles north of Phoenix, wanted to use artificial snow to enable skiing throughout the winter and says the move in the San Francisco Peaks is crucial to its economic survival.

Organized skiing started at Snowbowl in 1938, but has depended on highly variable natural snowfall rather than using artificial snow as at many U.S. resorts. In many years, enthusiasts can ski for more than 100 days a year, although in the especially poor 2001-2 season there were only four days when skiing was possible.

Last year, a U.S. District Court judge backed the plans to allow a $25 million upgrade on the 777-acre facility on federal forest land to include the use of treated sewage water.

The Navajo Nation, which has an estimated 300,000 tribal members in Arizona, New Mexico and Utah, joined several other tribes and environmental groups to fight the decision.

The appeals court decision described the religious significance of the Peaks to the Navajos, Hopi, Hualapai, Havasupai tribes, among others, and how sewage is treated to make reclaimed water.

"The record supports the conclusion that the proposed use of treated sewage effluent on the San Francisco Peaks would impose a burden on the religious exercise of all four tribes discussed above – the Navajo, the Hopi, the Hualapai, and the Havasupai," wrote Judge William Fletcher.

"We are unwilling to hold that authorizing the use of artificial snow at an already functioning commercial ski area in order to expand and improve its facilities, as well as to extend its ski season in dry years, is a governmental interest 'of the highest order."

Landmark Ruling Celebrated as a Victory for Religious Freedom, Environmental Justice & Cultural Survival

March 15th, 2007

Flagstaff, AZ —On Monday, March 12th the 9th Circuit Court of Appeals issued its ruling to protect a mountain held holy by more than 13 Native American Nations. The slopes of the San Francisco Peaks, located in Northern Arizona, have been at the center of a historical and lengthy battle that has pitted economic interests on public lands against environmental integrity, public health and cultural survival..A local ski resort planned to expand and use treated waste effluent to make snow.

Yesterday, a federal court appeals panel issued the unanimous decision written by Judge William A. Fletcher. "We reverse the decision of the district court in part. We hold that the Forest Service's approval of the Snowbowl's use of recycled sewage effluent to make artificial snow on the San Francisco Peaks violates [Religious Freedom Restoration Act] RFRA, and that in one respect the Final Environmental Impact Statement prepared in this case does not comply with NEPA [National Environmental Policy Act]."

More than 100 supporters gathered at an afternoon press conference near the base of the Sacred Peaks to celebrate. Tribal Leaders, Environmental Groups and representatives of the community based group the Save the Peaks Coalition spoke of the victory.

"This is a very important decision that sets great precedent for people who are concerned with Native American rights and religious freedom" said Howard Shanker, of the Shanker Law Firm, PLC, representing the Navajo Nation, the White Mountain Apache Tribe, the Yavapai-Apache Tribe, the Havasupai Tribe, Rex Tilousi, Dianna Uqualla, the Sierra Club, the Center for Biological Diversity, and the Flagstaff Activist Network.

"Because of this decision in the 9th circuit, other tribes throughout the nation could have the ability to rely on this case to help protect sites that are sacred to them and culturally and religiously important" Mr. Shanker said.

Mr. Shanker stated "the other thing that this court recognized in this decision which is important for all of us in Arizona is the fact that A+ treated water is not potable water. You can't drink it."

The 64 page ruling also states, "If Appellants do not have a valid RFRA claim in this case, we are unable to see how any Native American plaintiff can ever have a successful RFRA claim based on beliefs and practices tied to land that they hold sacred."

Ben Navumsa, Chairman of the Hopi Tribe stated, "The Hopi Tribe is immensely gratified by the 9th circuit decision, which explicitly recognizes the Hopi Tribes deep spiritual, traditional and cultural connection to the SF peaks which we call Nuvatukaovi."

"The making of snow with sewage on the home of the Kachinas was a dire threat to the centuries old link between Kachina, Nuvatukaovi and the Hopi. The 9th Circuit Decision recognizes the importance of the Hopi's bond to the mountain and protects that bond. In so doing, the decision of the court ensures Hopi people's ability to continue their way of life." stated Hopi Chairman Mr. Navumsa.

Jamie Fulmer, Chairman of the Yavapai Apache tribe stated, "We are gratified to learn that the appeal has been won. The San Francisco Peaks are a sacred mountain to us as we testified during the appeals hearing. We are honored to know that our native voice is still heard."

"This decision by the federal appeals court tells us that even in the current environment of development at all costs the United States appeals process stands for justice and the American justice system is capable of doing what is right when the facts are fully known. This is not just a victory for our elders and tribal traditions, but for all people of faith across the country. This confirms to us that when a few stand up for what is right everyone benefits." Mr. Fulmer stated.

Navajo Nation President Joe Shirley Jr. stated, "What I think this ultimately means is that it goes towards that, preserving our way of life, preserving my prayer, my sacred song, my sacred sites, my mother – the San Francisco Peaks. Years have been added to my life. I can't express how happy I am. As a people, we're elated."

Judge William A. Fletcher states, "We are unwilling to hold that authorizing the use of artificial snow at an already functioning commercial ski area in order to expand and improve its facilities, as well as to extend its ski season in dry years, is a governmental interest 'of the highest order.'"

Rudy Preston of the Flagstaff Activist Network stated, "Snowbowl tried to push for too much. We knew that the lower court ruling was wrong and we are grateful that the 9th Circuit recognized that too. We have no intentions of closing down the ski area, if Snowbowl can't manage their resort than maybe they're in the wrong business."

"Snowbowl's economic arguments have been completely shattered. The court decision clearly states that Snowbowl will not go out of business if it continues to rely on natural snow. The courts and the Forest Service EIS and the Courts recognized that the ski area is not a significant driver of the winter economy of the small city of Flagstaff" stated Mr. Preston.

Klee Benally, a volunteer with the Save the Peaks Coalition said, "This has been a struggle that has created painful division in our community. The actions of the Forest Service and Snowbowl have created many wounds, but today we can say lets let the wounds heal. We recognize this ruling upholds human rights that we have been denied for too long. We urge Snowbowl and the Forest Service to respect the ruling that has been issued by the 9th Circuit Court and not appeal."

The Appeals Court decision states that the Supreme Court has repeatedly held that the constitution "affirmatively mandates accommodation, not merely tolerance, of all religions, and forbids hostility toward any..declining to authorize the use of treated sewage effluent.is a permitted accommodation to avoid 'callous indifference.'"

The decision also poignantly illustrates the unmet environmental need as mandated by the National Environmental Protection Act (NEPA). The Forest Service "does not address as an environmental impact the risk to human health from the possible ingestion of artificial snow made from treated sewage effluent."

Many of the speakers at the press conference acknowledged that there are many threatened sacred sites throughout this country.

Coconino High School student Alberta Nells of the Youth of the Peaks stated, "This mountain is our mother, she is our grandparent and we're the children, the grandchildren, we hear it in our songs, in our prayers and now we can leave from this area knowing that we have made a difference in this world today. Now we can continue to walk life in beauty."

Alberta Nells shared a story about how a schoolteacher came up to her and said, "There is justice out there, sometimes you have to go out looking for it."

http://www.nerdshit.com/wordpress/?p=2395

Security aspects

The key security aspects related to SSCP are underscored by an extraordinary letter which Justice Krishna Iyer wrote to Hon'ble Prime Minister Manmohan Singh on April 13, 2005.

Krishna Iyer opposes Setu Project

Express News Service, Kochi, April 15: Former Supreme Court Judge V R Krishna Aiyar has written to Prime Minister Manmohan Singh to get the Setusamudram Shipping Canal Project (SSCP) spiked in view of the gravity of consequences involved.

He said, "Our nation will be weaker and may suffer new dangers with American presence in the Setusamudram waters by doing what for centuries has never been considered necessary or feasible or in any manner advantageous to the people of India."

The choice of a channel alignment for SSCP should be done only after a detailed multi-disciplinary evaluation of the impact of tsunami of the type which struck the Indian coastline on December 26, 2004.

Ram Setu reduced the impact of the tsunami. If the work is continued on the present alignment, an enormous energy of the next tsunami will be absorbed through this channel and result in the destruction of Kerala and significant parts of Tamil Nadu coastline.

On March 8, 2005, the PMO raised 16 objections, including the observations of tsunami expert Prof Tad S Murthy of Canada who has been engaged by India to set up tsunami-warning system in the country.

There is the issue of thorium and other rich mineral deposits close to the Ram Setu in Kerala sands.

The project will have a profound impact on the country's nuclear programme according to the website of Bhabha Atomic Research Centre. (Front Page)

Justice Krishna Iyer's letter to Prime Minister

V. R. Krishna Iyer
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April 13, 2007

Most respected Prime Minister,

I write this letter a little too late but its importance and the gravity of the consequences involved persuade me to think that I should address you better late than never. The subject must have already been within your attention and is known as Sethusamundram Shipping Canal Project. If the enclosed paper states the facts with scientific objectivity and national anxiety, my appeal to you to stop building any bridge or other construction, an action hostile to the nation and its swaraj. Our nation will be weaker and may suffer new dangers with American presence in the Sethusaudram waters by doing what for centuries has never been considered necessary or feasible or in any manner advantageous to us, the people of India. In the name of India i.e., Bharat and appealing to your patriotic statesmanship I beseech you to reconsider the stand taken if any already on this point. This is a matter of a political party business or popularity or pro-American yen. I hope you will give great thought as the Executive Head of India to the grave issue implied in the enclosed paper and with which the nation shall defend its survival.

With high regards,

Yours sincerely,

V R Krishna Iyer

(V.R. KRISHNA IYER)

Encl : as above

To,

Dr. Manmohan Singh
Hon'ble Prime Minister of India
Prime Minister's Office
Government of India
Secretariat, New Delhi

Paper attached to Hon'ble VR Krishna Iyer's letter can be downloaded from:
http://rapidshare.com/files/26060268/pilsupremecourtramSetu1.doc.html

Setusamudram Shipping Channel Project (SSCP) -- A Mariner's Perspective

By Capt (Retd) H. Balakrishnan, I.N

Introduction

1. The SSCP is an off-shore shipping canal project in the Palk Bay. It plans to cut short the distance navigated by ships sailing from the West coast of India and bound for ports on the Eastern seaboard and vice versa, by precluding the necessity to circumnavigate around Sri Lanka.

2. The total length of the SSCP in the Palk Bay is 152.2 Kms. It is divided into three legs. The Southern leg in the Adam's Bridge area is 20 Kms. The Northern leg in the Palk Strait area is 54.2 Kms. The Central portion is 78 Kms. Dredging is to be carried out in the Southern and Northern legs to maintain a dredged depth of 12 metres. This would facilitate a navigable channel for ships with a draught of upto 10.7 meters. The canal will be 300 meters wide.

3. The basic justification advanced in favour of the project is that it will reduce the sailing distance between Kolkata and Tuiticorin by 340 nautical miles and between Chennai and Tuiticorin by 434 nautical miles. This enables savings in fuel costs and sailing time, for ships plying between these ports.

4. This paper aims to analyse the viability of the SSCP against the canvas of the following factors, that have a bearing on shipping:

    (a) Environmental Factors
    (b) Security Implications
    (c) Navigational and Allied Factors

ENVIRONMENTAL FACTORS

Tropical Cyclones

5. The India Meteorological Department has assigned the Palk Bay area as a 'High Risk Area' for cyclonic activity. The cyclone season the Bay of Bengal is generally between Oct to Jan. It is interesting to note that the IMD's records from 1891-2001, states that of the 452 cyclones that hit the Indian coastline, 256 were on the East coast. We mariners, in a lighter vein, refer to the Tamil Nadu coast between Rameswaram and Cuddalore as the 'cyclone coast'!! There are valid reasons for this quip. Of the 256 cyclones referred, 64 have crossed the Tamil Nadu coast in this period. Of these, 36 were 'severe cyclones' (winds in excess of 90 Kmph). More interesting, of these cyclones, SIX have crossed the Palk Bay, 14 have crossed the coast at Nagapattinam and THREE have crossed the Gulf of Mannar. All these cyclones can have a devastating consequence on the SSCP and shipping in the area.

6. A few more examples of the devastating consequences of these cyclones, will be illustrative:

(a) In Dec 1964, a cyclone washed away the Pamban Bridge.
(b) In Dec 1973, FIVE metres high tidal waves hit the Palk Bay area – the very same area where the SSCP is to be dredged!!
(c) In Dec 1977/78, under the influence of a severe cyclonic storm that crossed the coast near Nagapattinam, 120 Kmph winds were recorded in the Palk Bay area.
(d) In Nov/Dec 1997/98, an oil-drilling ship, anchored with SIX anchors in the Cauvery Basin, broke loose from her anchors and was washed ashore by a cyclone.

7. The foregoing will serve to illustrate the fact that the Bay of Bengal cyclones pose a 'clear, live and present danger' to 'Safety of Lives at Sea' (SOLAS). And, the SSCP is sought to be created in a 'cyclone danger area'!!

Siltation

8. Allied to the cyclonic activity in the area, is the problem of siltation leading to a loss of sea depth. Scientists have concluded that the Palk Bay area is one of the FIVE areas, off the Indian coast, where siltation takes place regularly. Some of their calculations have indicated a loss in sea depth of about 1 cms every year. It is pertinent to state that TWO of the LEGS of the SSCP, where dredging is to be undertaken, happen to cross two such micro regions where high siltation takes place.

9. To conclude, the environmental factors of cyclonic activity and siltation rates in the Palk Bay area, impinge on shipping safety. It is also appreciated that maintenance dredging may have to be undertaken through the year to maintain dredged depths. This could lead to substantially increasing the costs of the SSCP.

SECURITY IMPLICATIONS

Global Scene on Maritime Terrorism

10. While terrorist attacks are predominantly land based, non-state actors have also sought to exploit vulnerabilities in shipping, ports and the container supply chains in Asia, Middle- East, Europe and North America.

11. Conventional arms trade and smuggling, both highly profitable global businesses, are spreading increasingly sophisticated conventional weapons to non-state actors, including long- range anti-ship missiles, unmanned aerial vehicles and close range armour piercing missiles and rocket propelled grenades. All these weapons are capable of inflicting serious damage to ships.

12. The list of foiled, failed and successful attempts in maritime-related

terrorism over the past decade is significant. Yet, there is a tendency to overlook or downplay what has happened, and thus ignore the possibility of further trouble. It is clear that terrorists can see the potential of using the maritime trading system and its land links in the container supply chain to conceal weapons or agents for attack purposes. Two recent examples of terrorist attacks on naval warships help illustrate the point.

13. Attack on the U.S.S. Cole. In Oct 2000, Al-Qaeda operatives in Yemen, packed a small boat with explosives and rammed the same onto the U.S. Navy destroyer, U.S.S. Cole, while the ship was in harbour. The blast left a gaping hole on the side of the destroyer and the cost of repairs amounted to USD 250 million. The blast killed 17 U.S. Naval sailors and, wounded another 40 seamen.

14. Missile attack on Israeli Naval Ships. On 14 Jul 2006, two days after hostilities between Israel and the Hezbollah commenced, the latter fired TWO, C-802 radar guided cruise missiles from ashore in Lebanon, at Israeli naval vessels patrolling off the Lebanese coast. One missile seriously damaged an Israeli naval corvette. The second missile narrowly missed another corvette. Instead it hit a Cambodian registered merchant vessel, sinking it with eleven hands on board.

The LTTE Factor

15. The LTTE factor has a direct bearing on the safety of shipping navigating through the SSCP. The LTTE has control over most of North Sri Lanka coastal region and the seas contiguous to it. The Sea Tigers, the naval arm of the LTTE, have displayed considerable ingenuity and daring in sea borne insurgency. They have carried out numerous daring attacks on Sri Lankan naval ships, and have not hesitated in resorting to suicide missions. It is pertinent to note that the SSCP is a 'next-door-neighbour' in the area of operations of the Sea Tigers!!

16. A new addition to the LTTE's fighting capability is its 'Air Arm'. They have todate carried out THREE daring 'night attacks' on Sri Lankan assets. This factor adds a new dimension to the threat perception along the SSCP.

17. Reports in open source literature indicate that the aircraft deployed by the LTTE Air Force is the Czech manufactured 'ZLIN-Z 242 L' aircraft. These appear to have been purchased from a private South African flying club. The aircraft is delivered in a knocked-down condition and can be easily smuggled as automobile parts or components of heavy commercial vehicles. By all accounts these aircraft were ferried by sea using forged Bills of Lading. This corroborates Para 11 above.

18. Reports also indicate that the flying training for the LTTE's pilots was carried out by the same South African flying club. It is also suspected that armament training were carried out by mercenaries in South Africa. All the air attacks on Sri Lankan assets todate have been at night, indicating a high degree of proficiency. The SSCP falls within the radius of operation of these aircraft!!

19. Media reports of 28 Apr 2007 in Chenai, attributed the recent killings of the TN fishermen at sea to the LTTE Sea Tigers. The grounds for the killings, attributed to LTTE sources, was that these fishermen were 'spying' on the LTTE's activities at sea!! If that be the case, the possibility of the LTTE advancing the same argument for attacking ships navigating through the SSCP cannot be ruled out. The consequences of a ship sinking in the canal could have a disastrous impact on the viability of the

project itself. It would have a psychological on the shipping industry which may then tend to avoid the SSCP and circumnavigate Sri Lanka in the larger interests of safety of men and material.

NAVIGATIONAL AND ALLIED FACTORS

20. The official website of the SSCP states: " Ships originating in the West of India and destined for Chennai, Ennore, Vishakapatnam, Paradeep, Haldia and Kolkata have to travel around the Sri Lankan coast resulting in increase of travel distance and time. Apart from this ships belonging to the Indian Navy and Cost Guard need also to traverse around Sri Lanka- - " .

Navy and Coast Guard

21. The website statement about the Navy and the Coast Guard would give the impression Naval/Coast Guard ships sail to and from either coasts on a frequent basis. In reality this is not the case.

22. The navy has been operating on a 'Two Fleet' concept for over three decades, to safeguard our maritime interests on the Eastern and Western seaboards. New induction ships are allotted to both Fleet to maintain the required Force Levels on both coasts. Thus the requirement for ships to cross over to the other coast is more the exception than the rule. At the most, they may meet annually for a combined Fleet exercise programme.

23.Besides, peacetime sailings of the Fleet are to hone skill levels in battle-manoeuvres, missile and gun firings, submarine exercises, aircraft operations and underway re-fuelling exercise at sea. All these and other exercises are conducted in areas far removed from the coastal and international shipping lanes for obvious reasons. Under these circumstances and considering the security implications in the area contiguous to the SSCP, it is debatable whether a Fleet would prefer to navigate through the SSCP. Also, if the Fleet happens to be a carrier battle group, availing the SSCP route can be almost ruled out, on account of various tactical factors.

24. During the period of hostilities, it is improbable that ships on passage to either coast would navigate through the SSCP as it militates against the basic principles of naval operations of avoiding straits and narrows to maintain secrecy of deployment.

25. Similar arguments can also be advanced on the deployment of Coast Guard vessels.

Mercantile Marine

26. It must be borne in mind that the SSCP is not an 'open seaway'. Thus for ships to safely traverse through the canal, it will be mandatory to embark a 'pilot'. A 'pilot' is a mariner with experience pertaining to local conditions. He would normally board a vessel at either extremity of the canal and take the vessel safely to the other extremity before disembarking. It is not clear at the present juncture, whether vessels calling at the SSCP will have a 'pilot' boarding on arrival. Delays in the boarding of the 'pilot' will entail the vessel to anchor and await the 'pilot'. Under adverse weather conditions this is not a comforting thought to a mariner. Besides,

during cyclonic weather, sea conditions may preclude the embarkation of a 'pilot'. What does the vessel then do?

27. Open source literature on the SSCP indicates that vessels upto 32,000 DWT can navigate through the canal. However, in the current global shipping scenario, to reduce the operating costs and cater to the enormous growth in shipping needs, trends are towards operating vessels of 60,000 DWT and above. This trend is likely to grow further in future, resulting in vessels of larger tonnage. A passage along the international shipping lane from South of Sri Lanka to South of the Great Nicobar Island will prove this point. None of these large vessels can avail of the facility of the SSCP.

28. This would leave the coal carrying bulk carriers on charter to the TNEB, the only ships that would use the SSCP on a regular basis. These vessels load coal at Haldia/ Paradeep/ Vishakapatnam and discharge the same at Chennai and Tuiticorin for the Thermal Power Plants. Besides, some smaller container feeder vessels from Colombo and bound for Chennai could also use the SSCP.

29. In the opinion of Mr. K.S. Ramakrishnan, former Deputy Chairman of Chennai Port Trust and former Managing Director of the Poompuhar Shipping Corporation, the pilotage costs of navigating through the SSCP and certain allied factors, could make the SSCP unattractive to the shipping industry. It is his opinion that the actual use of the SSCP maybe substantially lower than the projected figure of 3417 vessels by 2010 and 7141 vessels by 2025.

CONCLUSION

30. A report in the magazine 'Frontline' of 01 Jan-14 Jan 2005, entitled 'Of Gains and Loses', states: " George Gomez, Tamil Nadu Manual Workers' Union, Tuiticorin, who has several decades of experience in the shipping industry, says the Project cost will work out to Rs. 3000 crores. He says the Project will be a 'sick unit' as the money invested can never be recovered. 'I don't think any container ship will use the canal'. Major container operators deploying mother-vessels, will not use it. The difference in time between ships using the canal and those going around Sri Lanka will only be a few hours. Ships would not be able to cruise fast in the canal because they will have to be piloted, he argues. Moreover, the canal will have to be dredged continuously."

31. In the Chennai based English daily, The Hindu, of 21 Dec 2004, Mr. K.S. Ramakrishnan, former Deputy Chairman of the Chennai Port Trust had questioned the need for the canal. He had stated: "- - - . But the canal cannot be a free seaway because the grounding of a wayward coal or oil ship that strays from the alignment or a collision of two ships in the channel will result in an ecological disaster of unimaginable proportions to the Gulf of Mannar and the Palk Bay". He further stated: " The two statements that the ships using the canal will save money and that the project will be a financially viable undertaking are therefore mutually contradictory and cannot have simultaneous validity".

32. In the light of the foregoing analysis, it is debatable whether the investments made in the construction of the canal is justified from the security, environment or economic standpoints. The old adage 'Haste Makes Waste' readily comes to mind in the case of the SSCP.

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Channel passage through Rama Setu (Adam's Bridge) adversely impacts National sovereignty, integrity and safety

By S. Kalyanaraman, Ph.D., Former Sr. Exec., Asian Development Bank,
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http://rapidshare.com/files/26279488/pressmeet17april2007.ppt.html (Download ppt presentation)

Tsunami protection measures are required in the belt between Nagore (Tamilnadu) and Kayamkulam (Kerala) since the last tsunami impacted the mouth of kayamkulam canal. Such protective measures should become an integral part of the SSCP.

Prof. Tad S. Murthy (an expert on tsunami who was engaged by Govt. of India to set up a tsunami warning system) apprehends that, if the present Setusamudram channel project alignment is implemented, the next tsunami will destroy the part of Kerala (and Tamilnadu coastline) with thorium reserves, since the channel pointing to the epicenter of the tsunami will absorb the tsunami energy and funnel into the channel which will move in a narrow arc to destroy the coastline of Tamilnadu and Kerala.

Implications of intrusive identification of 'international waters boundary'

http://www.hinduonnet.com/fline/fl2201/images/20050114005902402.jpg

U. Arulanandam, President, Singaravelar Fishermen's Forum notes that the project is being implemented to enforce the international boundary line in the waters.
Once the canal is a reality, it will become an unofficial boundary line on the sea between India and Sri Lanka. Fishermen are afraid because, it is in the Sri Lankan waters that fish thrive. The canal would seal their entry into those waters for fishing.
http://www.hinduonnet.com/fline/fl2201/stories/20050114005902400.htm

A Parliamentary Enquiry Committee should be constituted to review and re-evaluate the alignments with the assistance of multi-disciplinary expert teams, given the serious situation created for the livelihood of the coastal people by the alignment of a channel passage along the 'medial line'.

Introduction

An account of the alignments considered since 1956 is provided in this document. A bolt from the blue arrives with the medial line as the new channel, a novelty not considered at all by any of the previous committees: Mudaliar committee (1956), Venkateswaran Committee (1968), Laxminarayanan Committee (1983).

> Who chose this new alignment and what evaluations were done on this new alignment and what impact studies were done in relation to the tsunami of Dec. 2004 and the protective measures needed in the coastline of Tamilnadu and Kerala in case another tsunami strikes? Some indications may be gleaned from the following paragraphs. One thing is clear. Mudaliar Committee

> emphatically said, "the idea of cutting a passage in the sea through Adam's Bridge should be abandoned." Of course, USA is interested in declaring the Gulf of Mannar, Palk Straits and Palk Bay as international waters, thus refusing to recognize the claims of India (Bharatam) and Srilanka that these are Historic (internal) waters. To emphasize the refusal, USA sents its naval vessels in 1993, 1994, and 1999.

Alternative alignments considered upto 2002 did NOT impact Adam's Bridge

The Setu channel alignment creates a passage destroying Rama Setu (Adam's Bridge) contravening AR Mudaliar Committee recommendations and succumbs to US pressure, thus creating an arbitrary International Waters Boundary which never existed. This is the reason why Justice VR Krishna Iyer (Former Judge of Supreme Court) , noted: "If the enclosed paper states the facts with scientific objectivity and national anxiety, my appeal to you to stop building any bridge or other construction, an action hostile to the nation and its swaraj. Our nation will be weaker and may suffer new dangers with American presence in the Setusamudram waters by doing what for centuries has never been considered necessary or feasible or in any manner advantageous to the people of India…This is a matter of a political party business or popularity or pro-American yen." The attached paper produced copies of the US Navy Operational Directive of 23 June 2005. It is notable that SSCP got inaugurated on 2 July 2005 after a cavalier reply on 30 June to 16 objections of PMO of March 8, 2005 including an objection that the project should be reevaluated taking into account the impact of the tsunami of Dec. 2004 and any probable future tsunami.

Excerpts below provide an overview of the alternative channel alignments considered to either create a canal or just a passage across the Gulf of Mannar and Palk Straits. The categorical recommendations of AR Mudaliar Committee (1956) are as follows, against any passage across the Adam's Bridge. It is surprising that these recommendations have been suddenly and arbitrarily abandoned in favour of a mid-ocean passage increasing the distance of the channel for ships and exposing the entire coastline of Tamilnadu and Kerala to devastation in a tsunami of the type that struck on Dec. 26, 2004. In fact, all the alignments considered so far should be revisited and reevaluated taking into account the impact on sea-depths caused by this tsunami:

> We are convinced that the Adam's Bridge site is unsuitable for the following reasons:
>
> First: The shifting Sandbanks in this area present a far more formidable problem – both at the stage of construction and during maintenance – than the sand dunes on the island site.
>
> Secondly: The approaches to a channel would be far too open with no possibility of construction of protective works. A channel at this site – even if it can be made and maintained (which is unlikely) – would entail definite navigational hazard.
>
> Thirdly: The channel would be bordering on the Setusamudram Medial Line. In these circumstances we have no doubt, whatever that the junction between the two sea should be effectd by a Canal; and the idea of cutting a passage in the sea through Adam's Bridge should be abandoned.

Setusamudram Project Committee (April 1983), Chairman HR Laxminarayan, Development Adviser (Ports), Min. of Shipping and Transport, Member V. Sundaram, Chairman, Tuticorin Port Trust (one of 4 members, until from Jan. 1981 to 8. 7.1982)

Para 6.1 "The Setusamudram Project Committee constituted by Government in December, 1955, with Sir A. Ramasamy Mudaliar as Chairman investigated the canal alignment across themain land and Capt. JR Davies, Nautical Adviser to Government of India investigated another alignment across the mainland. Shri CV Venkateswaran, Consultant, collected data for the above two alignments. The investigations confirmed the presence of layers of sand stone which made the Mandapam alignment expensive. As the soil particulars were not favourable Shri Venkateswaran then shifted his investigations to Rameswaram Island to find out a new alignment at an economic cost. He selected the DE – alignment across the Rameswaram Island near Thankachimadam and conducted detailed investigations both on land and sea. The results of the investigations were briefly reported in his project report of May, 1968.

Para 6.2 "As discussed in chapter 5, the K-alignment across Dhanushkodi at 1 km west of Kothandaramasamy Koil was chosen…

Para 5.1 Canal alignment. 5.1.1 Shri CV Venkateswaran, Consultant, Setusamudram Project has recommended the DE-alignment in his project report of May, 1968, after careful investigation of all previous alignments. DE-alignment passes across Rameswaram island at Thankachimadam west of the famous Rameswaram temple. 5.1.2 The representatives of the residents of Rameswaram island and the local fisherman association appeared before the Committee, in Ramanathapuram on the 9th August, 1981. They expressed the sentiments of the local public against cutting the canal along the 'DE' alignment separating the temple from the main land and also voiced their apprehension that such a cut could endanger the island during cyclones. Further the committee noted that there was a heavily built up residential area on this alignment and examined alternative alignments across Dhanuskodi east of Rameswaram temple. After preliminary site investigations and study of the coastal morphology in relation to the latest hydrographic chart, the committee has chosen the K-alignment across Dhanushkodi west of Kothandaramasamy Koil."

Setusamudram Project Committee Report (April 1956), Chairman: Dr. A Ramaswami Mudaliar, Member-Secretary RA Gopalaswami, ICS

"14. Navigational safety – overriding consideration. We may say, at the outset, that both in settling the lay-out of the route, as well as in planning the project in detail, we have kept before us the question of navigational safety as an overriding consideration. If the use of the new route is regarded by Shipmasters as being, in any respect, harzardous, it is unlikely that the route will be used merely because of saving in time and distance. We have, therefore, taken care to plan the project in such a way that the route proposed by us will be recognized as safe.
"15. The 'Setusamudram Medial Line' and the location of the Project to its west. One other consideration which we have kept in mind is the need to ensure that the navigational works and facilities proposed will be wholly under the control of the Government of India. The Government of Madras have informed us that a medial line of Setusamudram has been delimited and accepted as the administrative boundary between India and Ceylon, in respect of the ownership of Chank and Pearl fisheries

in the bed of the sea. The delimited line is marked on the Route Chart. It will be observed that all the project works are located to the west of this line.
"16. Unsuitability of Adam's Bridge: preference for Canal over Passage. We have been asked specifically to consider the proposal of cutting a channel at the approaches to Adam's Bridge in order to connect the Gulf of Mannar and the Palk Bay and thereby form the Setusamudram. We have considered this site and advise against it. The origin of this suggestion is to be traced to the opinion formed by the Harbour Engineer to the Government of Madras in 1921, which was recorded in the following terms: :'The approaches to the suggested channel at Adam's Bridge are much safer and more open than at Pamban and there is no possibility of trouble from shifting sand dunes, which is a very real trouble at Pamban adversely affecting both the canal and railways. It is very possible also that locks would be required at Pamban but not at Adam's Bridge. Speaking generally the latter is the simpler problem from an engineering point of view.' We observe that this opinion was expressed by the Harbour Engineer before he undertook the detailed investigation of the Rameswaram Canal Scheme. Subsequently, his detailed investigation was limited to the Island site and did not extend to Adam's Bridge. We consider, that, had a detailed also been made of Adam's Bridge, he would have revised his opinion. We are convinced that the Adam's Bridge site is unsuitable for the following reasons:
First: The shifting Sandbanks in this area present a far more formidable problem – both at the stage of construction and during maintenance – than the sand dunes on the island site.

Secondly: The approaches to a channel would be far too open with no possibility of construction of protective works. A channel at this site – even if it can be made and maintained (which is unlikely) – would entail definite navigational hazard.
Thirdly: The channel would be bordering on the Setusamudram Medial Line.
[unquote]

In these circumstances we have no doubt, whatever that the junction between the two sea should be effectd by a Canal; and the idea of cutting a passage in the sea through Adam's Bridge should be abandoned.

"17. Site recommended for location of Setusamudram Canal: superiority of recommended site to Rameswaram Site: The Rameswaram Ship Canal Scheme was investigated on three different occasions during the last sixty years. On all these occasions, the Canal was sought to be sited on the island, a few miles to the east of Pamban Railway Bridge. The old records show that long before these schemes were considered, another site which is situated on the main land a few miles to the west of Pamban Bridge had been recommended by Cmmander AD Taylor of the Indian Marine. Our local enquiries and investigation lead us to the conclusion that this site is the most suitable and we recommend accordingly. The distinguishing feature of a canal at this site will be clear from the following description given in the old records: 'The southern end was to start from 'Port Lorne' a natural harbour, a few miles down the coast from Mandapam, seven miles in length and 4 1/2 miles in breadth the greater part of which has a depth of 24 feet and for some considerable extent upto 30 feet deep, the deepest parts being 36 feet. It is well sheltered by the Musal and Muli islands and reefs. Its entrance has only a depth of 15 feet but if this were deepened it would make the harbour a safe one for the anchorage of all vessels during the south-west monsoon'. The proposal made by Commander AD Taylor was turned down on the ground that the northern side is exposed to the North-east monsoon and would require special protective works; and for this reason, the cost was estimated at that time at 2 crores. Thereafter, a search for a low-cost-site took

later investigators successively eastwards and this site was never considered again; eventhough the particular reason underlying its original rejection was later recognized to be of no great force. The North-east monsoon in this area is far from being a formidable problem. From the point of view of protection of canal entrances, the Southern entrance is much more important than the northern entrance. The natural harbour described in the extract cited above is still there; its depths remain the same. The availability of such a natural protection is a great asset from the navigational point of view. It is a decisive consideration in favour of this site. There are others.

First: The site is directly in line between Tuticorin and Palk Strait. It will therefore enable the fullest advantage being taken of saving in distance and time.

Secondly: It will facilitate the location of a direct route lying entirely to the west of the Setusamudram medial line.

Thirdly: The location of the canal to the west of the island, on the mainland obviating the use of the vulnerable railway bridge at Pamban has its obvious advantages over a canal on the island to the east.

Fourthly: The excavation will be much easier as the borings indicate the strata to consist almost entirely of sand. There is little sign of hard material.

Fifthly: The scope for development (which will be opened up by the construction of a canal) will be far more important at the recommended site; because of its situation on the mainland and in the vicinity of a natural harbour."

Setusamudram Ship Canal Project (May, 1968) Report by CV Venkateswaran, Consultant, Setusamudram Project, Parts I and II

Excerpt from Part II, Chapter 1 (by R. Natarajan IAS, Project Officer, Setusamudram Project): "1.2 Yes. 'Setu' which, according to immemorial tradition, was an Indo-Ceylon causeway built by Lord Rama, has had an instant appeal to the Indian imagination, besides possessing all the above patent advantages. Geologists affirm that there used to be a continuous passage between India and Ceylon and this did look like a causeway with two distinguishable parts – a substratum of sand reef running almost horizontally, just below sea level, for the entire length and a superstructure of broken sandstone and marine sand, lying atop. The substratum of sand stone reef is still there, stretching in an unbroken line from India to Ceylon and lying just below sea level. But the superstructure is no longer unbroken, having been blown away by a great storm of 1480 AD. What remains of 'Setu' above sea level to the west of Dhanushkodi consists of only two parts – the Thonithurai peninsula and the Island of Rameswaram, separated by the Pamban Gap and connected by the Pamban Railway Bridge. The narrow stretch of water between the South-East coast of India and the North-West coast of Ceylon is not one sea but consists of two separate seas known as the Palk Bay and the Gulf of Mannar, though they meet and mingle over Adam's Bridge through the Pamban Gap (pen to ships of 11 feet draught and less) and remain as such for purposes of navigation, with the sand stone reef, called by Arab navigators as 'Adam's Bridge' constituting an effective shipping barrier, compelling all ships which proceed from or to any part of the Gulf of mannar, the Arabian Sea or the Indian Ocean and call at Madras, Visakhapatnam or Calcutta, to circumnavigate Ceylon."

Implications of damaging Rama Setu under international Law of the Sea

In addition to this, the arbitrary choice of the medial line as the passage channel opens up serious concerns for national sovereignty and security and the arbitrary creation of an international boundary in what have always been considered to be Historic (Internal) Waters. The medial line was only an administrative boundary to delimit ownership of chank and pearl fishery areas between Bharatam and Srilanka and SHOULD NOT be converted into a de facto international waters boundary.

The new channel alignment now being implemented was never considered by any of the previous committees since 1860 when Commander Taylor proposed a canal. The channel alignment will only satisfy the US interests as seen from the US Navy Operational Directive of 23 June 2005 which refuses to recognize India's claim and Srilanka's claim of the Gulf of Mannar and Palk Straits and Palk bay as Historic (Internal) Waters and sought to impose its military (naval) might by sending operational ships during 1993, 1994 and 1999. The US Directive says: "This claim(of historic waters) is not recognized by the United States. U.S. conducted operational assertions in 1993 and 1994, to Gulf of Mannar claim in 1999."

- This stance of USA is in direct contravention of United Nations Conference on the Law of the Sea (1958), Convnention of the Territorial Sea and Contiguous Zone recognizes HISTORIC Waters
- Agreement between Sri Lanka and India on the Maritime Boundary between the two Countries in the Gulf of Mannar and the Bay of Bengal and Related Matters 23 March 1976 on Historic waters.

It is a matter of serious concern related to National Sovereignty and Integrity, apart from security of the coastline which will be adversely impacted if the mid-sea passage opens up a funnel to absorb the energy of a next tsunami with incalculable devastation and destruction of Kerala and Tamilnadu coastline apart from the desiccation of the nation's Thorium reserves (as placer deposits on the beach sands) crucial for the nation's nuclear programme. (See appended article on how placer deposits are accumulated due to ocean currents on the west of the Rama Setu which divides the two oceans).

a) India and Sri Lanka have consistently treated Palk Bay, Gulf of Mannar and Palk Straits as 'historic' and 'internal'.
b) USA does not recognize this claim, has always protested against these, and considers the waters as 'international' and rejects the 'historic' claim too.
c) India , by choosing a Setu Samudram Channel alignment running VERY close to international waters, involving damage the Ramar bridge (called Adam's Bridge) is going back on its earlier claims of waters being historic waters.
d) This view of historic waters also means Sri Lanka is free to do what it likes on its side of the waters.
e) A more serious situation arises by keeping the alignment close to the 'international' waters. Coast guard will be handicapped in protecting the channel from the Srilanka side since coast guard vessels will have to constantly get into international waters.
f) It will make eminent sense in terms of the juridical regime of historic and internal waters to choose an alignment close to Pamban island WITHOUT damaging the Ramar Bridge (Adam's Bridge). The relevant extracts from UN documents are given below.

Juridical Regime of Historic Waters, including Historic Bays Bottom of Form

last update: 30 June 2005
The first United Nations Conference on the Law of the Sea (1958) adopted, in paragraph 6 of article 7 of the Convention of the Territorial Sea and Contiguous Zone, a provision to the effect that its rules on bays "shall not apply to so-called 'historic' bays". [1] The Conference also adopted on 27 April 1958 a resolution requesting the General Assembly to arrange for the study of the juridical regime of historic waters, including historic bays. [2]

The General Assembly thereafter adopted resolution 1453 (XIV) of 7 December 1959 (E, F, S, R , C , A), which requested the International Law Commission, as soon as it considers it advisable, to undertake the study of the question of the juridical regime of historic waters, including historic bays, and to make such recommendations regarding the matter as the Commission deems appropriate.

The Commission, at its twelfth session (1960) requested the Secretariat to undertake a study of the topic, and deferred further consideration to a future session. [3] A study prepared by the Secretariat was published in 1962. [4] Also in 1962, the Commission, at its fourteenth session, decided to include the topic in its programme, but without setting any date for the start of its consideration. [5] At its nineteenth session (1967), the Commission examined the advisability of proceeding actively with the study of this topic. The Commission's report (which also dealt with the topic "Right of asylum") summarized the views expressed as follows:

"Most members doubted whether the time had yet come to proceed actively with either of these topics. Both were of considerable scope and raised some political problems, and to undertake either of them at the present time might seriously delay the completion of work on the important topics already under study [...]"[6]

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[1] United Nations, Treaty Series, vol. 516, p. 210.
[2] Official Records of the United Nations Conference on the Law of the Sea, vol. II, Plenary Meetings , (United Nations publication, Sales No.: 58.V.4, vol. II), p. 145.
[3] See Yearbook of the International Law Commission, 1960, vol. II, , p. 180, document A/4425, para. 40. (see Analytical Guide)
[4] Ibid., 1962, vol. II, p. 1, document A/CN.4/143. (see Analytical Guide)
[5] Ibid., p. 190, document A/5209, para. 60. (see Analytical Guide)
[6] Ibid., 1967, vol. II, document A/6709/Rev.1, para. 45. (see Analytical Guide)

http://untreaty.un.org/ilc/summaries/8_4.htm#_ftnref2

Paragraphs 4 to 6 of Article 7 of the Convention of the Territorial Sea and Contiguous Zone read as follows:

4. If the distance between the low-water marks of the natural entrance points of a bay does not exceed twenty-four miles, a closing line may be drawn between these two low-water marks, and the waters enclosed thereby shall be considered as internal waters. 5.Where the distance between the low-water marks of the natural entrance points of a bay exceed twenty-four miles, a straight baseline of twenty-four miles shall be drawn within the bay in such a manner as to enclose the maximum area of water that is possible with a line of that length. 6.The foregoing provisions

shall not apply to so-called "historic" bays, or in any case where the straight baseline system provided for in article 4 is applied.

Section 7 of President of the Republic of Srilanka in Presidential Proclamation of 15 January 1977 in pursuance of Maritime Zones Law No. 22 of 1 September 1976 reads as follows:

(7) (i) that the historic waters of Sri Lanka shall comprise the areas of sea in the Palk Strait, Palk Bay and the Gulf of Mannar bounded by:
(a) the coast of the mainland of Sri Lanka;
(b) the maritime boundary between Sri Lanka and India as defined in Section 8 of the Maritime Zones Law, No. 22 of 1976;
(c) the arc of Great Circle between the following positions defined by latitude and longitude in the Gulf of Mannar:
(i) 08° 15' 0" North, 79° 44' 0" East,
(ii) 08° 22' 2" North, 78° 55' 4" East; and
(d) the arc of Great Circle between the following positions defined by latitude and longitude in the Palk Strait:
(i) 09° 49' 8" North, 80° 15' 2" East,
(ii) 10° 05' 0" North, 80° 03' 0" East;
(ii) the historic waters in the Palk Bay and Palk Strait shall form part of the internal waters of Sri Lanka;
(iii) the historic waters in the Gulf of Mannar shall form part of the territorial sea of Sri Lanka.

http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/LKA_1977_Proclamation.pdf

Agreement between Sri Lanka and India on the Maritime Boundary between the two Countries in the Gulf of Mannar and the Bay of Bengal and Related Matters 23 March 1976

The Government of the Republic of Sri Lanka and the Government of the Republic of India, Recalling that the boundary in the Palk Strait has been settled by the Agreement between the Republic of Sri Lanka and the Republic of India on the Boundary in Historic Waters between the Two Countries and Related Matters, signed on 26/28 June, 1974, And desiring to extend that boundary by determining the maritime boundary between the two countries in the Gulf of Mannar and the Bay of Bengal, Have agreed as follows:

…Article 5
(1) Each Party shall have sovereignty over the historic waters and territorial sea, as well as over the islands, falling on its side of the aforesaid boundary.
(2) Each Party shall have sovereign rights and exclusive jurisdiction over the continental shelf and the exclusive economic zone as well as over their resources, whether living or non-living, falling on its side of the aforesaid boundary.
(3) Each Party shall respect rights of navigation through its territorial sea and exclusive economic zone in accordance with its laws and regulations and the rules of international law.

http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/TREATIES/LKA-IND1976MB.PDF

Document:- A/CN.4/143 Juridical Regime of Historic waters including historic bays - Study prepared by the Secretariat Topic:Juridical régime of historic waters, including historic bays

Extract from the Yearbook of the International Law Commission:- 1962 , vol. II

38. In summary, the concept of "historic waters" has its root in the historic fact that States through the ages claimed and maintained sovereignty over maritime areas which they considered vital to them without paying much attention to divergent and changing opinions about what general international law might prescribe with respect to the delimitation of the territorial sea. This fact had to be taken into consideration when attempts were made to codify the rules of international law in this field, i.e., to reduce the sometimes obscure and contested rules of customary law to clear and generally acceptable written rules. It was felt that States could not be expected to accept rules which would deprive them of considerable maritime areas over which they had hitherto had sovereignty.

http://untreaty.un.org/ilc/documentation/english/a_cn4_143.pdf

Palk Bay Issues and Security Concerns: An Analysis

by Commodore R S Vasan IN(Retd) Papere No. 1355 of 29 April 2005 at saag.org

Introduction

1. The narrow stretch of seas that connects and divides the Island nation with India which has historical and mythological significance to both the countries can rightly be called the melting pot of the region- the Palk Bay. While the Rama Setu (Adam's bridge) has been photographed by NASA and is indicative of the existence of Rama's Bridge of yore; from times immemorial, the Palk bay has been the conduit for the historical links that exist between the two countries. The boat routes used by the ancient mariners in the region are still in use today. It is a different matter that they may carry different merchandise. The fishing areas are still visited, not withstanding the disputes that abound these areas.

2. The Bay is charecterised by shallow waters, the Adam's Bridge and the presence of rich fishing grounds and many small islets. The presence of hydrocarbons in the area adds to the economic dimensions in the region. The Bay is also famous for the variety of marine life and thus has been a marine biosphere reserve. The area is obviously a very sensitive one from the security point of view, though not only, necessarily in the military sense but, also in the context of modern day definitions and understanding of security as it is applied in the larger context today.

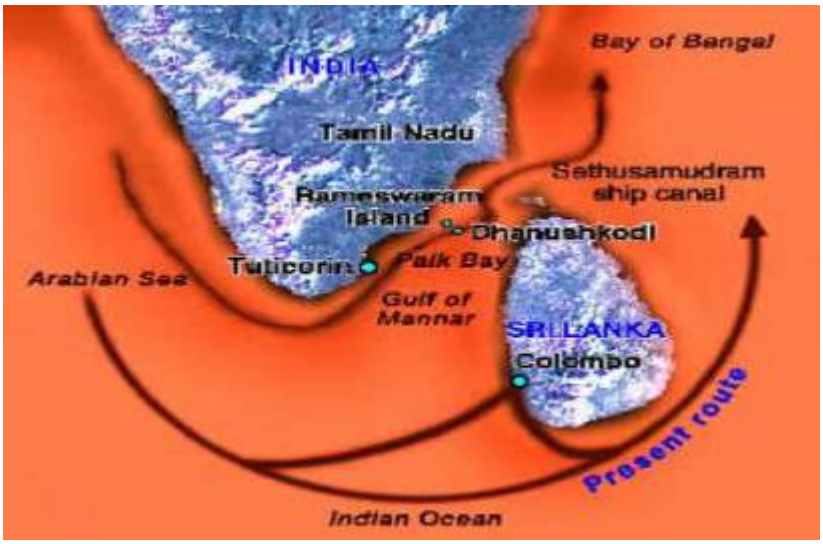
3. From the point of view of Marine security forces, the Palk Bay has the Coast Guard Station Mandapam strategically located to oversee the Palk Bay Operations. The Navy has a Naval Air Station at Ramnad with the Chetak Helicopters providing aerial surveillance towards Operation Tasha since the termination of IPKF operations. There are also several Naval detachments along the coast including one at Rameshwaram, one at Point Calimere and another at Nagapattinam to provide the necessary security mechanisms in the Palk Bay.

The Canal to Prosperity and Progress?

4. Military Analysts have discussed off and on about the security scenario in the Palk Bay that separates the two neighbours. Most of the recent discussions have all been about the likely impact of the Setusamudram Canal and how it would impact the livelihood of the fishermen and how it would affect the over all scenario in the coastal belts of the two countries. There is a debate going on, on the cost effectiveness of the proposal to dredge a canal on our side of the IBL to bring about not only a reduction of the time taken between Indian Ports on the East Coast and Tuticorin but also to act as a catalyst to growth and economic activity in the region. While there are a lot of expectations on the long term benefits that would accrue from the canal, the whole process has been vitiated by the politicization of the project and a keen sense of competition by the two major political parties of Tamil Nadu to take credit for its implementation as and when it is set in to motion by the creation of a Special Purpose Vehicle to monitor and implement the Setusamudram Ship Canal Project (SSCP)

Setusamudram Canal

5. The Setusamudram is not a new idea; the idea has been there since the times of the British while they ruled the sub continent. Many studies including technical feasibility reports have been undertaken at regular intervals by both British and our own Engineers. As many as eight studies were conducted between1860 and 1925, the earliest one being by a Marine Engineer Commander Taylor. Essentially, the project aims to link the Gulf of Mannar and Palk Bay, thereby, reducing the time taken to reach Indian ports in either direction. Presently, due to depth restrictions, Vessels have to go around the Island Nation to reach own ports on either side of Palk Bay. The proposal is to dredge a canal of 300Meters width and 142 kms length to connect the Indian Ports. Initially, it is to be dredged to 12 meters to allow ships drawing up to 10 meters plus, to ply these waters. In addition to reduction of time by 24 to 36 hours and a distance of up to 400 nautical miles for connecting Tuticorin with other important ports on the East Coast, the resultant fuel savings and the connectivity have long term strategic imperatives in the region. The ease of passage is expected to provide the necessary impetus to growth of containerized traffic, Ports and infrastructure development and overall growth in various related sectors. The project has also brought about a fear psychosis in the Island Nation as to the perceived ill effects that it may have on the overall economy of Sri Lanka and growth of Colombo port. It is felt that the proposal made by Sri Lanka to have an eight lane highway on a connecting bridge in lieu of the canal was to stall the Setusamudram project. However, both the Nations are engaged in a positive dialogue to examine all the related issues in an amicable manner.



6. This analysis is aimed at looking at the security implications in a highly sensitive area that is so important to both countries for many reasons. This is one area where not just the Military security would seek importance; but others, as well, which threaten to even stall an important strategic initiative of the country to provide direct access to Gulf of Mannar by dredging a canal through the shallow waters separating the Island Nation and India. Thus even issues of food (fishing) security, economic security of the coastal Population and the ecological/environmental security of which the eco lobby is worried about have all assumed greater importance. There are arguments and counter arguments about the viability/desirability /suitability of the project. Before looking at the very specific aspect of the military security dimensions, it would be worthwhile to examine the other issues mentioned above and assess the likely impact in the area.

Fishing Problems and related Issues.

7. The problems are of such magnitude that the solutions with or with out the Setusamudram being in place are no where in sight. The problems of fishing are as old as one might care to remember. The issue of fishing rights or lack of it today particularly around the Kachativu is both emotional and historical. The demarcation of the maritime boundaries was linked to the handing over of the Kachativu Island to Sri Lanka which happened in 1974. Not many people in Tamil Nadu have forgiven Delhi for the inconsideration shown to the Tamil fishing community in particular of Ramanad District in surrendering the traditional rights enjoyed since the time of Raja of Ramnad. While the agreement in 1974 recognised the rights of the Indian Fishermen to dry their nets and visit the St Anthony's shrine annually for thanksgiving, the clarifications provided on behalf of the Government by the then External Minister Dr Swaran Singh in 1976, drove the last nail in the coffin of the aspirations of the Tamil fishing community. Since then the situation has never been to the advantage of the local community what with the dwindling fish stock on Indian side of IBL and the inability to fish in the historic waters surrounding the Island. While the Island itself may be barren, it is the waters surrounding the Island that are rich fishing grounds and have traditionally provided our fishermen with some very rich variety of fish, particularly prawns .The fishing around the Island continued despite the agreement and continues even today and is a perfect case of "**fishing in troubled waters**"

8. The local politicians and the fishing population have not forgiven Mrs. Indira Gandhi for her insensitive statement that after all the "…**Kachativu is just a barren Island".** How reminiscent of an earlier statement of her father Late Pandit Nehru who said that "… **not a blade of grass grew in Aksai Chin"** commenting on the Chinese occupation and its claim to this Indian piece of land. Both the actions have been termed as Strategic blunders of the Nehru family who did not understand the strategic significance of these two places, one, in the high reaches of mountains and the other in the neighbourhood seas. So, one could be classified as a Himalayan blunder and the other a mean (really mean) sea level blunder. When one moves fast forward in time to this decade, there is no way that India can retract now from the agreed demarcation of the maritime boundary. Even the British had not been able to resolve the ownership issue even though the issue of fishing rights being controlled by the Raja of Ramnad was apparently never in dispute. Unfortunately, neither the Tamil Nadu Government nor the Center was in a position to produce the legal papers establishing the custodian rights of the Raja of Ramnad. The tenuous State Center relations did nothing to help matters either.

9. The considered view of analysts is that India can not be seen as a Nation that signs agreements in haste and retracts in leisure. This aspect has definitely influenced the conduct of the big neighbour separated by this stretch of sea. The present situation dictates that we live with the down stream effects of the accord while trying to find a solution to the vexed problem of fishing in the area. Not with standing the agreement, fishing around the Kachativu continued just as the annual festival of St Anthony was also regularly attended by the Christian fishing community from India along with the Priests. The stand off between the LTTE and the Sri Lankan Government indirectly helped the Indian fishing community, as, during the height of the LTTE confrontation with the Security forces fishing was totally banned for the Sri Lankan Tamil fishermen. The Indian fishermen made use of this opportunity to continue with their fishing with out opposition. The woes of our fishermen actually got accentuated with the lifting of ban in Sri Lankan waters, which brought them in to direct conflict with their counterparts from Sri Lanka. There was many a shooting incident resulting in even death of Indian fishermen. The identity of the shooters has

never been conclusively established with the Sri Lankan Navy maintaining that they were not the perpetrators and indirectly blamed the LTTE for the incidents. The last three four years have seen an increase in the number of abductions of our fishermen and boats. All such incidents immediately raised the diplomatic activity to a feverish pitch and resulted in enabling the return/repatriation of fishermen. At best, these measures can only be termed as fire fighting exercises which never served the purpose of finding a lasting solution.

Suggested Measures

10. The efforts of the State and the Center in educating the Fishing community about the accord and the requirement on our part to honour the agreement have been inadequate to say the least. The author of this paper in his capacity as the Regional Commander of the Coast Guard Region East met the Chief Minister of Tamil Nadu a couple of years ago and made some of the following suggestions. Some new suggestions have also been included for considerations by the powers that be:-

(a) As there is no fish on our side there is a need to create alternate avenues for jobs. Fishing as a vocation was not viable with the situation that exists in the Palk Bay. There is a need to support the fishing community to venture in for deep sea fishing and adopt modern responsible fishing methods. Those who still want to continue with fishing would need to be provided with subsidy/loans to invest in deep sea fishing vessels with mother ship concept and also mobile fish factories at sea to ensure that the landing time is minimized and the time at sea is optimized.

(b) In addition, the entire backward areas of Ramnad District would need to be developed economically to wean the fishing community away from the traditional ways of fishing by way of education employment opportunities and community /small scale industries.

(c) The fact that there is promise of oil and gas find in the Palk Bay needs to be translated to create oil/gas based industry in the region with a view to harness the oceans and to provide employment in related jobs that would automatically be created by way of support industry that is so essential to the oil based industry.

(d) The issue of perpetual leasing of the fishing areas around the Kachativu Island (this was also suggested by many analysts and academicians, notably, Professor Suryanarayana who has written extensively on the subject) was another option to be pursued between the two countries even if it meant paying for such fishing rights. A suggestion of reciprocal rights in other areas of interest for the Sri Lankan fishermen was also made. It is known that the Sri Lankan Fishermen engage in fishing in Indian Waters surrounding Lakshwadeep Islands for Tuna fishing. Thus it would be possible to ear mark areas for fishing in each other's territory based on the fishing interests of both the sides and reciprocal arrangements.

(e) The aspect of artificial reefing has also been attempted in the Gulf of Mannar area by the M/S Swami Nathan foundation. Based on the results, similar efforts could be initiated in the Palk Bay area for increasing the fish population by such measures.

11. The area has also witnessed lots of efforts in wind energy conversion by way of wind mills etc due to the wind gradients in the area. This also would need to be supported by the Government to see that it provides additional job opportunities

along with the additional production of energy. Thus it is evident that there are many other avenues that need to be explored and supported by the Government (Both the State and the Center) to see that the livelihood and economic development issues in the region are addressed.

12. The recent Tsunami has also added to the woes of the fishermen, many of whom lost their boats and fishing gear. The return to normalcy is at a slow pace. The fishing community also has to now live with the annual ban on fishing which lasts over 45 days as a part of the fish conservation programme. There are other social issues related with such inevitable ban which need to be addressed. The men folk are jobless during the lay off period and the women are the ones who are subjected to untold misery while maintaining a house as well as jobless husbands who take to drinking during the enforced ban on non fishing days. There have been some efforts to help the women to create self help groups but there is a greater need for both NGOs, women empowerment groups and the State machinery to come together to address this very important humane issue.

Environmental Issues

13**.** The areas of Gulf of Mannar and areas of Palk Bay have been designated as marine bio spheres and as such the environmentalists are quick to point out that the area is eco sensitive and as such are opposed to the idea of dredging a canal which passes through these areas. The detailed study by National Environmental Engineering Research Institute (NEERI) located at Nagpur has concluded that the project is feasible with hardly any impact on the marine environment in the area. Those opposed to this say that not enough is known about the likely impact of such mega projects. The fear of what the Tsunami can do to alter the impact matrix in the region with a new topographic changes needs to be assessed by scientific studies along with simulation modules. We do have an agency at Pune known as the Central Water and Power Research Station (CWPRS) capable of replicating the ocean bed models on their modern computer systems and software that can simulate wave/tide patterns. The author visited this place on two occasions and is certain that they have the wherewithal to arrive at scientific conclusions about the tidal/current and other patterns post dredging and the likely impact on the coast etc., Most of the modern ports and infrastructural facilities close to the coast now a days is created only after a detailed study by this Institute.

14. The creation of an artificial reef should also help thwart the ill effects of a Tsunami. In addition to contributing to increased fish yield, the orientation of such a reef and the required length of an underwater wall of resistance, as it were could be established by the CWPRS. There is just one issue that merits attention on the issue of environmental protection. During the Oliver Ridley conservation programme on the East Coast of India, while the Coast Guard and the State Agencies along side the NGOs were enforcing strict fishing control close to the coast, many fishermen complained that while the species of Olive Ridley Turtles may be saved, many a children of the fisher folk would starve and even die if the poor fishermen are prevented from fishing due to conservation programmes. These only highlights the fact that while conservation is perhaps required, there is a requirement to get a total picture and see that all the loop holes are plugged to ensure that mitigation of human factors are not overlooked in the name of environmental or threatened species protection.

The Security Dimensions.

15. Having looked at the fishing problems and the environmental issues, the readers would now be prepared to look at the total picture and concentrate on the all important security dimensions for the countries involved. There is an important aspect of the LTTE thought process that would affect the manner in which business is conducted in the areas. The proposal of the LTTE for self governance has this aspect of according a de facto naval status to the Sea Tigers who control the seas. The Tsunami did cause a dent in the material holding and preparedness of the Sea Tigers though the extent to which it has impaired the fighting capability is unknown. With the proven capability and potential of the LTTE, they would have done everything possible to rebuild the Sea Wing of the LTTE and would have made good, material and manpower losses/ shortages. From the Indian point of view, there can be no concession on this count. The acceptance of this proposal would mean total control of the approaches to the Sri Lankan Coast from the Eastern and Northern approaches. This only would make it easier for the LTTE to legitimize its illegal activities over the sea. The IN or the ICG can not be dealing with two Navies from the Island Nation on security issues. Even Sri Lanka would be hardly interested in encouraging this proposal which portends danger to the maritime security dimensions.

16. It is hoped that the Defence agreement between the two countries would have addressed this issue and hopefully includes provisions for neutralizing the threats that may emanate to shipping and fishing in the area by which ever quarter.

17. There have been regular IBL meetings between the Sri Lankan Navy, the Indian Navy and the Indian Coast Guard on a regular basis where various issues including fishing violations, Refugee repatriation, drug peddling, smuggling, communications and other issues are discussed. The meetings are invariably held close to the IBL on either an Indian Vessel or a Sri Lankan vessel. The meetings have been highly productive and many issues have been addressed to bring about lasting solutions.

18. The shallow waters of Palk Bay and the presence of many uninhabited small Islands have encouraged smuggling and unlawful activities. With dwindling fish stock and increased curbs on the fishing activity around Kachativu and in Sri Lankan waters, many fishermen have been forced to seek alternate means of livelihood. Smuggling of Diesel, Petrol, Medicines and even drugs was an attractive proposition for many who found it difficult to make both ends meet. The topography and the knowledge of local waters make it easy for them to carry on the ancient traditions of their fore fathers who had undertaken many a boat journey to Talaimannar and other places in Sri Lanka. It is only that the description of the cargo carried was quite different to what was carried then. It did not matter what they carried as long as it was required on the other side. The Marine Forces on both sides were using craft that could not cope with all the areas of interest due to depth constraints. The introduction of two Hovercrafts in 2001 at Mandapam definitely made it easier for the areas to be kept under surveillance and for chasing offenders even in shallow waters or on the beach.

Hover Craft

19. The Naval Detachments along the TN Coast numbering seven in number, the two Coast Guard Stations one each in Gulf of Mannar (Tuticorin) and Palk Bay (Mandapam), the Naval Air Station (Ramnad) are all engaged in the Operation code named "Tasha". In addition, there are regular patrols by the Coast Guard Dorniers operating from Chennai and staging through Ramnad as required.

There have also been proposals for joint patrolling along the IBL to prevent the fishermen from crossing over to each others side. Some analysts have suggested that the issue of joint patrols should be only considered only after the issue of livelihood of the TN fishermen is addressed. Any premature initiation of this process, they feel would be counter productive as it is the Indian fishermen who would be hurt by the joint patrols (Obviously, as there number is much larger than the Sri Lankan fishermen who cross over to Indian side) .The fears and apprehensions of some of the fishermen is also related to the canal that will permanently prevent them from crossing over to the other side of IBL which is possible now. But with the continuous movement of Vessels and the likely patrols by Marine Security Forces, the IBL would really be a problem for the fishermen who are used to violating the IBL on either side.

Conclusion and Recommendations.

20. It is clear that the security issues in the Palk Bay are quite complex, inter related and need very careful examination both by the Center and the State Government. There can not be any exclusive handling of a particular issue with out consideration to other issues which are equally important. The most important issue is definitely that of fishing security, which has affected the livelihood of the local fishermen. There has been lack of cohesiveness in the approach to solving this age old problem of the Tamil fishermen. The issue is politicized even with in Tamil Nadu, with the two major political parties tending to take sides which necessarily do not help the fishermen. It is only when the State and the Center sink their differences and work together, can a lasting solution be found.

21. Setusamudram will definitely figure in various discussions not only in the local press and media but also in the Island Nation. There would be a need for concerted effort by the UPA Government to allay fears and be open about its findings. The NEERI report and any other report on the project could be made public and relevant portions handed over to parties likely to be affected by the implementation for detailed analysis.

22. The security forces on both sides have their jobs cut out in ensuring the safe passage of vessels through the Canal. In addition, the Coast Guard as well as the Coastal District Authorities would need to have their contingencies in place for combating pollution /oil spills and other accidents which would cause irreparable damage to the marine biosphere if not handled properly. There would be a need to lay down the minimum standards of onboard hygiene /pollution prevention apparatus / Machinery emission etc. Mechanisms for Stringent monitoring of vessels plying for compliance with the Entry /Exit rules for the Canal would need to be in place even prior to the first vessel is cleared to enter the Setu canal.

23. Palk Bay and the Setusamudram Canal are both important to us strategically. Prima facie, there are a lot of advantages that the canal offers to Peninsular India and would facilitate economic growth in the under developed Districts of Tamil Nadu. The impact on related security issues definitely would need to be assessed and constantly reviewed to ensure that the Security Forces are pro active and have their Operational and Contingency plans in place simultaneous to the commissioning of the prestigious canal.

(The author is an alumni of both the Defence Services Staff College and the College of Naval Warfare (CNW). He was formally the Regional Commander of the Coast Guard Region East prior to his retirement. During his naval service, He commanded two naval air stations, a warship and held many important staff and planning appointments both ashore and afloat. He was also on the faculty of the CNW for over two years .His email address is vasadri@yahoo.com)

http://www.saag.org/%5Cpapers14%5Cpaper1355.html

Setusamuderam Project: Reasons for the Construction of the Canal and its Economic & Environmental Impact on Sri Lanka

by Donald Jayantha Gnanakone

The past three months has seen such a flurry of activity and controversy never seen before in Sri Lanka, since the signing of the Indo-Sri Lanka Pact by Rajiv Gandhi and J.R.Jayawardene. This would have sealed the fate of Srilanka in terms of Indian dominance 17 years ago if not for the brave Srilankans who had the courage of their convictions not only to oppose the treaty, but also to defend the sovereignty of the nation by fighting the foreign military presence.

It is no mean achievement to have stood up to the second largest army in the world, and the largest democracy, and defeat them on our soil. At that time many openly opposed the treaty because it was an exercise to demonstrate and satisfy the geopolitical need and greed of India. Several clauses in the treaty, which for months was kept secret, clearly demonstrated the designs India had on the Port of Trincomalee in particular and other ports and airports in the Northeast in general. Most of the experts have eloquently highlighted the havoc this canal would wreck on the environment, flora and fauna of not only the Gulf of Mannar, but also the entire Bay of Mannar, and Western coastline, from Puttlam to Colombo. Fertile fishing grounds in Mannar, Puttlam, Chilaw, and Negombo would be totally destroyed.

Other marine related damages have been illustrated in great detail, which would have an impact not only on about 50,000 Sri Lankan fishermen, but others connected with the fishing industry, resulting in substantial unemployment or underemployment contributing to poverty. Sri Lanka will have to increase the amount of fish imported to the country at great expense. The GOM is 275 km wide and 160 km long. This would be an ECOSIDE of the environment. Environmental organizations and recognized NGO's such as Manitham India, Eco Law, EFL, Green Peace movement are carefully studying the impacts of the SS canal projects and course of actions.

The affects on Agriculture, in the Northern Province is also a major concern, as the dredging would have a catastrophic effect on the water table, and increasing the salinity content of the drinking and irrigational water. This would have a drastic economic factor, destroying the livelihood of many farmers. Both these negative impacts would have a serious effect on the production of food, and marine products,

thereby affecting the GDP of the country as well as increasing the unemployment especially in related activities. The lobbyist who protested the Norichola i Coal projects are strangely silent either due to ignorance of the consequential damages, and or being silenced by the Indian or UNP lobbies.

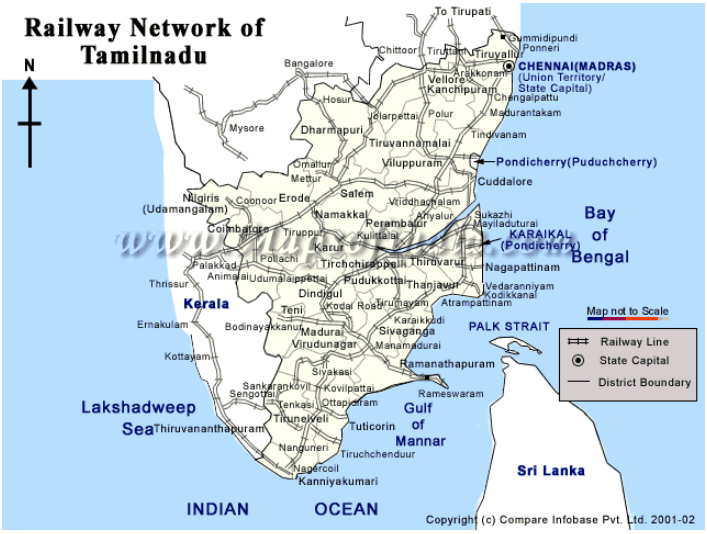
The potential damage to the Northern, and Western coastline due to a marine accident, or general pollution on a daily basis is also a serious concern. This also would have an effect very detrimental to our beaches, including sea erosion and pollution. The sad part of all this is that politicians and officials in power today in Colombo, who could make a positive impact to protect Sri Lanka, would be dead and gone or retired, when the serious damages are impacting Sri Lanka.

85 per cent of the transshipment cargo handled in the Port of Colombo is Indian container business. With the construction of the canal and development of the several ports in both the East and West coasts of India as container ports, the port of Colombo will most likely loose a major part of that business, which would have a drastic affect on the economics of the port of Colombo. Instead of being a hub port, Colombo would become a feeder port for both export and import containers, with the development of the Ports of Vallarpadam in Kerala, and Tuticorin and Chennai in Tamil Nadu. Port of Singapore Authority (PSA) has been contracted, quietly managing the container operations in Tuticorin. We confidentially learn that PSA are getting ready for some major expansion in the next 4-5 years no sooner the canal project begins. The port of Chennai, Vizagapattnam and Calcutta are making serious efforts in modernizing, in order to have direct or feeder services to the Far East or feeder services to Singapore for their container cargo. India would bypass Colombo to transship the containers, and there is no other container port conveniently located in the eastern seaboard of India or the Bay of Bengal, other than Trincomalee, which is in the same condition of development since independence.

It is crystal clear that no prudent financiers would bank roll the huge Hambantota or Galle project, as the return on investment would be a great risk. As a matter of fact with or without a canal these two projects have been an illusion in the minds of politicians who have fought ferociously for the Southern Singhala vote. These are what one would call the "Pork BELLY Projects" in the US congressional terms. Hambantota project is like the " reinvention of the wheel" when Sri Lanka within it's own territory locates the largest unused natural harbor in the world. Trincomalee is not only blessed with excellent deep-port area, but thousands of acres of adjoining hinterland, which is presently unused, and is ideal for warehousing, storage of containers, and other shipping activities. Above all the disciplined and hard working human resources far exceeds the competition any nation in Asia could put forward.

The container business Colombo could potentially loose could easily be recuperated and captured by Sri Lanka having a second container port within months, at 20 per cent of the cost of recreating a new harbor on any coastline. 3 consecutive maritime nations for centuries from 1500 AD, never considered Hambantota as a harbor. The Portuguese, Dutch, British, and the French, used only Galle and Trincomalee as their ports, and fought many battles with each other for the ownership and use of the port. The British had the best use of the Trincomalee Port for nearly 150 years, especially during the Second World War, when the entire British Navy in the Indian Ocean could be accommodated. Trinco became the headquarters of the British

Armed forces under Lord Mount-batten. If the private investors wish to develop the port of Galle or Hambantota they should be permitted to do so without risking the 20 million Srilankans meager resources.



This paper is not designed to condemn one port, and praise the virtues of the other. This is about the 21st century geo-politics, sovereignty of Sri Lanka, and commercial viability, prosperity, territorial integrity and independence of Sri Lanka as a nation. Most of us have not yet comprehended the true reasons behind the SS Canal project suddenly sprung on Tamil Nadu to their great delight, and Sri Lanka to their great shock and awe. There are no benefits to Sri Lanka except some misled politicians daydreams, of the land bridge across the Gulf of Mannar.

The Indian authorities are covertly buying the support of University Professors to sing the praise to the high heavens of disused little ports in the North would benefit commercially from the canal. These individuals have no idea whatsoever about international shipping or commerce, but they are simply "Singing for their Supper", competing with other Tamil politicians in Sri Lanka who themselves are well known to sing for their own supper in Colombo. One cannot take them seriously and there would be many others coming out of the woodwork to sing their support of the Indian project. The Tamil foreign Minister of Srilanka is heading the SSCP committee appointed by the cabinet, as well as being the most important adviser of the Sri Lankan President.

India, with such a huge economy, never provides cabinet approval so fast for spending a billion dollars without proper feasibility reports completed, including the environmental impact report. This project would be the only project where over a billion dollars has been approved, and the cabinet is now awaiting many reports to ratify the project. Even prior to that, the nodal agency has been formed and head quartered in Chennai, and the canvassing among Tamil Nadu politicians as to who will head the project under the DMK Minister of shipping has begun. Contrary to the popular belief, this project is neither a commercially prudent one, nor it is to placate the passions of Tamil Nadu politicians headed by Mr. Kaunanidhi, Vaiko Gopalaswamy, T R Baalu, Chidamparam and several others including Chief Minister Jayalaltha.

It is hilarious to see all of them claiming credit for the project to win the hearts and minds of the Tamil Nadu voters, despite the fact that half a million fisherman might be seriously impacted by this project and would become unemployed, or under employed. The other quarter million people affected due to the indirect ramifications of the fishing industry affected, does not concern the Tamil Nadu authorities, and Delhi. Their private arguments is that the net loss of employment would be mitigated

with the increase in jobs with the shipping and canal project, but the real benefit is to the security and defense of India. To understand and comprehend the geopolitical and military implications of the GOI it is paramount to study recent public statements, and historical facts. Take a look of what the Naval Chief of staff Admiral Arun Prakash recently said.

The 21st century is going to be a maritime century.'' because of the imperatives of globalization and the consequent growth of sea-borne trade, of energy security and outgrowing dependence on maritime resources. Admiral Arun Prakash added that "while we have no wish to dominate anyone, we need to ensure that nobody else is in a position to dictate terms to us.'' Do we trust or believe him ? He, however, pointed out that a capable Navy was only one element of a maritime power. A large merchant fleet, modern ports with good infrastructure, a vibrant, efficient and self-reliant shipbuilding industry along with its supporting technical staff were vital ingredients needed for the emergence of the nation as a maritime power.

India built super computers when America prohibited sale of critical technology. It developed homegrown nuclear bomb, telecom satellites, Preethvi and Agni missiles when embargos and prohibition was the order of the day.

Quoting from a lengthy recent report from the prestigious Tamil net editor, on the strategic, geopolitical and military policies of India, is as follows.

"Advocating that the "Indian Ocean must remain truly Indian", the architect of the Indian Naval doctrine Panikkar and K B Vaidya a popular Indian author, in his work - 'The Naval Defence of India'. State "Even if we do not rule the waves of all the five oceans of the world, we must at least rule the waves of the Indian Ocean". They further emphasized that India must be supreme and undisputed power over the waters of the Indian Ocean. He argued for the creation of three self-sufficient and full-fledged fleets to be stationed at the Andamans in the Bay of Bengal, at Trincomalee in Ceylon and at Mauritius guarding the western and eastern approaches to the Indian Ocean in the early years.

However, until the seventies India was largely pre-occupied with the defense and security of its mainland and invested little in naval power. Two events at the time jolted defense planners in Delhi to take a more serious view of the Indian Ocean neighborhood in terms of India's security.

One was the acquisition of Diego Garcia by the US and the other was America's decision to send the aircraft carrier USS Enterprise to the Bay of Bengal in December 1971 in a show of support for Pakistan during the Bangladesh war.

India, with the support of its ally USSR, began a campaign for a nuclear free Indian Ocean. The campaign was aimed at preventing the US from developing Diego Garcia into a major base for nuclear weapons. Sri Lanka supported India during the Non Aligned Movement summit in Colombo in 1976 to adopt a resolution criticizing the US for developing a nuclear weapons base in Diego Garcia.

However, New Delhi's naval ambitions remained somewhat muted until the fall of the Soviet Union, which had provided a safety umbrella to India in the larger Indian Ocean theatre. But today India feels that it has to defend itself on its own. In recent years the importance of sea-lane security has become paramount in the thinking of

Indian naval strategists. New Delhi's plans for rapid economic growth depended of safe, uninterrupted supply of energy to feed the country's burgeoning industry and fast expanding automobile market.

The Strategic Defense Review of Indian Navy, published in 1998, stipulated four specific tasks for the immediate future:

1) Sea based deterrence

2) Economic and Energy security

3) Forward presence and

4) Naval diplomacy. The four tasks are interconnected.

New Delhi has been able to postpone massive investments in a blue water navy by developing the natural forward defenses in either side of peninsular India - in the Lakshadweep Islands in the Arabian Sea and the Andaman and Nicobar Islands in the Bay of Bengal. The Malacca Straits is the second busiest sea-lane in the world. And most of the ships approach the Straits through the 10-degree channel, which bisects the Andaman Islands from the Great Nicobar Islands. Therefore Delhi has made huge investments in developing its forward military presence on the islands as it gives it dominance over the second busiest sea-lane choke point. The strategic importance of the islands has been a historical fact.

During negotiations for India's independence, the Muslim League demanded that the Andaman Islands should be an integral part of Pakistan for geographical and strategic reasons. It must also be pointed out that sections in the British Defense establishment wanted the islands to be detached from India. They wanted the Andaman and Nicobar Islands to be made into a separate Crown Colony, which would, in turn, safeguard the strategic interests of the far-flung British Empire. However, this did not materialize due to stout opposition from Nehru who had close friendship and support of both the Mountbatten’s on the matter. The responsibility for the security of the Bay of Bengal, including Andaman and Nicobar Islands, and also the waters extending to the six littoral states in the region - Bangladesh, Myanmar, Thailand, Malaysia, Indonesia and Sri Lanka - was vested for a long time with the Indian Navy's Eastern Naval Command based in Visakhapatnam.

In August 1998, New Delhi decided to establish a Far Eastern Marine Command at Port Blair in Andaman, independent of operational control from Visakhapatnam. The idea was modified in favor of a Joint Service Command in 2001. The Command will be headed by the three Services in rotation and will function directly under the Chief of Defense Staff of the Indian armed forces. There are plans in Delhi to develop Port Blair as a strategic international trade center and for building an oil terminal and trans- shipment port in Campal Bay (Great Nicobar islands) to cater to increasing maritime trade in the region.

India, while consolidating its forward position and grip on the entrance of the Malacca Strait, ensured that no external power could dominate the vital sea-lane further southwest in the Bay of Bengal by signing the Indo-Sri Lanka Agreement (ISLA)in 1987. The Letters of Exchange in the ISLA preclude anyone except India

from using Trincomalee - a strategic port necessary for dominating the sea-lanes that emanate from the Malacca choke point. India is insisting on similar conditions to provide 500 million Indian rupees financial assistance to repair and reconstruct the Jaffna airport. (Palaly). According to Delhi watchers this condition was not a surprise to anyone.

However, China since the late eighties quietly moved to develop safe line of energy supply from the Persian Gulf to the South China Sea set off alarm bells in Delhi. India appears to fear this line of supply defined by the strategic facilities that China has developed along this route could give Beijing naval advantage in the region. This concern should be seen in the light of the fact that China has developed naval facilities on the Greater Cocos Island, which is part of the Andaman Archipelago but belongs to Myanmar.

China has built a naval base in Bandar Abbas on Iran's coast on the northern side of the Hormuz Strait in the Persian Gulf. Further east on the Pakistan coast China is building a dual-purpose naval facility in Gwador. The next stop on this line of supply are Maldives and Sri Lanka.

China negotiated a deal with Maldives from 1999 to build a base in Marao one of the largest islands of the 1192 atolls that make up Maldives. It lies 40 kilometers from Male. The base deal was finalized after two years of negotiations when Chinese PM Zhu Rongji visited Male on 17 May 2001 on his four nations South Asian tour.

The Marao base will not be operational until 2010.Beijing will use Marao Island for 25 years on fee-paying lease. An Indian defense reporter, sounding the alarm at the time, wrote: "Coral islands make fine submarine pens. The People's Liberation Army - Navy (PLAN) proposes to deploy nuclear submarines fitted with sea launched Dong Feng 44 missiles and ballistic missiles in Marao.

The dangers posed by the SSC project, clearly violates the mandates of UN Law of Sea Convention, 1982. Which would be at issue if Sri Lanka decides to exercise its sovereignty and territorial integrity, as it keeps regularly talking about it when it comes to the negotiations with the Tamils.

- Part II, Section 2, Article 6 deals with Reefs, Article 10 speaks about Bays.- Part V, Article 61 - Conservation of the living resources, Article 64 - Highly Migratory species.- Part V, Article - 65 and Part VII, Section 2, Article 120 also speaks on Marine Mammals.- Part VII, Section 2, Article 116 speaks on fishing rights.

- - Part XI, Section 2, Article 145 and Article 237 emphasizing that protection of Marine Environment is obligatory. In the same part Article 146 urges the need for protecting the Human life, Article 149 and Part XVI, Article 303 both deals with Archaeological and historical objects.- Part XIII, Section 3, Article 254 dealt with Rights of neighboring land-locked and geographically disadvantaged States. Sri Lankan legal experts in maritime law need to provide the necessary opinion to the GOSL committee appointed by the President.

- Part XI, Article 169 - before implementation [of the SSCP], consultation should be held with Independent International NGO's on this project for perfect clearance in all forms and terms. On these criteria, Sri Lanka should insist on 'Independent

International Experts' to be permitted to provide a fair report on SSCP, after careful study. (MANITHAM REPORT)

On the Energy security, India has already moved into Trincomalee, and captured the 99 oil storage tanks, hundreds of acres of strategic land, and part of the port without firing a single shot. Details of the lease of the oil tanks are still shrouded with mystery, secrecy and payments for the lease, if any remains undisclosed. Now India wants to make Trincomalee a bunkering hub, selling retail bunkers to foreign ships, fishing trawlers, and servicing their own expanding navy in perpetuity pro bono. In other words India already has a naval base in Trincomalee to be utilized at their discretion without any interference from the GOSL.

This would be in direct competition with Hambantota if ever the project begins and more significantly is ever completed. Would India promote and assist the Hambantota project in any manner when the GOI owned LIOC has vested commercial interest in the bunkering and other facilities in Trincomalee Port? It would be a total disadvantage for the SLPA or some private operator to compete in the bunkering business with a giant like GOI owned LIOC operating from the Port of Trincomalee. Large vessels using the SSC proceeding to the Bay of Bengal, Europe or Far East would have the opportunity to Bunker in Trincomallee, and if cargo handling facilities such as cranes, barges and warehouses are available even use the port for it’s cargo operations in the future.

Another hidden agenda of the SSCP is the potential of Oil and Gas being available for exploration in the Gulf of Mannar. With the oil prices rising daily and possibly reaching $60 per barrel before the year-ends, the gulf is ready to be explored and exploited as a future source of energy provider. With all the equipment available after the dredging just a few miles away, the bio diversity destroyed, Cauvery basin already generating oil, there won’t be any hurdles to overcome for the Indians to explore for energy in that region.

GOI would ensure foreign oil companies have no chance in bidding for exploration rights. Over the years the oil revenue itself would pay for the entire cost of the SSCP, and most of the benefit will remain in India with Sri Lanka or the Tamil Province of Northeast (Whatever it is named in the future) receiving hardly any benefit in the event of windfall oil profits. There is every intention of Delhi to deprive, deny, and cheat any and all benefit from oil and gas revenues, which legitimately belongs to the people of that region and Srilanka. India is determined to keep the European and American oil companies out of Sri Lanka, and secure the maximum benefits out of the future oil and gas finds in the Gulf of Mannar. India would only increase it’s stranglehold on Sri Lanka’s economy in general and the Energy sector in particular.

Therefore the underlying reasons for the SSCP is the military advantage, geopolitical need and greed, and energy security which all fits into the Indian Naval doctrine carefully planned, clearly thought, and systematically documented many years ago. Now it is being executed with surgical precision and undue haste.

It is crystal clear that Sri Lanka has been caught in deep slumber. The Delhi and Chennai high commission are guilty of not being alert to these moves, which has been well known in both Chennai and Delhi political circles. Sri Lanka’s Ambassador in Delhi has been there for several years and is a veteran. Sri Lanka should show

some independence from India but due to poor economic policies and lack of liquid assets has become totally dependent on India. This would only ruin the future of Sri Lanka, but making it nothing but a welfare state of India.

Come hell or high water, India is determined to bulldoze this project down Sri Lanka's slender throat. Delhi will receive all the support from Tamil Nadu politicians, who will be prepared to suppress any dissent, as well as they hope to receive popularity among the voters. The complexity of shipping and return on the $2 Billion investment is not a priority for India. Whether small Islands in the North West of Sri Lanka submerges under water, the North becomes saline, Fishermen and Farmers loose their livelihood, several others loosing their employment, Colombo port loosing it's major business and importance, is no concern to India.

It is essential to highlight to India the much hyped saving of time and fuel is only a fallacy. The 21st century ships averaging 15 Knots, will take about 24-28 hours to circumnavigate Sri Lanka from Bombay or the Persian Gulf. From the Malacca straights it would be much less. DMK Minister of Shipping and other Indian journalist fail to comprehend that transiting the SetuSamuderam Canal would involve time at very slow speeds, and would require additional services such as pilotage, tugs, as well as expenses such as canal transit dues, tonnage dues, pilotage fees, and Shipping agency fees. During Northeast monsoon the delays for transiting the canal could be substantial. That bay is also subject to cyclonic effects such as in 1964 when Dhanushkodi was submerged under the ocean and remains submerged. Constant dredging of the canal would be necessary at additional costs to India.

Maritime accidents resulting in serious pollution is a distinct possibility. If war breaks out in Sri Lanka or India in the future ships could come under deliberate attack from the warring parties, or accidental damages could occur to merchant ships from outside naval forces or missiles. This would increase further the cost of Insurance for ships transiting the canal.

The time saved might be very minimal, or even delays could cause more time utilized, additional costs for ship owners, ships prone to accidents transiting the canal with other ships, fishing vessels, or grounding. Strikes or labor unrest, which India is usually troubled with, and weather related delays, also could pose a problem.

Contrary to popular belief the average size of tankers transporting crude oil from the Persian Gulf to the Far East or US West coast are 150,000 tons. The average size of Container Mother vessels even now is over 40,000 tons. The next generation container vessels would be over 60,000 tons. None of these ships would be able to transit the Setusamuderam Canal, which only a few in Delhi are aware of but decided to keep it under wraps until the project gets into full gear.

The port of Trincomalee without any present or future dredging, expensive breakwaters like that is needed in Tuticorin, Colombo or Hambantota can accommodate easily what the 21st century ship builders can accomplish or what the shipping trade requires.

Therefore in terms of cargo volume quite a substantial portion of the cargo will be forced to bypass the canal, as well as Colombo and Hambantota. Only smaller ships going to the Bay of Bengal, where most of the ports are "River Ports" with severe

draft and tide restrictions would transit the canal, albeit without saving of time or money. It is incumbent upon India to carefully study how prudent this 1 or 2 Billion dollars are going to be for commercial reasons. But if the purpose of the canal is to build a safe haven Naval base, surrounded by two landmasses, as well as a sub marine and missile base for the 21st century then the SSCP becomes a priceless project. That is India's prerogative, but should not damage or cause any damage to Sri Lanka and it's flora, fauna or it's people. It also should not cause havoc to the ocean or seabed in the Gulf of Mannar or the Indian Ocean. That violates the Law of the Sea Convention rules, as well as neighborly conduct. In the 21st century no nation can disregard International treaties and environmental issues even if land or water areas are within their own territorial borders.

Srilanka needs to question itself what can be done to counter the negative impact and possible disastrous economic consequences of the SSCP. As a matter of fact with Defense pacts being considered, and the possibility of another war with the Tamils in the near future, Sri Lanka might hand over the defense duties and responsibilities once again to India soon. Our only answer is to develop the ports and airports of Trincomalee, and KKS independent of India.

Commence and complete a peace agreement with the Tamils with the establishment of the ISGA as soon as possible. If there is Peace with the Tamils, investment in Billions of dollars would pour in to Trincomalee and the rest of Sri Lanka, for the Free Trade Zones, and Industrial Zones. Over 100 hundred-tourist hotels can be constructed with the establishment of the ISGA and dawning of "real" peace in the Northeast.

Elevated "toll" coastal highways can be constructed with minimum investment and expenditure to the GOSL. Seafood production, Commercial Agriculture and Dairy production will increase significantly, contributing to the increase in the GDP, and prosperity. KKS can produce 2 million tons of cement with the lime stone raw materials readily available in Jaffna, thus saving that quantity of cement being imported from India and generating employment both direct and indirect, and related cement based industries.

GOSL cannot be afraid of the development of Trincomalee. The two most successful industries in Sri Lanka are located in the port of Trinco. The chauvinistic and racist argument that the Tamils will get all the jobs would prove fatally flawed. If Prima Singapore or Mitsui's Tokyo Cement were contacted they would confirm 75 per cent of the employees are Singhalese and Muslims. With such development in the Trincomalee district the main Singhalese parties would essentially increase their representation in parliament by 100 per cent. The past 20 years the Tamil MP's in the Trinco district has been a maximum of two.

KKS can immediately commence operations and produce 2 million tons of cement with their own raw material. A coal generating plant could be set up in both KKS and Trincomalee to generate the power requirements once the ISGA is established. International communication could be improved in the north and the east very quickly. All the bulk cement facilities in the port of Colombo can be easily and economically handled in Trinco thus freeing those berths and space for container operations. Similarly nearly a million tons of break bulk cargo can be handled in Trinco instead of Colombo. SLPA will earn more money from the Trinco operations

than with P and O's SAGT in QEQ without loosing it's investment of 30 years, as well as loss of income due to SAGT's arrival.

With the second International Airport there would be a true National Airline once again emerging, as well as increase in domestic carriers, and a true hub airport to service the region. Both airport and port would not compete with Colombo, as many are paranoid and fearful about, but can compliment each other and expand the business. Colombo streets would become less congested and polluted, and a lot of warehouse space, Container freight Station space would become quickly available for better revenue generating projects.

The treasury or government agencies (SLPA or SLAA) can maintain part ownership, as well as there would be participation from the big business groups, that would ensure the profits remaining in Srilanka. With commercial trawling based from Point Pedro, Trincomalee and Mullaitheevu, export of marine products both by Air, and Sea would increase many fold. Even cruise ships would soon call Trincomalee, with duty free complexes like in Singapore and Dubai being established for both Indian and other tourist.

Our own regional cruise ships can operate to cater for the millions of Indian, Maldives and domestic tourist. Ferries can operate between Srilanaka and India. Air sea packages would be made available like in the carribean, between Southern India and Trincomalee. Ferries would regularly operate in addition to RO/RO vessels and container feeder vessels if necessary.

Foreign investment from the Tamil Diaspora also would be guaranteed if the Trincomalee and KKS districts were permitted to be developed by the private sector. Billionaire investors like Raj Rajaratnam, Sanjay Kumar (Part owner of Computer associates) both Tamil expatriates and many other millionaires, as well as South Asian companies would be encouraged to invest more in Sri lanka.

The former Prime Minister permitted a group of US based consortium to commence a feasibility study to develop Trincomalee last year. This group in association with a group of Colombo based investors had already obtained the blessings of the LTTE leadership, for the project, which the GOSL and the US embassy was aware of. This same group had several discussions with the GOSL on the second International Airport to be located in Trincomalee providing numerous valid reasons.

Unfortunately the committee, which was set up to select the location, did not even consider the Trincomalee location as an alternative for unknown or unexplained reasons. Ratna Seevaratnam a retired Tamil businessman headed this committee with three other Tamils with whom private discussions were held. He did not even inform the other members of the committee about the discussions, communications, and correspondence. The political decision was made by the GOSL and UNP to locate the second airport in the South.

There was also an experienced Australian based organization in association with a British group recently offered a plan to develop Trincomalee as a BOI project. This partially owned Sri Lankan group is anxiously awaiting a response to this offer for the past few months. Both these groups are prepared to pool their resources collectively to commence the project and make the development a reality. The projected investment is around $500 million dollars over 5-7 years period with 50,000

employment to the district of Trincomalee and adjoining districts such as Pollonoruwa and Anuradhapura. Trincomalee would become the Hokgkong or Singapore of South Asia,the Dubai of the Persian Gulf or the Switzerland or Europe. We lost that opportunity in 1977 under J R Jayawardene and the civil war of 1983.

If not, all the investment would move into Tamil Nadu, as the industrial zones similar to China, would be created there. Shipping and Aviation opportunities would increase many hundred folds in Tamil Nadu. Trincomalee and KKS would only become an Indian naval base, sub marine and missile base and part of the Southern command of the Indian military in the near future. The FTA with India has increased the trade in balance in favor of India in a significant manner. Small industries would be wiped out in Sri Lanka if we do not change our policies or regain our independence from India.

I dread to imagine the consequences and ramifications of the failure of the Peace process. Without any development the LTTE would have failed to deliver any peace dividends to the Tamils. Due to myopic and racially motivated, chauvinistic policies of the GOSL, ports in Trinco, Point Pedro, Mannar and KKS would remain undeveloped and under the choke hold of Indian and Sri Lankan military forces.

The Tamils and their sole representatives would have no alternative but to abandon the mistakes of the LTTE negotiating team in Bangkok in September 2002, and fight for the liberation of it's people and territory. Sri Lanka would plunge into another ferocious and vicious civil war, despite any defense agreement with India or International safety net. Due to the security situation even India would be forced to postpone it's activity in Trincomalee and KKS, as well as any oil exploration in the Gulf of Mannar. The future of the SSCP will also be in jeopardy, as the Palk Bay would become as area of conflict.

The security situation in Colombo would become untenable, the safety of VIP's insecure and uncertain, insurance premiums skyrocketing and the stock market diving to new lows. There would be minimal FDI, real estate market depreciating, and tourism vanishing with only empty hotel rooms or damaged hotels and buildings to show.

The world has witnessed what is happening in Iraq, with the most powerful military in the world. The death, injuries, and destruction are tearing the American nation apart. Sri Lanka has seen and experienced such horrible conditions in the past 21 years. Only in the past 3 years that Sri Lanka has experienced a steady peace conditions, thanks to the ceasefire agreement signed by the UNP and the LTTE. Thankfully the ceasefire is still holding under trying conditions despite the change in government in April 2004. Indian military would not get suckered again like in 1987 to fight GOSL's battles even with a defense agreement being signed. The Indian politicians have learnt from their previous mistakes and experience. Sonia Gandhi or J N Dixit who have personally experienced the worst of the Sri Lankan war would not permit the past mistakes to occur again even if "revenge" motivates them.

For the sake of Peace and Prosperity to Sri Lanka, and to safeguard the sovereignty and integrity I would urge the GOSL to carefully consider this document in the spirit it is written. My only desire is overwhelmingly to see a permanent peace prevailing in Sri Lanka. We cannot permit Sri Lanka to turn into a Biafra.

In conclusion if GOSL are unable to prevent the SSCP they can at least negotiate some compensation for the affected civilians and regions, and ensure protection of the environment and prosperity of the nation. Sufficient safeguards, developmental plan for the next 10 years, as well as compensatory device should be set in motion to ensure the provinces and people who are affected should be adequately compensated financially for their losses and other damages. Some of the suggestions are as follows,

1. Compensation Insurance Fund for the Fisherman if they loose their income and livelihood. This fund should be used to indirect beneficiaries of all those who are affected by the fisheries. Alternate vocational training for them and educational facilities especially in the Mannar district and the Northern Island.

2. Similar fund for the farmers. Additionally a desalinity plant converting Sea Water to Fresh water in Point Pedro area one fourth the size of what India is building in Madras. Funds for rain water harnessing and irrigation tanks in the Killinochi, Manaar, and Mulaitheevu district, as well as the Thondamanaar causeway to be allocated by GOI and GOSL and other donor nations.

3. Some compensation Insurance fund for environmental damage, and pollution damage for the gulf of Mannar, and the Northern Beaches.

4. Funds to develop the Ports of KKS, Point Pedro, TalaiMannar, and Trincomalee for only commercial purposes in Aid, Grant, and loans. Not for any military purposes. (At least $200 Million dollars over 5 years).

5. New Airports in Trincomalee to be built as the Second International Airport in Sri Lanka. GOI, to fund by way of Aid, Grant, and loans at least 50%. The Airport to be used only for commercial purposes.

6. At least 3 Universities, 3 Junior colleges, and three vocational districts to be built in the most affected areas.

7. No naval bases to be built in and around the SSCP canal or neighboring areas. Sri Lanka should not be target, real or accidental in any missile or conventional war in the 21st century due to India's military activity.

8. If oil and gas is found in the Gulf of Mannar then GOI and GOSL should adequately compensate and ensure the province and the State equally share the benefits.

This way most of the potential losses, and fears could be addressed, including the losses to the Colombo port can be compensated by way of development of the Container and commercial port in Trincomalee, and other shipping activities in KKS and Point Pedro, Trinco and TalaiMannar which can be used as a Fisheries and Shipping harbor.

This way both India and Sri Lanka, can amicably resolve the SSCP problems, and keep the DMK, LTTE, and the Indian military planners backed by the US to keep China under check in the India Ocean power politics, under control.

Failing which Sri Lanka and the NE Province need to do whatever that is necessary to protect and promote the best interest of it's people, sovereignty, and territorial integrity of the nation in general, and NE province in particular. The KEY WORD here is CONSULTATION, CONSENSENSUS, COMPROMISE, and COOPERATION.

The Tamils are prepared, ready, willing and able. India should not bite the hand extended in friendship. DMK and Tamil Nadu cannot act selfishly only in the interest of the people of Tamil Nadu. They need to be fair, reasonable, and just with their immediate neighbors the Tamils of the North East Province.

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An overview of world thorium resources, incentives for further exploration and forecast for thorium requirements in the near future

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Abstract

Thorium occurs in association with uranium and rare earth elements in diverse rock types. It occurs as veins of thorite, uranothorite and monazite in granites, syenites and pegmatites. Monazite also occurs in quartz-pebble conglomerates, sandstones and fluviatile and beach placers. Thorium occurs along with REE in bastnaesite, in the carbonatites. Present knowledge of the thorium resources in the world is poor because of inadequate exploration efforts arising out of insignificant demand. But, with the increased interest shown by several countries in the development of Fast Breeder Reactors using thorium, it is expected that the demand will increase considerably by the turn of the century. The total known world reserves of Th in RAR category are estimated at about 1.16 million tonnes. About 31% of this (0.36 mt) is known to be available in the beach and inland placers of India. The possibility of finding primary occurrences in the alkaline and other acidic rocks is good, in India. The other countries having sizeable reserves are Brazil, Canada, China, Norway, U.S.S.R., U.S.A., Burma, Indonesia, Malaysia, Thailand, Turkey and Sri Lanka. Considering that the demand for thorium is likely to increase by the turn of this century, it is necessary that data collected so far, globally, is pooled and analysed to identify areas that hold good promise.

Reference:

Proceedings of a technical committee meeting on utilization of thorium-based nuclear fuel: current status and perspectives held in Vienna, 2-4 December 1985
International Atomic Energy Agency, Vienna (Austria)
IAEA-TECDOC--412, pp:8-21

http://hinduthought.googlepages.com/thoriumdeposits.pdf

The accumulation of thorium reserves of India is party attributed to the reworking of beachsands by seawaves (almost like a cyclotron or sieving operation to remove small stones from fresh husked paddy by women in India) given the nature of the ocean currents and the Rama Setu (Adam's bridge) acting as a barrier to the ocean currents inducing countercurrents. Views of Prof. Rajamanickam, geomorphologist and mineralogist: "The coast between Nagapattinam to Nagore, Nagore to Poompuhar, Colachal and Madras were the places where the strong impact from the Tsunami was noticed. These were also the places where a high order of ilmenites was found soon after the Tsunami. For example in the Nagore coast, the pre-Tsunami heavy mineral content of 14 per cent jumped to 70 per cent of ilmenites after the Tsunami."

http://soma-fish.net/stories.php?story=05/08/14/4004215

Monazite, a radioactive material, contains 3 to 7% thorium by weight. Ilmenite less radioactive, contains .05% thorium.
http://cat.inist.fr/?aModele=afficheN&cpsidt=3186552

Chavara mineral division, India Rare Earths Limited. Corporate office:
Plot No.1207,Veer Savakar Marg, Near Siddhi Vinayak Temple, Prabhadevi,Mumbai - 400 028 +91 22 24382042/ 24211630/ 24211851, 24220230 FAX +91 22 24220236 Major Activity : Mining and separation of Heavy Minerals like, Ilmenite, Rutile, Zircon, Sillimanite, Garnet and Monazite from beach sand. Also engaged in chemical processing of Monazite to yield Thorium compounds, Rare Earth Chlorides and Tri-Sodium Phosphate.

Dr. S. Suresh Kumar, Head Tel. No: (0476) 268 0701 – 05 Located 10 Km north of Kollam, 85 Km from Thiruvananthapuram capital of Kerala and 135 Km by road from Kochi is perhaps blessed with the best mineral sand deposit of the country.The plant operates on a mining area containing as high as 40% heavy minerals and extending over a length of 23 Km in the belt of Neendakara and Kayamkulam. The deposit is quite rich with respect to ilmenite, rutile and zircon and the mineral-ilmenite happens to be of weathered variety analyzing 60% TiO_2. The present annual production capacity of Chavara unit engaged in dry as well as wet (dredging/ up-gradation) mining and mineral separation stands at 1,54,000t of ilmenite, 9,500t of rutile, 14,000t of zircon and 7,000t of sillimanite. In addition the plant has facilities for annual production of ground zircon called zirflor (-45 micron) and microzir (1-3 micron) of the order of 6,000t and 500t respectively.
http://irel.gov.in/companydetails/Unit.htm

MANAVALAKURICHI (MK) MINERAL DIVISION:

Plant is situated 25 Kms north of Kanyakumari (Cape Comorin), the southern most tip of the Indian sub-continent. All weather major seaport Tuticorin and the nearest airport at Thiruvananthapuram are equidistant, about 65 kms from the plant site. Nagercoil at a distance of about 18 kms from the plant, is the closest major Railway station. MK plant annually produces about 90,000t ilmenite of 55%. TiO_2 grade, 3500t rutile and 10,000t zircon in addition to 3000t monazite and 10,000t garnet based primarily on beach washing supplied by fishermen of surrounding five villages. IREL has also mining lease of mineral rich areas wherein raw sand can be made available in large quantities through dredging operation. In addition to mining and minerals separation, the unit has a chemical plant to add value to zircon in the form of zircon frit and other zirconium based chemicals in limited quantities.

RARE EARTHS DIVISION (RED) Aluva:

Unlike the three units of IREL as described earlier, RED is an exclusively value adding chemical plant wherein the mineral monazite produced by MK, is chemically treated to separate thorium as hydroxide upgrade and rare earths in its composite chloride form. It is located on the banks of river Periyar at a distance of 12 Km by road from Kochi. This plant was made operational way back in 1952 to take on processing of 1400t of monazite every year. However over the years, the capacity of the plant was gradually augmented to treat about 3600t of monazite. Elaborate solvent extraction and ion exchange facilities were built up to produce individual R.E. oxides, like oxides of Ce, Nd, Pr and La in adequate purities. Today RED has built up large stock pile of impure thorium hydroxide upgrade associated with rare earths and unreacted

materials. Henceforth, RED proposes to treat this hydroxide upgrade rather than fresh monazite to convert thorium into pure oxalate and rare earth as two major fractions namely Ce oxide and Ce oxide free rare earth chloride.

http://irel.gov.in/companydetails/Unit.htm#MK

The total known world reservesof Thi nRA R category are estimated at about 1.16 million tonnes. About 31% of this (0.36 mt) is known to be available in the beach and inland placers of India…Prior to the second world war thorium was used widely in the manufacture of gas mantles, welding rods, refractories andin magnesium based alloys .Its use as fuel in nuclear energy, in spite of its limited demand as of now and low forecast, is gaining importance because of its transmutation to 233 u. Several countries like India, Russia, France and U.K. have shown considerable interest in the development of fast breeder reactors (FBR) anditisexpected thatbytheturnof this century someofthe countries would have started commissioning large capacity units…

Beach sands: Although monazite occurs associated with ilmenite and beach sands, skirting the entire Peninsular India, its economic concentration is confined to only some areas where suitable physiographic conditions exist.The west coast placers are essentially beachorbarrier deposits with development of dunes where aeolin action is prominent in dry months…

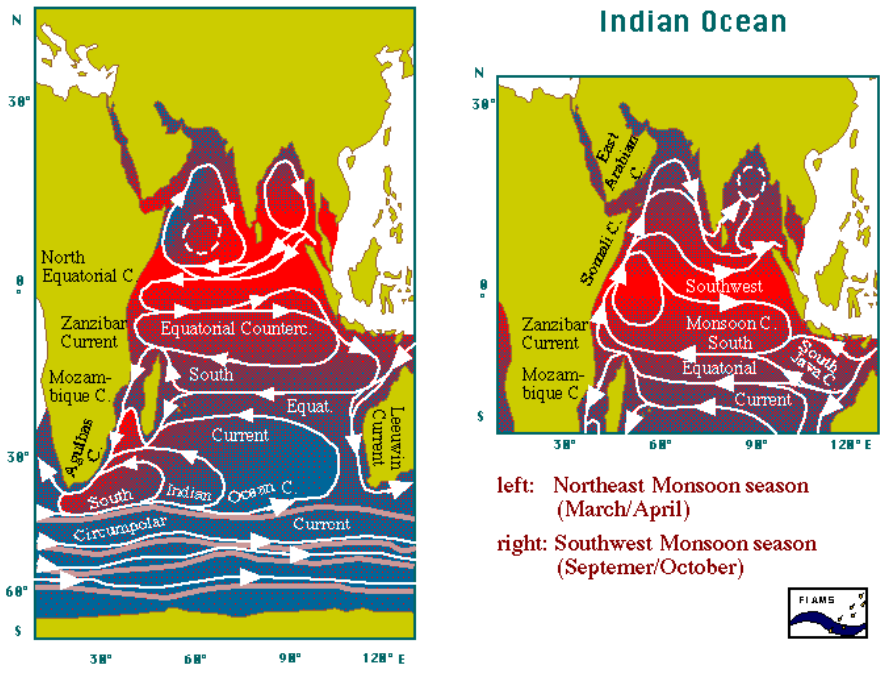
Origin of West Coast deposits: …The deposits are formed in four successive stages:(i) lateritisation of gneissic complexes, (ii) successive mountain uplift and simultaneous seaward shift of strand line., (iii) reworking
of the beach sands by sea waves, which rise often to a height of 3m.in 12s.period and (iv) littoral drift caused by the breaking of thewaves faraway from the shore and consequent northerly movement of lighter minerals along the reflected waves…

In Manavalakurchi, Tamil Nadu, the depositis formed by the "southerly tilt of the tip of the peninsula [9] aided by seasonal variation of sea currents, both in direction and magnitude [Udas, G.R.,Jayaram, K.M.V., Ramachandran, M and Sankaran,R.,Beach sand placer deposits of the world vs.
Indian deposits. Plant maintenance and import substitution.1978.35.] …

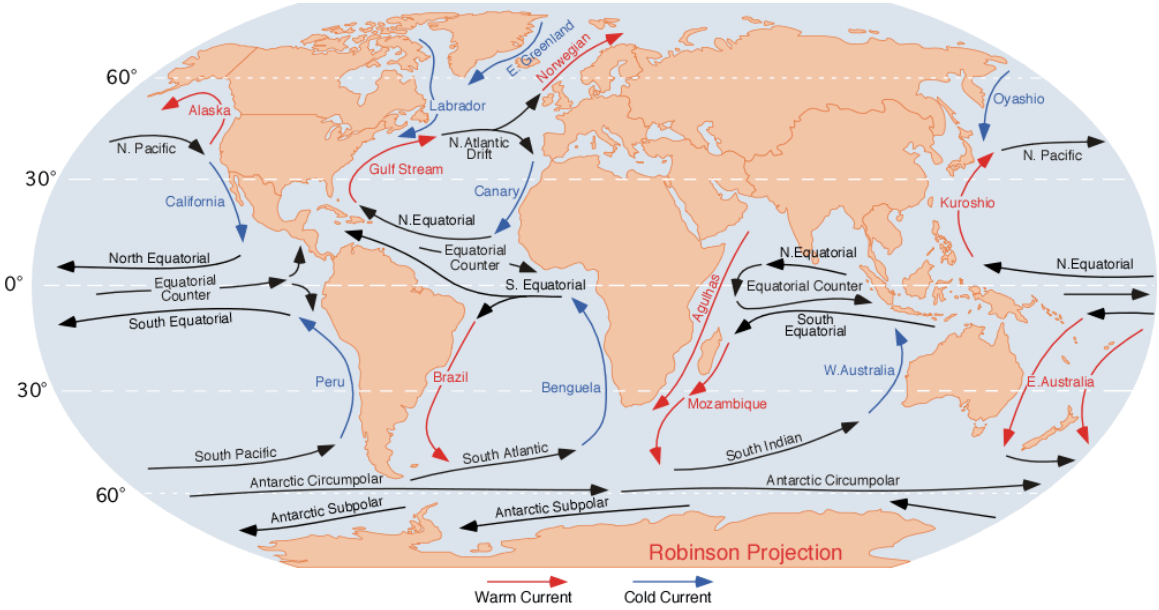
The reasonably assured resources of thorium in India, form about 31% of the world's estimated deposits.The reserves could have been several times more if systematic surveys are carried out…

http://www.iaea.org/inis/aws/fnss/fulltext/0412_1.pdf

Indian ocean currents both east to west and counter currents result in a churning operation and consequent deposition of heavy minerals such as thorium or titanium.



This is a colour version of Figure 11.3 of Regional Oceanography: an Introduction by M. Tomczak and S. J. Godfrey (Pergamon Press, New York 1994, 422 p.). http://www.lei.furg.br/ocfis/mattom/regoc/text/11circ.html



Major ocean currents of the world. On this illustration red arrows indicate warm currents, while cold currents are displayed in blue. (Source: PhysicalGeography.net) http://www.eoearth.org/article/Ocean_circulation http://maritime.haifa.ac.il/departm/lessons/ocean/wwr205.gif This map shows the unique phenomenon of two ocean currents in two opposing direcions operating like a cyclotron/sieve to isolate heavier minerals with heavy atomic weights such as Thorium 232 and Titanium.

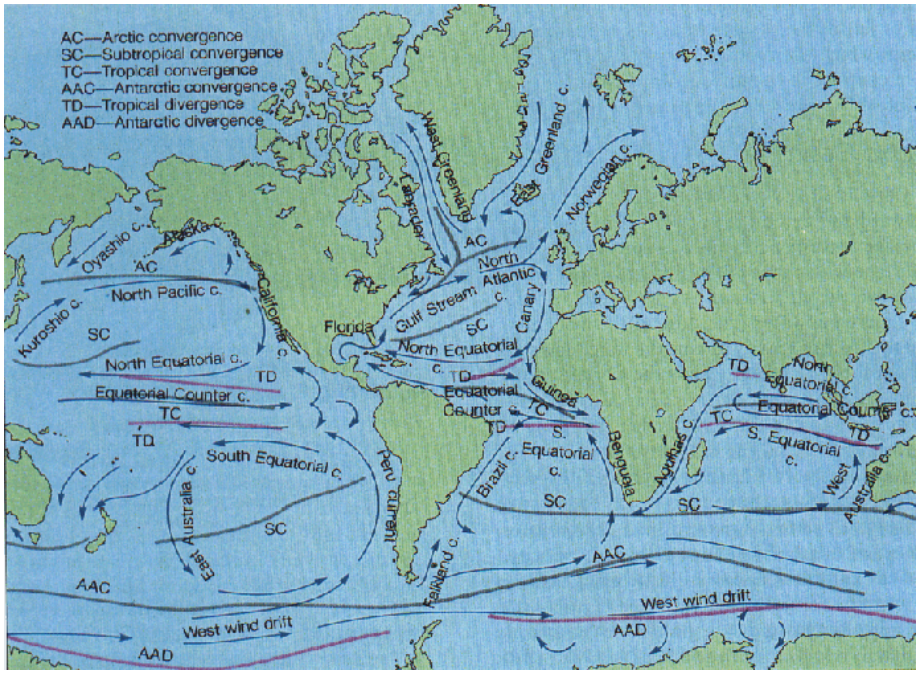
Beaches of Kerala with thorium sands.
http://www.mcdonald.cam.ac.uk/genetics/images/kerala_lowres.jpg

Importance of thorium for Bharatam's strategic program

- From BARC website: Thorium deposits - ~ 3,60,000 tonnes
- The currently known Indian thorium reserves amount to 358,000 GWe-yr of electrical energy and can easily meet the energy requirements during the next century and beyond.
- India's vast thorium deposits permit design and operation of U-233 fuelled breeder reactors.
- These U-233/Th-232 based breeder reactors are under development and would serve as the mainstay of the final thorium utilization stage of the Indian nuclear programme.
- http://www.barc.ernet.in/webpages/about/anu1.htm This is underscored in a US report: www.carnegieendowment.org/publications where, Tellis, the point-man for Indo-US nuke deal notes that India reserves of 78,000 metric tons of uranium. The interests of US are best served by selling uranium and nuke reactors instead of allowing India to gain self-sufficiency using indigenous thorium reserves.

The extraordinary monograph by Prof. Monu Nalapat, Prof. of Geopolitics in Manipal University, notes with forthrightness and clarity and unravels the shocking sell-out of the national interests, national integrity and national security of Bharatam, ignoring the sage advise of the nation's foremost nuclear scientists. [quote] The Indian position has been deliberately made murky, given the lack of an adequate official response to recent statements made by the US that have described the proposed "strategic" partnership for what it is—a non-proliferation mechanism intended to bring India into the now tattered NPT fold as a non-nuclear weapons state. Should Congress finally get their way and force this agreement on the nation, not only should the pact be torn up by the successor government, but both should be prosecuted for high treason. [unquote]

http://www.organiser.org/dynamic/modules.php?name=Content&pa=showpage&pid=177&page=2



The issue of thorium as the nuclear fuel which will unleash the nuclear potential of Bharatam has been underscored in the BARC website. One of the principal earth science reasons for the accumulation of thorium resources on Kerala beaches is the oscillating, sieving action of the ocean currents around Ramasetu. Incursive channel in an arbitrarily drawn medial line between Bharatam and Srilanka as a defacto boundary of international waters, discarding the age-old rights as 'historic waters' under the UN Law of the Sea, is a serious dereliction of responsibility on the part of the Setusamudram Channel Project designers. PM and UPA Chairperson have to explain to the nation for the undue haste and carelessness in choosing an alignment impacting on RamSetu while five other alternative channels closer to the Bharatam coastline were available. Was the new, arbitrarily drawn medial line as the channel alignment influenced by US Navy Operational Directives of 23 June 2005? Is it mere coincidence that the inauguration of SSCP takes place within a week thereafter, on 2 July 2005 ignoring the imperative subjecting the impact of a future tsunami on the integrity of the coastline if the present chosen alignment is implemented? Together with the destruction of Kerala, will it impact on the harnessing of the thorium resource as the foundation fuel for the nuclear programme of Bharatam? As the trial for treason unravels, in case Bharatam succumbs to US geopolitical pressures, a lot of questions will have to be raised and answered. Was the PM satisfied by the answers (provided on 30 June 2005) to the 16 questions raised by PMO on 8 March 2005?

The US study pointing to the urgency of striking the Indo-US nuclear deal can be downloaded from www.carnegieendowment.org/publications: Tellis notes that India reserves f 78,000 metric tons of uranium.

•eight reactors allocating a quarter of their cores for the production of weapons-grade material, uranium needed would be: 19,965 to 29,124 tons. T two research reactors will need 938 to 1,088 tons.

• These would yield India 12,135 to 13,370 kilograms of weapons-grade plutonium.

•Thorium blanket as fuel will be the nuclear fuel of the future for Bharatam, which has the largest reserves of thorium in the world. A team of scientists led by Dr. VJ

Loveson of the CISR New Delhi, studying placer deposits in the area, says an estimated 40 million tonnes of Titanium alone has been deposited in the entire stretch of 500 km. coastline.

The message is loud and clear: somehow, Bharatam should be dissuaded from pursuing an independent, self-reliant nuclear programme using thorium blanket on fast-breeder reactors.

With thorium resources accumulated thanks to the ocean currents and counter currents facilitated by Rama Setu, the consequences will be serious if the next tsunami were to desiccate these resources together with the devastation of the coastline of Tamilnadu and Kerala.

Historical background on and evaluation of Tsunami of Dec. 26, 2004

A recent book titled The Indian Ocean Tsunami by Tad S. Murty (Editor), U. Aswathanarayana (Editor), N. NIRUPAMA (Editor), 2006, Taylor and Francis includes contributors: Bal Rastogi ; Arun Bapat ; K.S.R.Murthy ; R.K. Chadha ; Hema Achyuthan ; V.Sundar ; A.D.Rao ; N.Nirupama ; Zygmunt Kowalik ; Ioan Nistor ; Samir Hamdi ; V.P.Dimri ; Phil Watts ; Vasily Titov ; Arun Saraf ; Ashok Gwal ; George.A. Maul ; Arthur Berman ; Anthony Joseph ; Hontoro ; Loy Rego ; Carol Amaratunga ; Emdad Haque ; Fikret Birkes ; Murat Saatcioglu ; M.Baba ; N.P.Kurian ; Emdad Haque ; Fikret Birkes ; T.K.V.Sastry ; V.Keshava Das ; Jayakumar ; C.S.P.Iyer ; R.Ramesh ; Y. Sadhuram ; Subbarao Durvasula ; S.S.L.Hattiarachchi ; P. Sridhar ; Ambika Verma ; Tad Murty ; U. Aswathanarayana.

Drawing on information gathered from a study of the Indian Ocean tsunami of December 26, 2004, this book explores the development of methodologies for predicting and preparing for tsunamis. The volume provides a state-of-the-art review of tsunami science and indicates thrust areas that have the potential to improve temporal and spatial resolution of tsunami prediction and warning systems. The knowledge base contained in the volume is relevant not only to the Indian Ocean countries, but globally. It will be useful to university students, professionals, and administrators concerned with seismology, ocean science, meteorology, disaster management, coastal management, and related areas.

A Catalog of Tsunamis in the Indian Ocean

By B. K. Rastogi and R. K. Jaiswal, National Geophysical Research Institute, Hyderabad, India, pages 128-143 http://www.sthjournal.org/253/rastogi.pdf

SUMMARY

A catalog of about ninety tsunamis in the Indian Ocean has been prepared from 326 BCE to 2005 AD. In the nineteenth and twentieth centuries tsunamis have occurred once in three years or so. Sunda Arc is the most active region that has produced about seventy tsunamis. The source zones of the remaining tsunamis are Andaman-Nicobar islands, Burma-Bangladesh region in the eastern side, while Makran accretion zone and Kutch-Saurashtra region are in the west. These zones are subduction zones or zones of compression.

GENERAL DESCRIPTION

Tsunamis are not as common in the Indian Ocean as in the Pacific. As compared to average eight tsunamis per year in the Pacific, Indian Ocean has one in three years or so. A catalog of tsunamis presented here includes about ninety tsunamis in the Indian Ocean out of which over 70 tsunamis are from Sunda. Some 20 tsunamis are reported from rest of the Indian Ocean, though source region of five of them may be in Sunda arc. Hence, eighty percent of the tsunamis of the Indian Ocean originate in Sunda arc covering Java and Sumatra. Figure 1 shows the locations of significant tsunamis and Figure 2 shows the annual number. Table 1 gives the list of tsunamis from Sunda arc and Table 2 from rest of the Indian Ocean.

The Sunda belt extends northward to Andaman-Nicobar Islands where a few tsunamis have originated. Further north, Bangladesh-Myanmar coast has produced some well-documented tsunamis. Makran coast in the northwest is known to have generated at least one major tsunami. Karachi-Kutch coast region has also produced some possible tsunamis. Cause of tsunamis is mostly thrust-type earthquakes with vertical uplift in subduction zones and zones of compression. The seismic gap areas along the subduction zones are possible sites of future great earthquakes. Along the Sunda arc, great earthquakes of magnitude 8.5 or greater can repeat every two centuries at a site but smaller tsunamigenic earthquakes can repeat every few decades. Along Sunda Arc volcanic eruptions have also given rise to large tsunamis. There appears to have been a hiatus in tsunami generation in this region, with a significant gap in events occurring from around 1909 through 1967 (Tsunami Laboratory, Novosibirsk, Russia). The Carlsberg spreading ridge or old oceanic ridges like Chagos Ridge and Ninetyeast Ridge with normal faulting can give rise to local tsunamis. Many of the tsunamis and their effects are described in some details. However, tsunamis from Java region are not described in detail as they did not affect the countries other than Indonesia.

TSUNAMIS FROM SUNDA ARC REGION

Newcomb and McCann (1987) compiled historical records of earthquakes and tsunamis from Sunda arc region. Heck (1947), Berninghausen (1966), Litzin (1974) and USGS catalogs list some more…The Sumatra part of the Sunda arc had been much more active than Java part. Detailed description of some of the significant earthquakes and the tsunamis caused by them are given below:

Earthquakes/Tsunamis in Sumatra

11 Dec 1681. "Strong earthquake" shook the Sumatra mountains near Mentawai Archipelago and a seaquake was observed.

3 Nov 1756. Many houses collapsed in several towns of Sumatra near to Enganno Is. No tsunami was reported.

No date, 1770. Severe damage in the same general area as the 1756 event, but a tsunami was reported.

10-11 Feb 1797, Mw 8.2. A large earthquake and tsunami was observed in ports on the coast of the mainland and on the Batu Is. Waves of great force near Padang (0.99S 100.37E) The town was inundated and more than 300 fatalities occurred (Heck, 1947).

18 Mar 1818. A very strong shock associated with both tsunami and seaquake near to Enganno Is.
24 Nov 1833. The great earthquake of magnitude > 8.7 had maximum intensities and generated a tsunami over 550km along the south central coast of Sumatra that also caused much damage to the coast. Numerous deaths occurred in W. Sumatra. This earthquake ruptured the plate margin from the southern island of Enggano to Batu.

5-6 Jan 1843, Mw 7.2. The earthquake caused severe damage, liquefaction and many fatalities in Nias Is. A tremendous tsunami wiped out towns on the east coast of Nias and mainland. The damage and associated tsunami were very localized. The village of Barus (2N 98.38E) and Palan Nias (Nias Is. 1.1N 97.55E) reported large waves on two days.

11 Nov 1852. Earthquake near Nias generated seaquake.

16 Feb 1861. A great earthquake of magnitude 8.5 ruptured a major segment of the plate boundary in northern Sumatra. The tsunami that was generated extended over 500km along the arc. Tsunami destroyed southern towns of Batu Is., and a town on the southwest side of Nias experienced a tsunami height of 7m. The earthquake and tsunami caused 1000s of fatalities at west coast of Sumatra. Two aftershocks on March 9 and April 26, 1861 also caused tsunamis. There was no major shock for almost 50years.

The historic record shows that the strongest tsunami was associated with the volcanic eruption of Krakatau in Indonesia on 27 Aug. 1883. The 35m-high tsunami took a toll of 36,000 lives in western Java and southern Sumatra. Tsunami waves were observed throughout the Indian Ocean, the Pacific Ocean, the American West Coast, South America, and even as far away as the English Channel. On the facing coasts of Java and Sumatra the sea flood went many kilometers inland and caused such vast loss of life that one area was never resettled and is now the Ujung Kulon nature reserve.

Subsequent local tsunamis in the Sunda Strait were generated by the 1927 and 1928 eruptions of the new volcano of Anak Krakatau (Child of Krakatau) that formed in the area. Although large tsunamis were generated from these recent events, the heights of the waves attenuated rapidly away from the source region, because their periods

and wavelengths were very short. There was no report of damage from these more recent tsunamis in the Sunda Strait (George, 2003).

According to ancient Japanese scriptures, the first known supercolossal eruption of Krakatau occurred in the year 416 A. D. – Some have reported it to occur in 535 A.D. The energy of this eruption is estimated to have been about 400 megatons of TNT, or the equivalent of 20,000 Hiroshima bombs. This violent early eruption destroyed the volcano, which collapsed and created a 7 km wide submarine caldera. The remnants of this earlier violent volcanic explosion were the three islands of Krakatau, Verlaten and Lang (Rakata, Panjang, and Sertung). Undoubtedly the 416 A.D. eruption/explosion/collapse generated a series of catastrophic tsunamis, which must have been much greater than those generated in 1883. The time of tsunami with wave height of several meters that affected Tamilnadu in India matches with this early Krakatau eruption. However, there are no other records to document the size of these early tsunamis or the destruction they caused. Subsequent to the 416 A.D. eruption and prior to 1883, three volcanic cones of Krakatau and at least one older caldera had combined again to form the island of Rakata.

4 Jan 1907, Ms 7.6. This event caused tsunamis that devastated Simeuleu, Nias and Batu Islands of Sumatra and extended over 950km as measured by tide gauges.

25 June 1914. M7.6 earthquake destroyed buildings in southern Sumatra. No tsunami was reported.

1935: Mw 7.7. Tsunami in SW Sumatra.

The 2004 Sumatra-Andaman earthquake of magnitude 9.3 generated 30m-high tsunami when upward slip of the ocean floor was up to 15m along a 1300 km long and 160 to 240km wide rupture. It was the deadliest tsunami killing about 300.000 people in 13 countries situated all around the Indian Ocean. The earthquake had created large thrust ridges, about 1500m high, which collapsed in places to produce large landslides, several kilometers across. The force of displaced water was such that blocks of rocks, massing millions of tons apiece, were dragged as much as 10km. An oceanic trench several kilometers wide was also formed. The run up in the India was 5m or less.

Magnitude 8.7 great Sumatra Earthquake of 28 Mar. 2005 with an upward movement of 2m of seafloor in an area of 400kmx100km generated locally damaging 4m-high tsunami that struck nearby islands and coastal Sumatra and was recorded by tidal stations in the Indian Ocean (asc.India.org). The earthquake and tsunami killed 665 people. The tsunami struck Nias Island with wave heights of 4-5 m. A 3-4m wave struck the islands of Banyak and Simeulue and the Singkil district of Sumatra. According to the Pacific Tsunami Warning Center (PTWC) tide gauges in the Indian Ocean recorded minor wave activity in the Australian Cocos Island (10-22cm), the Maldives (10cm), and Sri Lanka (25-30cm).

TSUNAMIS THAT AFFECTED THE INDIAN REGION AND VICINITY

Though rare, tsunamis have hit India earlier. The tsunamis in the Indian region and vicinity are listed in Table 2. The oldest record of tsunami is available from November 326 BCE earthquake near the Indus delta /Kutch region that set off massive sea waves in the Arabian Sea. Alexander the Great was returning to Greece after his

conquest and wanted to go back by a sea route. But a tsunami due to an earthquake of large magnitude destroyed the mighty Macedonian fleet (Lisitzin, 1974).
Poompuhar is a town in the southern part of India in the state of Tamil Nadu. It was a flourishing ancient town known as Kaveripattinam that was washed away in what is now recognized as an ancient Tsunami in about 500 CE. This time matches with the Krakatoa explosion.

There is mention of tsunami effect in scriptures at Nagapattinam in 900 CE that destroyed a Budhist monastery. According to literature available in the library of Thondaiman kingdom in Puduckottai, Tamilnadu, it was during the reign of Raja Raja Chola that waves had washed away the monastery and several temples and killed hundreds of people. There is evidence of this in Kalaki Krishnamurty's book "Ponniyin Selvan- The Pinacle of Sacrifice". In the chapter "The Sea Rises", the author explains how the sea had risen very high and the black mountain of water moved forward. The sea inundated warehouses and sheds and began to flow into the streets. Ships and boats seemed suspended in mid-air, precariously poised on the water peaks. The book also describes how an elephant was swallowed by the gushing water.
Tsunami has been observed in the North Indian Ocean on the Iranian coast from a local earthquake between 1st April and 9th May 1008 (Murty et al., 1999).

An earthquake occurred during 1524 A.D. off the coast of Dabhol, Maharashtra and. a resulting large tsunami caused considerable alarm to the Portuguese fleet that was assembled in the area (Bendick and Bilham, 1999).

A tsunami is known to have occurred in the Bay of Bengal on April 2, 1762, caused by an earthquake in Bangladesh – Myanmar border region. The epicenter is believed to be 40 km SE of Chittagong, or 61 km N of Cox's Bazaar, or 257 km SE of Dhaka, Bangladesh. The shock caused severe damage at Chittagong and other areas on the eastern seaboard of the Bay of Bengal. The Arakan coast was elevated for more than 160 km. The quake also caused a tsunami in the Bay of Bengal. The water in the Hoogly River in Kolkata rose by two meters. The rise in the water level at Dhaka was so sudden that hundreds of boats capsized and many people were drowned. This is the earliest well-documented tsunami in the Bay of Bengal (Mathur, 1998).

1819 June 16, India, Kutch, Mw 7.8. Severe earthquake with large changes in the elevation of the land. The town of Sindri (26.6N 71.9E) and adjoining country were inundated by a tremendous rush from the ocean, and all submerged, the ground sinking apparently by about 5m (Macmurdo,1821)
An earthquake on 11th November 1842 near the northern end of Bay of Bengal caused a tsunami by which waters of the distributaries of the Ganges Delta were agitated. Boats were tossed about as if by waves in a squall of wind.

1845 June 19, India, Kutch. "The sea rolled up the Koree (Kori creek, 23.6N 68.37E) (the east) mouth of the Indus overflowing the country as far westward as the Goongra river, northward to the vicinity of Veyre, and eastward to the Sindree Lake," (Nelson,1846)

On October 31, 1847 the small island of Kondul (7°13'N 93°42'E) near Little Nicobar was inundated (Heck, 1947; Berninghausen, 1966) by an earthquake whose Mw, magnitude could have been >7.5 (Bilham et al. 2005).

Mihir Guha (http://www.freejournal.net), former Director General of the India Meteorological Department, informed that a tsunami struck Sunderbans (Bangladesh) in May 1874, killing several hundred thousand people. It was result of an earthquake in Bhola district. Earthquake and tsunami both played havoc in vast areas of Sunderbans, 24-Prganas, Midnapore, Barishal, Khulna and Bhola. Even Kolkata felt its impact. It was the same year that the meteorological center in Alipore was set up. However, no written record of such an earthquake or tsunami is available.

Other minor tsunamis of height up to 2m hit the east coast of India in 1842 and 1861 (from Sumatra), 1881 (from Car Nicobar), 1883 (Krakatau), 1907 (Sumatra) and 1941 (Andaman). The 1881 Andaman earthquake of Mw7.9 caused 1.2-m high tsunami. Indonesian earthquake of 1907 registered about a meter high tsunami in India. Madras Port Trust recorded a 2m high tsunami due to the eruption of the Krakatau volcano in Indonesia on 27 Aug 1883. Andaman earthquake of Mw7.7 in 1941 registered a 1.5m high tsunami. Some of these tsunamis are described below:
An earthquake of magnitude Mw 7.9 occurred at Car Nicobar Island on 31 Dec. 1881. A tsunami was generated by this earthquake in the Bay of Bengal. Though the run-ups and waves heights were not large, its effects were observed in the Andaman & Nicobar Islands and were recorded on the east coast of India. A meter high wave was recorded at Port Blair on South Andaman Island (Berninghausen, 1966). In the Nicobar Islands, the waves were less than 75 cm high. On the east coast of India, the tsunami first arrived at Nagapatinam at around 10:15 am local time (LT) with a 1.2m high waves. Tidal gauges at other locations recorded minor variations from normal tidal changes. The tsunami then struck the rest of the Tamil Nadu coast, first hitting Chennai and then progressing north toward Vishakhapatnam in Andhra Pradesh at 10:43 LT. Waves arrived at False Point on the Mahanadi delta in Orissa at 11:15 LT and at Pamban in the Gulf of Mannar at 11:32 LT. Waves less than 0.3 metres high were recorded later in the day in West Bengal by tidal gauges at Dublat at the mouth of the Hoogly river at 13:00 LT and then in Diamond Harbour at 15:10 LT (Ortiz and Bilham, 2003). Waves attributed to this tsunami were also observed at Batticaloa and Trincomalee on the east coast of Sri Lanka (Berninghausen, 1966). No tsunami was reported from tidal gauges in Myanmar (Ortiz and Bilham, 2003).
A tsunami was noticed at Dublet (mouth of Hoogly River) near Kolkata due to earthquake in the western part of the Bay of Bengal in 1884 (Murty et al. 1999) that reached up to Port Blair. June 26, 1941 Andaman earthquake had a moment magnitude Mw 7.7 and was located at 12.1^{o} N and 92.5^{o} E (Bilham et al., 2005). A tsunami was triggered by this earthquake in the Bay of Bengal. Height of the tsunami was reported to be of the order of 0.75 to 1.25 meters. At the time no tidal gauge was in operation. Mathematical calculations suggest that the height could be of the order of 1m. This tsunami was witnessed along the eastern coast of India. It is believed that nearly 5,000 people were killed by the tsunami on the east coast of India. Local newspapers are believed to have mistaken the deaths and damage to a storm surge, however, a search of meteorological records does not show any storm surge on that day on the Coromandel Coast (Murty, 1984). National dailies like the Times of India, which reported the quake's shaking effects, did not mention any deaths, either as a result of a storm surge or a tsunami.

The deadliest tsunami prior to 2004 in South Asia was in November 1945, which originated off the Makran coast of Pakistan in the Arabian Sea and caused deaths as far as Mumbai. More than 4000 people were killed on the Makran Coast by both the earthquake and the tsunami. The earthquake was also characterized by the eruption

of a mud volcano, a few kilometers off the Makran Coast, which are common features in Western Pakistan and Myanmar. It led to the formation of a four small islands. A large volume of gas that erupted from one of the islands, sent flames leaping "hundreds of meters" into the sky (Mathur, 1988). The most significant aspect of this earthquake was the tsunamis that it triggered. The tsunami reached a height of 17m in some Makran ports and caused great damage to the entire coastal region. A good number of people were washed away. The tsunami was also recorded at Muscat and Gwadar. The tsunami had a height of 11.0 - 11.5 m in Kutch, Gujarat (Pendse, 1945). At 8:15am, it was observed on Salsette Island i.e Mumbai (Newspaper archives, Mumbai). It was recorded in Bombay Harbour, Versova (Andheri), Haji Ali (Mahalaxmi), Juhu (Ville Parle) and Danda (Khar). At Versova (Andheri, Mumbai), 5 persons who were fishing were washed away. At Haji Ali (Mahalaxmi, Mumbai), 6 persons were swept into the sea. At Danda and Juhu, several fishing boats were torn off their moorings. The tsunami did not do any damage to Bombay Harbour. Most persons who witnessed the tsunami said that it rose like the tide coming in, but much more rapidly. The height of the tsunami in Mumbai was 2m. A total of 15 persons were washed away in Mumbai.

Mw 7.7, 1983 earthquake in Chagos Archipelago, was one of the strongest earthquakes ever recorded in the Indian Ocean. It occurred at 17:46pm UTC. The earthquake caused some damage (NEIC) to buildings and piers on Diego Garcia. Diego Garcia is part of the Chagos Archipelago. The 1983 earthquake spawned a tsunami in the region. In the lagoon, on Diego Garcia, there was a 1.5-meter rise in wave height and there was some significant wave damage near the southeastern tip of the island. A 40 cm wave was also recorded at Victoria, Seychelles. There was a large zone of discolored seawater observed 60 - 70 km NNW of Diego Garcia. Moment-tensor solution indicated normal faulting along an E-W plane at a depth of 10km with source duration of 34 sec.

CONCLUSIONS

The catalog prepared for tsunamis in the Indian Ocean includes about ninety tsunamis. Eighty percent of the tsunamis in the Indian Ocean are from Sunda arc region where on an average tsunamis are generated once in three years. In rest of the Indian Ocean tsunamis can be generated once in ten years or so. The Makran accretion zone of southern Pakistan has produced some tsunamis. The 28 Nov. 1945 (Mw 8.0) earthquake generated the last major tsunami in the Arabian Sea. Indus Delta and may be the Coasts of Kutch and Saurashtra are also potential zones for great earthquakes and tsunami. Tsunami was generated by an earthquake in 1762 in Myanmar and in 1874 by an earthquake near Bangladesh. The Chagos ridge has given rise to a local tsunami due to a normal earthquake of Mw 7.7 on 30 Nov. 1983 near Diego Garcia.

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Tsunamis on the coast lines of India

by T. S. Murty,Baird and Associates Coastal Engineers Ottawa, Canada, A. Bapat, Sadashiv Peth, Puna, India

Although the majority of the reported tsunamis are from littoral countries of the Pacific Ocean, there are a few cases of tsunamis in the Indian Ocean. The approximate length of the Indian coast is about 6000 kilometers. The coasts run from north to south and have two arms in the east and west with a tapering end at Kanyakumari. The tsunamigenic earthquakes occur mostly at the following three locations; (1) The Andaman sea, (2) Area about 400-500 kilometers SSW of Sri Lanka (Ceylon), (3) The Arabian Sea about 70-100 kilometers south of Pakistan Coast -- off Karachi and Baaluchistan. The oldest record of tsunami is available from November 326 BCE earthquake near the Indus delta/Kutch region. Alexander the Great was returning to Greece after his conquest and wanted to go back by a sea route. But an earthquake of large magnitude destroyed the mighty Macedonian fleet as reported by Lietzin (1974).

The earliest record of tsunami is reported to be about 1.5 meters at Chennai (formerly Madras) which was created due to the August 8, 1883 Krakatoa volcanic explosion in Indonesia. An earthquake of magnitude 8.25 occurred about 70 kilometers south of Karachi (Pakistan) at 24.5 N and 63.0 E on November 27, 1945. This created a large tsunami of about 11.0 to 11.5 meters high on the coasts of India in the Kutchch region, as reported by Pendse (1945). An earthquake of magnitude 8.1 occurred in the Andaman Sea at 12.9 N and 92.5 E on June 26, 1941 and a tsunami hit the east coast of India. As per non-scientific/journalistic sources, the height of the tsunami was of the order of 0.75 to 1.25 meters. At the time no tide gauge was in operation. Mathematical calculations suggest that the height could be of the order of 1.0 meter. There are a few more cases of earthquakes of magnitude less than 8.0 which have given rise to some smaller tsunamis. Bapat, et al (1983) have reported a few more earthquakes on the coast of Myanmar (formerly Burma).

http://iri.columbia.edu/~lareef/tsunami/

Summary account on historical background on Indian Ocean tsunamis

Information relating to the submarine earthquake in between Aceh, Indonesia and Sri Lanka of the 26th of December, 2004 has been compiled here. This compilation archives much of the readily available scientific information. Aspects that were not immediately brought out by news reports were:

- The 9.0 Earthquake at 6.58 hours at the epicenter (and in Sri Lanka) led to a sequence of 15 other quakes across the Andaman region.
- While earthquakes could not be predicted in advance, once the earthquake was detected it would have been possible to give about 3 hours of notice of a potential Tsunami. Such a system of warnings is in place across the Pacific Ocean. However, there was no warning system in the Indian Ocean. In addition, coastal dwellers are educated in the Pacific littoral to get to high ground quickly following waves. However, those in the Indian Ocean were quite unaware.

- Tsunamis are rarer in the Indian Ocean as the seismic activity is much less than in the Pacific. However, there have been 7 records of Tsunamis set off by Earthquakes near Indonesia, Pakistan and one at Bay of Bengal.
- Earthquakes occur when any of the 12 or 13 plate collide at their boundaries. The present collision is due to compression between the Indian and Burmese plates. Scientists now believe that one plate that comprised the landmass from India to Australia has broken up into two. The initial 8.9 eruption happened near the location of the meeting point of the Australian, Indian and Burmese plates. Scientists have shown that this is a region of compression as the Australian plate is rotating counterclockwise into the Indian plate. This also means that a region of seismic activity has become active in the South Eastern Indian Ocean.
- Tsunamis are not entirely unknown in Sri Lanka. For example, the Tsunami in 1883 generated by the Volcanoes at Krakatoa led to a surge of at least 1 m in Sri Lanka. The damage was much less then. However, one difference was that this particular episode happened in the month of August. In the month of December, under the North-East monsoon, the Equatorial Indian Ocean jet propagates along the equator from Sumatra (near the epicenter of the quake) slightly to the South of Sri Lanka and to Somalia. This may be why the impact of the quake led to severe impacts in Sri Lanka.
- Once the large amount of pent-up energy in the compression zones of the plate boundaries have been released, it takes another buildup of energy for another event of similar magnitude. This is unlikely in the short-term. However, in the future, Indian Ocean littoral regions should generate and pay attention to earthquake and tsunami warnings and be aware of the interplay of the seasonal oceanographic currents

Details at: http://iri.columbia.edu/~mahaweli/climate.lk_mirror/tsunami/

Tsunamis return after 60 years

By N. Gopal Raj

It is pell-mell near the Vivekananda Rock Memorial, Kanyakumari, where three passenger boats were washed ashore. - Photo: A. Shaikmohideen

THIRUVANANTHAPURAM, DEC. 26. Tsunamis returned to devastate India after an interval of more than 60 years. The tsunamis of 1941 and, before that, of 1881 were set off by earthquakes in the Andaman and Nicobar Islands.

Where the sea and the road merged. A scene on the Marina beach in Chennai. - AP

The islands are earthquake-prone as they are close to the zone where the section of the earth's crust carrying India and Australia is sliding below the section that holds Asia. The two sections are converging at an estimated rate of 5.4 cm a year, according to a paper in the scientific journal, Current Science, last year. As the sections slowly slip past one another, strains develop at various points and they are released in the form of earthquakes.

Today's undersea earthquake off Sumatra appears to have set off smaller quakes in the vicinity of the Andaman and Nicobar islands. At least one of them had a magnitude of over 7, according to data on the United States Geological Survey (USGS) website.

Trigger earthquakes?

The USGS data also showed that earthquakes in the Andaman and Nicobar islands had occurred up to 9 degrees northwards and 2 degrees westwards of the one in Sumatra. Tremors from the Sumatran earthquake might have caused "trigger earthquakes" at faults in and around the Andaman and Nicobar islands where strain

had been building up, said C.P. Rajendran of the Centre for Earth Science Studies (CESS) here. Dr. Rajendran was the lead author of the Current Science paper.

The earthquake that occurred on June 26, 1941 is thought to have exceeded a magnitude of 8.5. "It is quite likely that the magnitude of this earthquake has been underestimated," the authors said in their Current Science paper. The quake caused extensive damage in the Andamans, including bringing down the central tower of the infamous Cellular Jail where many freedom fighters were imprisoned. The earthquake set off a tsunami that inundated the western coast of the Andaman Island and then hit the Indian east coast, destroying property and killing people.

The magnitude 7.5 earthquake of December 31, 1881 is thought to have occurred under the sea off the Car Nicobar Island. It too generated a tsunami.

Nearly a dozen earthquakes bigger than magnitude 5 have occurred in the region since 1973, with the one over magnitude 6 occurring in January 1983, according to the Current Science paper. But data from the country's tide gauges, available from the mid-1970s, do not indicate that any tsunamis had occurred, said Satish Shetye, Director of the National Institute of Oceanography at Dona Paula in Goa.

Although undersea earthquakes are the most common cause of tsunamis, submarine landslides, underwater volcanic eruptions and the large meteorities plunging into the sea can also set off these killer waves. A tsunami can race across the water at speeds of 500 to 1,000 km per hour. In the open ocean, however, the waves of a tsunami may be only 30 cm to 60 cm in height and can pass unnoticed. But as the tsunami nears a coastline and the water depth falls sharply, the waves slow down but gain in height.

Series of waves

A tsunami can be 10 to 20 m high when it hits the shore. One with waves almost half a kilometre high slammed into Alaska in 1958. Moreover, a tsunami is not one giant wave, but a series of waves that come ashore at intervals of 10 to 45 minutes.

With nearly 800 of them recorded between 1900 and 2001, the Pacific Ocean is where the most tsunamis occur, and 17 per cent of them are generated in or near Japan. As a result, countries in and around the Pacific established a Tsunami Warning System. Seismic stations pinpoint the earthquakes while seafloor pressure recorders detect tsunamis even one centimetre high and promptly pass this data over satellite. All this information is combined with extensive computer modelling to find out which places could be at risk.

Open sea tidal gauges would help in detecting if a tsunami had been generated, Dr. Shetye observed. Such gauges would be expensive and not easy to set up.

http://www.hindu.com/2004/12/27/stories/2004122702951800.htm

Impact of Tsunami on Setusamudram Shipping Channel and the neighboring coastal areas

Interview with Professor Tad S. Murty

Prof. Tad S. Murty is one of the most respected Tsunami Experts around the world; he advises the Government of Canada on Tsunamis and had played an important role in the development of the 'Baird' simulation model of the December 26th Tsunami. He was in the Editorial Board of the most prestigeous Tsunami Journal "Science of Tsunami Hazards" for many years.

*He along with Dr.Arun Bapat, had analysed the Tsunamis of the Indian Ocean in 1999.**
He was in India this January to participate in the 'Brainstorming' Session on the Tsunami of 26 th December organized jointly by Department of Science & Technology (DST), Department of Ocean Development (DOD), Council of Scientific and Industrial Research (CSIR) and Indian National Science Academy (INSA) on 21-22 January, 2005 at New Delhi. Subsequently, when National Institute of Oceanography, Goa organised a National Workshop on Formulation of Science Plan for "Coastal Hazard Preparedness" on 18 - 19 February 2005, he set the tone for the workshop with his paper titled "Perspectives on Coastal Hazard Preparedness".

The following is an e-mail interview conducted with him by the Editor of this web portal on 7- 11 July 2005.

The interview assumes its importance following the July 24, 2005 Nicobar 7.3 R Earthquake that had caused much panic. It also assumes its importance as the Expert Level discussion between India and Sri Lanka on the possible impact of the Setusamudram Shipping Channel Project on the marine and coastal environments of both the countries is scheduled on 1 August 2005 at New Delhi.

** [" TSUNAMIS ON THE COASTLINES OF INDIA" Science of Tsunami Hazards Volume 17(3), 1999]*

Question: Respected Professor! Would you please tell me what you personally think about the reply given to the Prime Minister by Tuticorin Port Trust with regard to your critical opinion about the present alignment of the Setusamudram Shipping Channel published in the Indian Express dated 18 January 2005?

Prof. Tad S.Murty: I would first of all share with you a bit of background on my slight involvement with Setusamudram Shipping Channel Project.

In January 2005, I was in India as the tsunami expert on the delegation of Prime minister Paul Martin (Canada) visit to various Asian countries following the tsunami. On 18th January I was with the prime minister at a press briefing in Delhi.

Later some Indian express and Telegraph reporters spoke to me about SSCP and I made these comments. Earlier I was working on a paper on SSCP and was interested in the scientific aspects of the project.

In May Tuticorin Port Trust (TPT) sent me a fax dated early February asking for my comments and said that the project is finalized by end of Feb and they wanted my comments within 24 hours. I replied to Mr. Raghunadh(IAS officer) *(read: Mr.Ragupathy - Editor)* that I received his fax only in May and possibly I cannot reply by mid-Feb. I sent a page explaining why the eastern entrance of the channel should be re-oriented.

After a few days I received a reply saying that his experts outright dismissed my idea as ridiculous and has absolutely no merit. I did not do anything after this, as I have no official involvement. If you include my student days in the Andhra University and later at the university of Chicago, I have more than 45 years of experience with tsunamis worldwide and I know what I am talking about.

I cannot understand why Tuticorin Port Trust could not find me when everyone else can find me. The Indian Express newspaper article clearly says that I was staying at the Taj Palace hotel in Delhi and will be there for another week or so.

Question: How do you react to Tuticorin Port Trust's statement that the suggestion you had made with respect to the present alignment of the Channel and its possible chance of acting as a conduit to future tsunamis, thus paving way to causing damage to South Kerala coast as untenable?

Prof. Tad S.Murty: Tuticorin Port Trust (TPT) of course can draw whatever conclusions they want to.

I feel that the Bay of Bengal entrance of the present orientation of the channel will undoubetedly funnel tsunami energy into the channel and this will meet the tsunami traveling from south of Sri Lanka at the southern part of Kerala and through constructive interference will augment the tsunami wave amplitudes. The southern part of Kerala was not much impacted by the 26th December 2004 tsunami mainly because the tsunami that arrived from the Indian Ocean has to diffract around Sri Lanka, which necessarily has to take a very wide turn (because tsunamis are long gravity waves and cannot bend as easily as short waves, just like a big car versus a mini. A mini cut cut corners, but a big car has to take very wide turns.) and missed south Kerala.

It is very easy to show that the SSCP channel with a depth of 12m will indeed provide another route for the tsunami and the energy will be directed towards south Kerala.

I have no official connection with the SSCP, only a scientific curiosity plus my concern that south Kerala will be put at risk in future. I do not worry that TPT does not think much of my ideas or me. I do not have to justify myself to TPT. I have to

fight my battles, not with TPT but in the field of peer reviewed international scientific journals.

To summarize, a re-orientation of the eastern entrance of the channel towards northwest will fix the tsunami problem.

Why this concerns me is a parallel example in the Alberni canal on Vancouver Island, British Columbia province of Canada. In the March 28th 1964 Alaska earthquake tsunami, outside of Alaska, the largest tsunami amplitude was at the head of the Alberni canal well inland and not at the open coast as everyone expected. Later when I joined the Canadian Oceanographic Service, I explained this as due to quarter wave resonance amplification.

The SSP canal has many characteristics similar to the Alberni canal, and this is the reason I am concerned.

Question: Professor! The Detailed Project Report prepared by L&T - Ramboll has finalized the location of the dumping sites for the dredged materials.

They are located in Bay of Bengal and Gulf of Mannar and have a depth ranging from 30 to 40 km. These sites happen to lie just north of and south of the entrance and exit of the channel. What are the chances for these sites to remain safe and stable during the time of a future tsunamis and cyclones? Also, what are the chances for them to be carried over into the channel in the event of future tsunamis and cyclones?

Prof. Tad S.Murty: I need to do some back of the envelope calculations to precisely answer your question, which I will do in a few days.

However, my initial intuition is that the dumping sites will not be completely stable, especially if they happen to be in the path of the tsunami waves. They may be relatively stable from the cyclones and storm surges, since these do not cause much bottom scouring like tsunamis. The safety issue arises if they are contaminants, especially radioactive contaminants.

Again, I need to do a back of the envelope type computation for a definite answer, again my intuition is that the cyclone and storm surge effects will be less as compared to tsunamis. Certainly tsunamis have the potential to pull all this material back into the channel, if the orientation is right.

The basic question I will attempt to answer through an analytical analysis is simply this.

Would storm surges and tsunamis have the energy to move the dredged material back into the channel? As I said earlier, my present feeling is, storm surges probably will not move much material, but tsunamis definitely would. I will try to quantify this in a couple of days.

As per the TPT's conclusion that no re-orientation of the eastern entrance of the channel is required, I absolutely disagree with it. I do not need to analyze that any more.

I have analyzed the problem to my complete satisfaction.

…….

I now have more definite answers to your questions.

In spite of what the TPT says, there is a real threat to southern Kerala from future tsunamis from SSP.

At this time I do not have the resources to actually do a numerical model to determine the quantitative aspects of the movement aspects of the dredged material.

(However) I did some analytical analysis of whether cyclones (and storm surges) and tsunamis can move the dredged material from Palk Bay into the channel.

The impact from cyclones and storm surges will be minimal, but tsunamis can move a significant amount of the dredged material into the channel.

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http://www.Setusamudram.in/htmdocs/Articles/Interviews/tad_murty.htm

Prof Murty reiterated his concerns in February 2007. From Personal Communication, Feb. 2007: "I requested him (Raghupathy) to consider slightly re-orienting the entrance of the Setu canal on the Bay of Bengal side, so that in future tsunami events, tsunami energy will not be preferentially funnelled into the Setu canal. Shri Raghupathy assured me that he will look into this matter. When a senior IAS officer like Shri Raghupathy says something, I beleive him and I have no further concerns on this matter."

URL is an animated model of how the last tsunami moved, doing a pradakshinam around the Ramar bridge:
http://www.Setusamudram.in/Simulation/Setu_DHI%20Tsunami%20Model.gif

This shows the spread of the massive displacement of waters displaced by the plate tectonic event at Aceh. The spread was dosn the southern Tamilnadu coastline, circled the entire Srilanka island and moved partially into Kerala and towards the Ramar bridge. This circling around Srilanka occurred because the Ramar bridge acted as a natural shoal barrier preventing the inflow of waters.

If a Setusamudram channel is dug through the bridge, it will act as the channel for the waters to flow directly into the entire southern bharatam coastline beyond Dhanushkodi and into the coastline of Kerala right into the Konkan region. The devastation of such direct onrush of tsunami waters will be incalculable.

There are clear indications that the environmental clearance was done without taking into account fundamental engineering and cost-benefit factors:

1. Effect of a tsunami-type of event on the project (all scientists are unanimous that a recurrence of tsunami's cannot be ruled out).
2. Locations for dumping the dredged sand.
3. Costs of continuous dredging given the continuous sea currents which tend to create the shoals and again rebuild the Ramar bridge making the project inoperatble for most of the time.
4. The types of naval craft which can navigate through the project channel (Apparently, the heavy oil tankers cannot go through this channel given the limited draft and will continue to circumnavigate around Srilanka and through Straits of Malacca to reach the markets of Southeast and East Asia.) There has been no market study of the numbers and types of vessels which will navigate through the channel and the freight rates expected to be paid by these vessel for being tugged through the channel.

Sources cited at
http://manisanga.blogspot.com/2005_05_08_manisanga_archive.html

In the interests of safety of the lives of the coastal people, it is prudent to stop the project work until the fundamental factors are re-studied and re-evaluated. It is also essential to involve NIOT and create a Marine Archaeological Unit to study the archaeology of the Ramar Bridge and Kizhakkarai (Tiruchendur) where a s'ankha industry flourishes. It will be a tragedy of incalculable proportiont to the cultural traditions of Bharatam, if this industry were to be devastated by the project. It will be prudent to study the impact of the project on the cultural aspirations of the people and industries such as the ones which support livelihood of s'ankha divers. Impact on fisheries and future projects for desalination of seawater to provide drinking water to coastal towns should also be evaluated. The possibility of choosing an alternative route for the channel with little impact on the Ramar bridge should also be re-studied, taking into account the satellite image analyses which show that the secular historical trend of incursions and recessions of seawaters from almost the entire Bharatam coastline from Dwaraka through Gulf of Khambat, through Gulf of Mannar upto Ganga Sagar (West Bengal) -- caused by a number of factors not excluding plate tectonics and global warming cycles. The received narratives of the submergence of Kumarikandam should be a pointer to the imperative of careful studies before embarking on projects which hurt the cultural sentiments of the people who are inheritors of a glorious sea-faring, maritime, riverine civilization continuum.

Classification of tsunami hazard along the southern coast of India: an initiative to safeguard the coastal environment from a similar debacle

by N. Chandrasekar, S. Saravanan, J. Loveson Immanuel, M. Rajamanickam
Manonmaniam Sundaranar University, Tirunelveli, India G. V. Rajamanickam,
SASTRA Deemed University, Thanjavur, India, page 3-23
http://www.sthjournal.org/241/chand.pdf

Abstract

Prevention of natural disasters is not feasible but the destruction it conveys could be minimized at least to some extent by the postulation of reliable hazard management system and consistent implementation of it. With that motive, the beaches along the study area have been classified into various zones of liability based upon their response to the tsunami surge of 26 December 2004. Thereby, the beaches which are brutally affected has been identified and the beaches which are least. Based on the seawater inundation with relative to their coastal geomorphic features, we have classified the tsunami impact along the coast and the probability of the behaviour of the beaches in case of similar havoc in future. The maximum seawater inundation recorded in the study area is 750 m as in the case of Colachel and the minimum is 100 m as in the case of Kadiapatanam, Mandakadu and Vaniakudy. Beaches like Chinnamuttom, Kanyakumari, Manakudy, Pallam and Colachel are under high risk in case of similar disaster in future and the beaches like Ovari, Perumanal, Navaladi, Rajakkamangalam, Kadiapatanam, Mandakadu, Vaniakudy, Inayam and Taingapatnam are under least viability.

1. Introduction

A Tsunami is a killer wave that brings great havoc in the coastal environment. On 26th December 2004, tectonic disturbances happened in the Java Sumatra islands with an intensity of around 9.3 in the Richter scale extend to the Southern Indian Ocean basin. One such region is south west part of India facing the Bay of Bengal and Arabian Sea. Detection of Tsunami is possible only in nearshore zone where the shoaling effect can be observed. The major destructions in this area are due to the run-up height of 3m-4m leading to erosion activities changes in the beach slope variation. The first visible indication of an approaching Tsunami is a recession of water by the through preceding an advancing wave. A rise in water level is amounted to one half the amplitude of the decreasing water level. The wave moved to shore as above with churning front. In the shallow water of bay and breaker has initiated the seizing.

26th December 2004 havoc induced more damage in the southwest coast compared to southeast coast of India. It did raise the concern of scientists and emergency planners about the impact of larger earthquake/tsunami from the Java Sumatra coast. With increased awareness of the tsunami hazard, there has been confusion about areas at risk and areas of safety. Some areas of high hazard have no evacuation planning or tsunami awareness. The hazard maps produced by this study is to improve awareness of tsunami hazards and to encourage responsible emergency planning efforts by illustrating the range of possible tsunami events based on the best currently available information.

The coastal area has been subjected to tsunami which had wrought a major impact on nearshore morphology forming a risk to any vulnerable coastline. This vulnerability leads to a long term environmental impact along the shore. The tsunamis hit the obstacles that come along their path with great ferocity and the east coast (islands) was the first obstacle which the huge tidal waves encountered, causing destruction all along. All the areas remained like deserted battlefields with broken buildings, dead bodies, carcasses of animals, uprooted trees and deserted and lone houses and huts. With increased awareness of the tsunami hazard, there has been confusion about areas at risk and areas of safety. Some areas of high hazard have no evacuation planning or tsunami education efforts. Unnecessary evacuation increases exposure to other earthquake hazards. The hazard maps produced in this paper is intended for educational purposes, to improve awareness of tsunami hazards and to encourage responsible emergency planning efforts by illustrating the range of possible tsunami events based on the best currently available information.

2. Study Area

The study area (Figure. 1) lies between Latitude of N 8^{0} 04' to N 8^{0} 17' and Longitude of E 77^{0} 32' to 77^{0} 54' E at southern and western part of the Tamilnadu State, India. It encompasses the districts of Kanyakumari and Tirunelveli…

Conclusion

From the above investigation it has been inferred that the tsunami impact is more in the beaches of low lying flat topography as in the case of Manakudy, Colachel, etc., Based upon the elevation of the coast the inundation of the seawater influenced by the tsunami had varied from few meters as in the case of Mandakadu,Kadiapatanam, Vaniakudy, Inayam, Ovari etc., to around 750 meters inland as in the case of Colachel. The High lying undulating topography have less impact during the tsunami as in the case of Muttom, Kadiapatanam, etc., Furthermore, the coastal vegetation have been found to be a reliable feature in checking the seawater inundation and they had really served as a initial line of defence in controlling the inundation as in the case of Mandakadu,Taingapatanam, etc., It is well evident from the field observation that the river mouths and estuaries may facilitate the inundation of seawater under certain critical circumstances as attested by the beaches of Manakudy and Colachel.

The hazard map thus prepared bestow a panoramic view of the impact induced by the tsunami surge and the response of the respective beaches to the unexpected hazard. It exposes the beaches which are severely affected, thereby providing some probable clues for their destruction. The hazard map urges the need of proper coastal hazard management programme and would definitely serve as a guide to initiate the hazard management system as it shows clearly the beaches where immediate action should be taken and the beaches which need consistent disaster management measures.

Acknowledgement

The authors wish to thank the Council of Scientific and Industrial Research (CSIR) & the National Resource Data Management System (NRDMS) Division of the Department of Science and Technology (DST) for providing the financial assistance and the necessary equipments to accomplish this task.

Table 1. Inundation Distance Extent along the Study area

Location	Longitude	Latitude	Elevation (m)	Inundation distance (m)
Ovari	77.49	8.17	19	150
Idinthakarai	77.45	8.14	18	175
Perumanal	77.39	8.09	17	200
Navaladi	77.37	8.08	16	200
Kuttapuli	77.36	8.08	16	250
Vattakottai	77.34	8.07	15	300
Lakshmipuram	77.34	8.07	16	250
Chinna muttam	77.34	8.06	17	350
Kanyakumari	77.33	8.04	21	300
Keelamanakudi	77.29	8.05	09	600
Pallam	77.25	8.05	14	400
Rajakkamangalam	77. 22	8.06	16	150
Muttom	77.19	8.07	11	200
Kadiapatanam	77.18	8.08	14	100
Mandakadu	77.16	8.09	16	100
Colachel	77.15	8.1	12	750
Vaniakudy	77.14	8.11	16	100
Midalam	77.12	8.12	17	300
Enayam	77.09	8.13	15	130
Taingapatnam	77.1	8.14	14	200

Tsunami impacts on morphology of beaches along south Kerala coast, West coast of India

by K. A. Abdul Rasheed, V. Kesava Das, C. Revichandran, P. R. Vijayan and Tony J. Thottam National Institute of Oceanography, Kochi, Kerala, India, page 24- http://www.sthjournal.org/241/rash.pdf e-mail: rasdea@gmail.com

ABSTRACT

The present study is based on the post tsunami survey conducted in January 2005 along the southwest coast of India. Although tsunami affected the whole coastline of Kerala, it devastated the low-lying coastal areas of Kollam, Alleppey and Ernakulam districts leading to the loss of life and property. This paper illustrates the variation of tsunami intensity along the coasts of these districts and the consequent morphological changes occurred in the coastal area during tsunami. Topographic survey data showed that the coastal inundation was rampant along the worst affected regions where the coastal areas are like a narrow strip of land of width 100-400m, lying between the Arabian Sea and the backwaters and the down slope of the coastal area increases towards the backwater side. The data on run-up height showed a variation of 1.9 – 5 m along the study area. Post tsunami beach profiles showed erosion of the foreshore and backshore and landward transport of beach material during the run-up of waves at Puthu-Vypeen. The erosion of the backshore (berm) in several places along the coast was quite evident in the study. This has caused reduction in the elevation which may make these areas more vulnerable to breaching by the high waves, particularly during the monsoon and also during certain spring tides which is a matter of serious concern.

INTRODUCTION

On 26th December 2004, Indian suBCEontinent experienced the most devastating tsunami in its recorded history. The phenomenon was triggered by a submarine earthquake located at 3.4° N, 95.7° E off the coast of Sumatra (Indonesia) with an intensity of 9RSU.

Even though tsunami is a common phenomenon in the Pacific region, some destructive tsunamis have also occurred in the Indian and Atlantic Oceans (Altinok, 2000). Oceanic waves caused by the (27th August) 1883 Krakatoa volcanic explosion in Indonesia, was the earliest record of tsunami attack in India (Murty and Bapat 1999). The earthquake of magnitude 8.25 RSU occurred on 28th November 1945 near Karachi created large waves of height 11 to 11.5m in Kutch region (Pendse 1945). Most of the tsunamis are generated by the earthquake-initiated seabed displacements. Landslides (including underwater landslides), volcanic eruptions, impact of large objects (such as meteors) into the open ocean (Hills and Goda, 1998) and underwater explosions are also some triggering mechanisms for the generation of tsunami. The coastal features can determine the size and impact of tsunami waves. Kishi and Saeki (1966) identified the effect of coastal terrain roughness on wave run-up.

While tsunami approaches coast, it undergoes shallow water transformation (Synolakis, 1987). Tunami, imperceptible at deep sea, may grow to several meters

when it approaches the land (Mirchina and E.N. Pelinovsky, 1982). Its speed decreases as the water depth decreases but the kinetic energy transported by the tsunami, which is dependent on both its wave speed and wave height, must remain constant. Gedik et al., (2005) carried out laboratory investigations of tsunami run-up and erosion on permeable slope beaches. Tsunamis may affect coastal areas differently, causing great damage and loss of life in one area but little in another. The destructive nature of the waves themselves act as a main cause of damage. Secondary effects include the debris which will act as projectiles and run into other objects. Just like other water waves, tsunami begins to loose energy as it rushes into the land. Some energy may get reflected and part of its energy may dissipate on the bottom.

MATERIALS AND METHODS

State of Kerala has a coastline length of 560 km and undergoes seasonal changes in the near shore processes. For the present study, the southwest coast of Kerala between Neendakara (latitude 9° 01' 17.87") and Munambam (Latitude 10° 10' 37.55") is selected (Fig. 1). The coastal plain between Cochin and Kollam consists of a series of parallel sand ridges. The coastal area is backed by Vembanad estuary, extending from Munambam to Alleppey and the large brackish water system in Kerala opens into the sea near to Valiazheekkal and heavy mineral deposits can be seen north of the Kayamkulam inlet. The Cochin port is situated at the mouth of Vembanad Lake at 9° 58' 18".

An extensive field survey was conducted using Differential global positioning system (DGPS), Theodolite, Dumpy level, GPS, directional compass etc., to study the impact of tsunami waves on the South west coast of India. Measurements were made of land elevation, beach slope, tsunami flow direction and distance, maximum run-up height and duration of inundation, shoreline position and status of beach vegetation. In all places, the phenomenon was also documented through systematic interviews of eyewitnesses. The Post Tsunami Survey guidelines of the Intergovernmental Oceanographic Commission (IOC, 1998) were strictly followed during the observation. The primary measurements in the field surveys were the estimation of height reached by the seawater as well as for its horizontal penetration. Information on run-up height and inundation limit are important to analyze the phenomenon (Curtis, 1982).

RESULTS AND DISCUSSION

Tsunami inundation and damage was not uniform along the coast. This may be due to the geographical orientation of the coast, geomorphology of the landmass, shallow water bathymetry and orientation of approaching waves etc. Traces left by the tsunami such as watermarks on buildings, trees and debris lines along the coast or vegetation damaged by seawater were used to identify the run up and inundation limit.

Field investigation shows variation of tsunami intensity along the study area. Maximum intensity of the tsunami was observed in Kollam district followed by Alleppey and Ernakulam. The sectors adjacent to the Kayamkulam inlet between Kollam and Alleppey districts, recorded the maximum run-up height during the flood. The run-up level recorded at the northern side of inlet (Valiazheekkal) was 4.4m. There was a drastic increase in the run-up level at Cheriazheekkal (southern side of

inlet) and reached up to 5m. Figure 2 shows the post tsunami beach profile at Cheriazheekkal, where the coastal area experienced maximum inundation and run-up (zero value in the X-axis indicates the position of benchmark used for conducting the topographic survey). Here the down slope of the narrow coastal belt increases towards the backwater side. This coastal feature allows seawater to enter in to the land during high tide and strong waves which trigger panic situation among the coastal community. The devastation was quite extensive at Valiazheekkal where the width of the narrow coastal belt varies from 100m to 400m and is running parallel to the shoreline (Fig. 3). The down slope of this low-lying region increases towards the backwater side. The run up level on the coastal area between Alleppey and Cochin varied from 1.9-2.8 m. On the northern side of Cochin barmouth, the waves got intensified and maximum run up height was observed at Edavanakkadu (Fig. 4), a narrow down sloping barrier beach (Fig. 5), backed by water bodies (aquaculture farms) connected to the chin backwaters.

The northern side of Cochin inlet (Puthu-Vypeen) beach is wide and having an average elevation of 1.5-2.0m. Monthly beach profile measurements have been carried out in this region as a part of an ongoing programme. Maximum inundation occurred here at 13:28 on 26th December 2004 as recorded by the digital camera from the shoreline, and covered up to 600m towards the land (Fig. 6). The post tsunami beach profiles of four stations at distance of 1km apart (Fig. 7) show the changes in beach elevation and erosion that have taken place near the seaward end. It is evident from the observation that the eroded sediments from the seaward side have been carried further inland and got deposited near the benchmark. The presence of vegetation on the beach appears to have helped to reduce the intensity and thereby decreased the erosional characteristics of the incoming waves. Most of the vegetation is seen already were wiped off during the run-up of waves, or being destroyed due to high saline conditions in the soil.

The run-up measurements show a variation in height from 1.9 –5 m along the study area. The run-up heights and inundation limits are listed in table 1.The maximum run-up height was at Cheriazheekkal (5m) where the loss of life and property were severe.

The post tsunami beach profiles at Cheriazheekkal (Fig. 2), Valiazheekkal (Fig. 3) and Edavanakkadu (Fig. 5) reveal some basic similarities among these regions. The coastal areas are lying below the mean waterline due to its down sloping characteristic (Fig. 8). Moreover, the back water system is generally running parallel to the shoreline and the coastal areas are like a narrow strip of land (barrier Beach) lying between the backwater and sea. The inundated water had flooded into the backwaters and the force of wave has damaged most of the physical structures along the coast. It is evident that presence of seawall has played an important role in reducing the intensity of the waves along the coast, but the affected areas were not having any effective coastal defense structures (because the traditional fishermen use these places as fish landing centres). The tsunami floods at some places even destroyed the rubble-mound seawalls which got scattered along the coastline (Fig. 9).

Tide gauge data provide vital information on severity of tsunami. The sea level data collected by Cochin port trust at Cochin and the hydrographic department, Government of Kerala at Neendakara provided important information on the intensity and time of occurrence of tsunami at respective places (Fig. 10). The alongshore

separation between the two stations is approximately 100 km. The first hit of the tsunami took place at Neendakara at approximately 1045 hrs on 26th December, 2004 whereas in the case of Cochin, it was at 1115 hrs, suggesting a speed of 200km/hr. The sudden increase in water level at Cochin was approximately 0.65 m in 9 minutes, at the first hit. Subsequently, there were dramatic rise and drops in the water levels. In the case of Neendakara, The sudden increase in water level was approximately 0.83 m in 15 minutes. As observed in the case of Cochin, here also there were dra*matic rise and drops in the sea level. The overall range of water level variability was quite high at Neendakara, as compared to Cochin. Normally, the tidal ranges are less at Neendakara as compared to Cochin, as seen in the figure. The tidal records showed the occurrence of tsunami continued till 30th

Impact of the Tsunami and the Setusamudram project

The survival of the small scale fisher folk in the aftermath of the tsunami,

The Setusamudram Ship Canal Project proposes creating a navigable route between India and Sri Lanka, linking the Palk Strait with the Gulf of Mannar, to be achieved by excavating and dredging a 80km channel through the shallow sea bed. The canal would reduce the distance between the east and west coasts of India, saving the time taken for ships to circumnavigate Sri Lanka. However, the project is opposed by many in Sri Lanka, concerned about the impact upon the environment and the livelihoods of fisherfolk.

and in the implementation of the Setusamudram project

Fisher folk from Asia were the worst hit by the tsunami. They lost not only loved ones, livelihoods, homes and boats and fishing gear but also the resource base – mangrove swamps, coral reefs, and coastal fish breeding grounds that supported their livelihoods. According to many experts it is likely that if the Setusamudram Project is implemented it could lead to further marginalisation of the fisher folk.

A workshop was organized by ITDG Practical Action South Asia for the development organizations working in this sector and journalists with the aim of communicating the information to fisher communities and ongoing policy dialogues on the likely implications of the Setusamudram Project and the Rebuilding Programme for the fisheries sector which will direct future fishing industry in Sri Lanka.

The workshop on the impact of the tsunami, and the Setusamudram project, on small scale fishery industry and coastal resources was held at the andaranayake Memorial International Conference Hall on the 12th of August 2005 with the participation of many interested groups. Among the participants were representatives from Community based organisations, lobby groups campaigning on the rights of fisher folk, media, Coastal Conservation Department, Task Force for Rebuilding the Nation (TAFREN), FAO etc.

The presentations and discussions that followed generated many important suggestions and recommendations on the rebuilding work and the Setusamudram project. The presentations by the panel of scientists and activists were on

- *The impact of the tsunami on small scale fishery industry in Sri Lanka* by Tinil Fernando from the National Aquatic Resources Research & Development Agency view presentation (373k)
- *Impact of the tsunami on coastal resources – a case from Sri Lanka* by Dr. Ruchira Cumarathunga from the University of Ruhuna
- *Impacts of the Setusamudram project on coastal resources and fisheries sector* by Turney Pradeep Kumara from the University of Ruhuna
- *Role of fisher communities and other stakeholders in rebuilding the fisheries sector* by Herman Kumara from the National Fisheries Solidarity Movement
- *Rebuilding lives and livelihoods of small-scale fishing communities in the post-tsunami context* by ITDGPractical Action view presentation (118k)

- *Trends and future directions of the fishery sector in the post tsunami rebuilding process* by Patrick Mulvany, ITDGPractical Action UK. view presentation (434k)

The fisheries sector provides considerable number of direct and indirect employment opportunities to nearly one million household dependants. In 2003 the sector obtained foreign exchange worth Rs. 9.5 billion through marine product exports. Its contribution to the country's GDP was estimated at 2.6%. However with the tsunami this sector suffered severe losses. The death toll of fishermen was 5,006, around 32,989 houses of fishermen were affected by the tsunami and 24,572 were destroyed and around 17,157 of the marine fishing crafts were either destroyed or 4,241 damaged. According to *Tinil Fernando from the National Aquatic Resources Research and Development Agency* the total loss in fish production would be around 86,000 tons in 2005, and the country's foreign exchange earnings from fish exports will be lowered by a third as a result of non-availability of fish for export. view presentation (373k)

The natural coastal habitats (coral reef, estuaries, lagoons, mangroves, salt marshes and sand dunes) are immensly productive, essential for national growth and a rich reservoir of genetic resources and bio diversity. However, as a result of the tsunami the fragile corals had been damaged by vigarous water and coral rubble movement and the entanglements of gill nets and clothing. *Turney Pradeep Kumara from the Department of Fisheries Biology at the University of Ruhuna* stated that having a buffer zone, a green belt and involvement of coastal communities for conservation measures such as clean up of beach areas, mangroves and reefs, and eco tourism measures such as artifical reefs and wrecks are necessary strategies for coastal zone management.

Dr. Ruchira Cumaratunga from the University of Ruhuna, who is also on the committee from Sri Lanka on the Setusamudram project, explained in detail the impacts of the Setusamudram Project on coastal resources and the small-scale fishery industry. Due to the civil war that prevailed in the country no proper study has been carried out on the ecology and bio diversity on coastal areas for the past two decades. The Setusamudram project could affect most important ecosystems, coral reefs – dredging the canal will stir up the dust and toxins that lie beneath the sea bed and will adversely affect the population of corals. Further, an upsurge of coastal currents due to the Setusamudram project can lead to higher tides and to more energetic waves, and hence to coastal erosion. As a result harbours and coastal structures which have been built with designs based on present ocean dynamics may become vulnerable. In addition the changes of ecology and the food chain have an effect on the fish population, which can in turn affect the lives of the hundreds of thousands of fisher folk in the area. There could be also an ecological imbalance in coastal ecosystems due to invasive species being dispersed into the relatively protected areas within Palk Bay and Mannar Bay when the bilge water (ballast water) of ships sailing through the Canal is released in to this area.

Dr.Cumaratunga concluded her presentation with the comment that "considering the seriousness of the possible impacts of the Setusamudram canal project on the sensitive ecosystems, biodiversity and physical and chemical properties of coastal aquatic and terrestrial environments, a thorough assessment of possible impacts of this project should be carried out before commencing the project. This assessment should be a joint project of Sri Lanka and India."

Upon presenting the views on the role of fisher communities and their organisations in rebuilding the small scale fisheries sector, *Herman Kumara from the National Fisheries Solidarity* posed the question – "How many scholars, governmental departments and fisher folk were involved in developing the post-tsunami recovery plan for the fisheries sector?"

Patrick Mulvany of ITDGPractical Action, a strong international activist and campaigner for the rights of the small scale farmers and artisanal fisher folk, stated that although the largest humanitarian response ever was generated by the tsunami, fisher folk could anticipate worse conditions. This is mainly due to organisations and institutions of the fisher folk in many cases being decisively weakened not only by the disaster itself, but also by people and institutions, who take advantage of the disaster to further their own interests.

Speaking further on the rights of artisinal fisher folk Patrick stated that "as NGOs and other organisations that work in support of peasant and fisherfolk organisations and communities, we need to commit ourselves to support the defence of labour-intensive, beach-based fisheries, as well as the monitoring of relief and reconstruction efforts, raise awareness and campaign against dumping of discarded fishing vessels from industrialised countries in tsunami-affected areas and strengthen local government authority level organisations. The future of fishing, provision of fish and the conservation of the coastal areas depend on the survival of small-scale coastal beach-based fisheries." view presentation (434k)

Some of the recommendations proposed by the participants of the seminar were that the committee from Sri Lanka on studying the impacts of the Setusamudram project should involve a relevant national or international agency to study the impacts of the Setusamudram project and to work closely with local organisations involved in the fisheries sector to obtain their recommendations to the process. A direct outcome of this workshop was TAFREN (Task Force for Rebuilding) inviting ITDGPractical Action and other key participants for a meeting to discuss further the recommendations and suggestions generated as per the request of participants of the workshop.

Background

The impact of the tsunami, and the Setusamudram project, on small scale fishery industry and coastal resources.

The Tsunami has shown that oceans although within territorial waters of certain nations belong to the whole world or region. The coastal inhabitants from India and Sri Lanka suffered equally from the Tsunami. Apart from being displaced and deprived from their livelihoods, the fisher folk also have to battle with the negative environmental conditions resulted from the tsunami.

According to a research by a team of scientists from Central Industrial Research Institute about 40 million tonnes of Titanium had been deposited in the whole 500km stretch of the coastline that was hit by the tsunami. Further, independent surveys conducted at Kodiakkarai in India in January had revealed that the sea is now half its depth than it was before tsunami.

These studies continue to highlight the negative impacts to the coastal and marine resources from the tsunami. However, despite the constant reminders about the negative impacts on the coastal and marine resources that has already occurred from the tsunami, and the many protests from political leaders, environmentalists and media the Government of India (GoI) has cleared Setusamudaram Project (SSCP).

The Sunday Observer (July 10, 2005) reported that fishermen from Pesalai and Talaimannar in Mannar district had complained to North East Governor Tyronne Fernando that, "deepening of the Palk Straits under the Setusamudram Canal project would destroy the breeding ground of fish in the sea territory close to Mannar shore." Environmentalists too express the view that the project could destroy the coral reef in the area that is home to more than 700 fish varieties. A report by the Environmental Foundation expresses the view that Setusamudram Project is potentially damaging to the environment and could seriously affect Sri Lanka; and sought that a proper study is needed and demanded that all stakeholders, on both sides of the Palk Straits, be consulted in the course of the Environmental Impact Assessment (EIA) process.

We understand that media has an important role to play in keeping the general public informed, and getting the views of the fisher folk and coastal residents across to policy dialogues on Setusamudram. Therefore, we feel that it is of paramount importance for us to understand the environmental, social and economic implications of the project.

With the aim of involving media and development workers to communicate, and to feed the information to fisher communities and ongoing policy dialogues which will direct future fishing industry in Sri Lanka, ITDGPractical Action organised a workshop on the Impact of the tsunami and the Setusamudram, on small scale fishery industry and coastal resources on August 12, 2005 at the Bandaranayake Memorial International Conference Hall.

http://practicalactionconsulting.org/?id=tsunami_Setusamudram

Re-design of Setusamudram Canal Project

The following conclusion in the paper presented by Dr. S. Badrinarayanan should compel a re-design of the channel passage project into a land-based canal project on the lines of the Panama canal with adequate protective measures to maintain the relatively calmer waters in Gulf of Mannar:

> "The dredging and opening of the Adams Bridge in all likelihood may cause the sediments and turbulent tide to enter the tranquil Gulf of Mannar and choke and destroy the delicate coral island. As an alternative dredging in the Pamban or nearby areas and bypassing the Adams bridge could be favourably considered like other inter sea canal (Panama Canal) locks could be provided both in the palk bay side and Gulf of Mannar side so that such calamities could be prevented."

This should be done, in addition, to incorporating adequate protective measures along the coastline, to cope with another tsunami, on the pattern of high-walls constructed along the coastline areas of Japan, as may be seen from the following report:

How Japan handles tsunami threat

By Jamie Miyazaki
in Tokyo, Wednesday, 5 January, 2005, 15:09 GMT

As one of the world's most earthquake-prone nations, Japan has had considerable experience of tsunamis.

The very word is Japanese, and probably the most famous Japanese painting, by 18th Century artist Hokusai, depicts a tsunami passing by Mount Fuji.

So seriously does Japan take the tsunami threat that one university even has a specialist engineering faculty to study the natural effect.

There is also a Tsunami Warning Service, established in 1952, and run by the Japan Meteorological Society (JMA).

Six regional centres connected up to 300 sensors located across Japan's islands, including around 80 water-borne sensors, monitor seismic activity round the clock.

If an earthquake looks as if it has the potential to trigger a tsunami, the JMA issues an alert within three minutes of it being identified.

If some of these countries like Sri Lanka had a system like ours perhaps we could have saved lots of lives -- Makoto Hikida, Kobe quake survivor

The alerts are broadcast on all radio and TV channels, and if necessary an evacuation warning is also given.

The JMA aims to give people in the path of the wave at least 10 minutes' warning to evacuate the area.

Local authorities, central government and disaster relief organisations also get warnings via special channels so they can respond to a disaster swiftly.

So sophisticated is the JMA's network that it can predict the height, speed, destination and arrival time of any tsunami destined for Japanese shores.

System cost

Underpinning this cutting-edge warning system are strict new building laws to protect against tsunamis and quakes, and good disaster planning that have so far kept Japanese casualties from such natural disasters low for such a vulnerable nation.

When a 30-metre-high tsunami swamped part of the northern island of Hokkaido in 1993 there were only 239 fatalities from the tsunami and quake.

Residents could thank tsunami walls, strong buildings and disaster awareness for their good fortune. While the JMA got a warning out within five minutes, the tremor was so close to shore that by the time the warning was issued the first wave had struck.

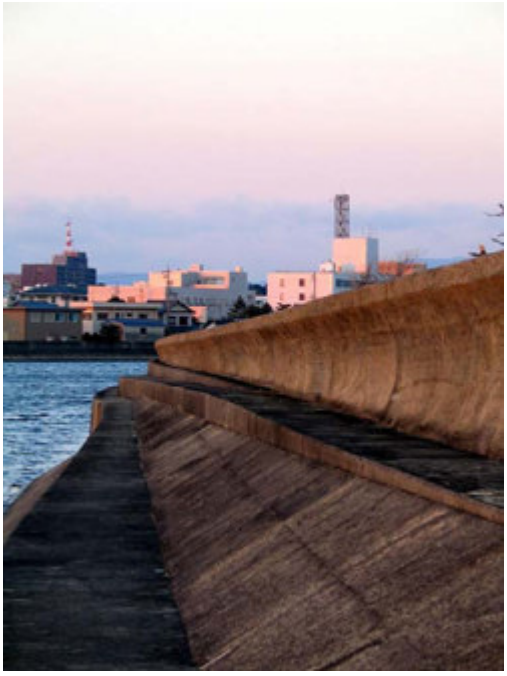
But Makoto Hikida, who survived the 1995 Kobe earthquake, told the BBC News website: "We have great faith in the JMA, they do a good job in saving people's lives, if some of these countries like Sri Lanka had a system like ours perhaps we could have saved lots of lives."

Japan's system is being upgraded constantly. In 1999, a new tsunami-forecasting model was introduced. But the system comes with a price-tag - around US$20m a year.

Not much for wealthy Japan, but a price that some poorer countries might balk at.

Time to warn

However, as Hokkaido's residents know, it is not just an early-warning system that saves lives.



Shizuoka prefecture, on Japan's tsunami-prone east coast, has 258 tsunami and quake-resistant shelters along its shoreline. Other coastal towns have built floodgates to prevent water from tsunamis heading inland through rivers and wreaking more havoc.

Tsunami walls also ring other parts of the coast to prevent damage.

But these walls are rarely more than a few metres high, and would not have fully protected against the tsunami in the Indian Ocean in December.

So even with all these precautions and warning systems, Japan still remains at risk.

According to government estimates, if the worst-case scenario of three simultaneous strong quakes across Japan was to occur, up to 12,700 people

could be killed in the resulting tsunami.

With some underwater quakes in Japan occurring just a few kilometres offshore, it could take only five minutes for tsunamis to hit land. That would make even Japan's cutting-edge system effectively useless, without further advances.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/1/hi/world/asia-pacific/4149009.stm
See also: http://www.unisdr.org/ppew/tsunami/what-is-tsunami/backinfor-brief.htm 'International strategy for disaster reduction'

http://www.unisdr.org/ppew/images/tsunami/photo-japan2.jpg

Tsunami protection wall, Japan

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06.06.2005

Impacts of the Proposed Sethusamudram Ship Canal Project

- Why the Environmental Clearance should be Withdrawn and Project Stopped

1. SSCP - The Background:

Sethusamudram Ship Canal Project (SSCP) is a 144-year proposal. Commander A D Taylor from Indian Marine planned this SSCP project in the year 1860. In 1952 Sir A Ramasamy Mudaliar submitted a proposal and a feasibility report.

As per the present plan, the total length of SSCP would be about 260 km - about 120 km from Tuticorin Port to Adam's Bridge (in Gulf of Mannar), and about 140 km north of Rameswaram from Adam's Bridge to Bay of Bengal channel (in Palk Bay). Overall GOM and Palk Strait [PS] cover an area of 10,500 kms. The canal is being investigated for different drafts (for 9.15 m, 10.7 m and 12.8 m). In general, the canal will have a depth of 12 metres enabling 10,000 to 12,000 GRT vessels to pass through. The Government of India is proposing to dredge a

Advocate, Chennai; T.Mohan, Advocate, Chennai; Bless- Cuddalore; Consumer Action Group - Chennai; Human Rights Advocacy & Research Foundation – Chennai; Legal Resources for Social Action- Chengalpattu; Neythal – Nagapattinam; People's Watch, Tamil Nadu - Madurai; Rural Upliftment Centre- Nanguneri; Society for Integrated Rural Development - Madurai; Sneha- Nagapattinam; Tamil Nadu Environment Council -Dindigul; Tamil Nadu Rural Reconstruction Movement- Ramnad; Tamil Nadu Women's Collective - Chennai; MJM Centre- Mavelikara, Kerala; Equations - Bangalore, Karnataka.

1.1. Geographic Location:

Gulf of Mannar [GOM]: The Gulf of Mannar [GOM] falls in the Indo-Pacific region, considered to be one of world's richest marine biological resources. Gulf of Mannar Marine Biosphere Reserve (GOMMBRE) is the first Marine Biosphere Reserve not only in India, but also in South and Southeast Asia. The IUCN Commission on National Parks and WWF, identified the Reserve as being an area of "Particular concern" given its diversity and special multiple use management status. As the first Marine Biosphere Reserve declared in India, this area has long been a national priority. The Gulf has been chosen as a biosphere reserve primarily because of its biological and ecological uniqueness. The region has a distinctive socio-economic and cultural profile shaped by its geography. It has an ancient maritime history and was famous for the production of pearls. Pearl has been an important item of our trade with the Roman Empire as early as the first century A.D., while Rameswaram, has been and continues to be famous for its production of chank (Indian conch).

The GOM is famous for its chanks, although irrational chank fishing has severely depleted the stock. In addition, the biosphere reserve in the area has 17 different mangrove species. The GOM thus constitutes a live scientific laboratory of national and international value. It has 3,600 species of plants and animals that make it India's biologically richest coastal region. It is, of course, specially known for its corals, of which there are 117 species belonging to 37 genera. The GOM is a chain of shoal, called Adam's Bridge. It is an inlet of the Indian Ocean, between South Eastern India and Western Sri Lanka. The GOM is 130 km to 275 km wide and 160 km long. During high tide the seawater would raise to more than 1.2 meters above the sea level. Full of beach ridges, the GOM can be grouped into: (i) Beach ridges south of Vaigai River; (ii) Beach ridges between Kotangudi River and Palar River; (iii) Beach ridges between Palar River and Gundar River system; (iv) Beach ridges between Gundar River and Vaippar River; and (v) Beach ridges south of Vaippar River. The total water logged land has been calculated to be 5.96 km^2. Eight serious of Strand Lines can also be observed, apart from the Sea Cliff and Caves.

Adam's Bridge: Adam's Bridge is a chain of Shoal, nearly seven in all, is 30 km long. Sir Emerson Tennet in his book 'Ceylon' writes -" The barrier known as Adam's Bridge which obstructs the navigation in the canal between Ceylon and Ramad, consists of several parallel ledges of conglomerate and sand dunes, hard at the surface and growing course and soft as it descends till it rests on a bank of sand, apparently accumulated by the influence of current at the change of the monsoons". Also according to geological survey, it is apparent that Miocene Era limestone beds are under the Adams Bridge, which connects Jaffna peninsula in Sri Lanka and Rameswaram in India. [Ref: The pre-history of Sri Lanka by S.U.Deraniyagala]. The legends as well as Archeological studies reveal that the first signs of human inhabitants in Sri Lanka date back to the a primitive age, about 1,750,000 years ago and the bridge's age is also almost equivalent.

Palk Strait [PS]: PS is an inlet of Bay of Bengal. The PS is 64 kms to 137 kms wide and 137 kms long. It receives several rivers including Vaigai from India and contains many islands of Sri Lanka.

1.2. Nodal Agency / Consultant:

During 1997 Ministry of Surface Transport made Tuticorin Port Trust [TPT], which has celebrated its Silver Jubilee on 10-07-2004, as Nodal Agency for this project.

National Environmental Engineering Research Institute [NEERI]: The Initial Environmental Exam was done by National Environmental Engineering Research Institute [NEERI], Nagpur [a Central Government Agency], in 1998 as directed by the Nodal Agency, TPT. It recommends securing a major marine project and a full scale, 'Environmental Impact Assessment' [EIA]. The provisional executive summary of EIA submitted by NEERI in May 2004 to TPT after receiving Rs. 1 Crore from the Nodal Agency. Detailed Project Report [DPR] also has to be submitted before 30th November, 2004 by L & T of India and Rampaul of Denmark, the fixed contractors of SSCP.

This project was envisaged by Mr.Taylor in 1860 who designed it on the land, where there will be no turbulent sea or churning water currents. The present alignment, the fifth one, is in the sea passing through one of most dangerous areas. Dangerous, because it is where an entire train was washed way taking along with it hundreds students in 1964. The Danuskodi Railway station was away and it is now keeping Company with thousands fishes under the water. The NEERI Environmental crop act Assessment for the project says that this area is notorious for currents and cyclones. While all the sea canals are dug on the land, the Sethusamuthram project is made in the turbulent sea.

2. 'Environmental Impact Assessment' [EIA]:

The efforts of Sethusamudram canal was started in 1860 and continues up to 1955 do not give importance to the proposed project because the values of biodiversity and their role in the existence of human species was started lately (Earth summit 1992, 2002) and the signatories of participating countries including India are responsible to protect their own biodiversity. During early centuries the importance of saving our biodiversity did not arise because it was less disturbed when compared to recent past throughout the world and India is not an exception. (P.1.3).

In the introductory part itself it seems probable that the “proposed canal will bring benefits like surge in the development of coastal trade and development of industries”. (P.1.2) The impact assessment starts with the biased information of supporting the proposal rather than emphasizing the importance of impact to the human kind. There is no data supporting their statement.

Through the EIA studies state, “environmental concerns will be addressed and resolved through their report”. It is a biased one. Through the report one cannot resolve the problems on the loss of habitats or other losses. It is a misleading statement of NEERI (2004). (P.1.7) Without balancing the impacts and benefits every chapter begins with the support of the project, which is rather partisanship by the NEERI. (P.2.1)

2.1. False information: Only a Rapid EIA not a comprehensive EIA:

Section 1.5.1 of the report states that *'the objectives of the EIA study is to carry out rapid and comprehensive assessments for delineating environmental management plan for Sethusamudram Ship Canal Project to enable the Ministry of Shipping to obtain environmental clearances from concerned local, state and central Government authorities'.*

How an EIA study for an area like the Gulf of Mannar and Palk Bay region can be both rapid and comprehensive at the same time. This aside, the report is essentially a Rapid Assessment Report and not a comprehensive EIA Report. The report itself mentions that the comprehensive EIA report will be prepared later based on the primary data collection for the region.

The EIA notification does not state that a rapid EIA will suffice. It explicitly states in Point 2.I (A) that *any person who desires to undertake any new project in any part of India or the expansion or modernization of any existing industry or project listed in the Schedule-I shall submit an application …the application shall be made in the proforma specified in Schedule-II of this notification and shall be accompanied by a project report which shall, inter alia, include an Environmental Impact Assessment Report, an Environment Management Plan and details of public hearing as specified in Schedule-IV*

Thus it is amply clear that the MoEF requires a complete EIA and not a Rapid EIA. Hence even the basic

requirements of law is not completed.

Schedule IV of the notification related to procedure for public hearing also states that whoever applies for a project should submit an executive summary along with an Environment Impact Assessment Report. It does not state that a Rapid EIA will suffice for the public hearing.

A public hearing cannot be conducted on the basis of a Rapid EIA. It is clear that the project proponents in this case have sought to only provide a makeshift document to primarily overcome the 'hurdle' of environmental clearances. This is unacceptable. Therefore the Rapid EIA in question cannot be used and need not be viewed by the public as a serious document for impact assessment. As far as the general public is concerned, no EIA has been provided to the public, only a Rapid EIA was provided, which is totally inadequate to assess the impacts of the project.

The report by NEERI does not state that it is a rapid EIA on its cover page. It is only as the reader explores the document further that one realises that the document is only a Rapid EIA without information from more than one season's data, particularly the monsoon season. Many of the sources of data on the biodiversity of the region are outdated and cannot be sued for a project of this magnitude and with its attendant impacts.

Instances of inadequate information in the report:

1. Overall, we find that the Rapid EIA maintains a deafening silence when it comes to justifying or giving an explanation for about details and statistics regarding impacts something that the document is mandated to do in the first place.

2. While mentioning that there is going to be a spurt in the shipping traffic in the region, the report does not state anywhere what will be the impacts of a single oil spill in the region. A report prepared for the Directorate General of Shipping, on the Development of Coastal shipping and Minor Ports by the Tata

Consultancy Services mentions that the highest percentage of cargo that passes between the East and the West Coast are Coal, Crude Oil and POL products and cement. The impacts of a breaching of a vessel carrying any of these goods have not been studied or even mentioned in the EIA. Whereas the EIA goes on to expound about the benefits of coastal shipping without taking into consideration the impacts of increased coastal shipping in this region.

3. The EIA mentions that there will be attendant development all along the coast in the form of industries, workshops, minor ports etc, but nowhere is there a mention of the cumulative impacts of these on the environment of the Gulf of Mannar

4. The EIA report completely undermines the marine biodiversity of the region. It has failed to record the impacts on the dugongs for example. Without conducting primary studies in there region, it mentions that all corals along the alignment at dead corals. It also provides false information stating that the endangered dugongs and dolphins are only confined to the Gulf of Mannar National Park! This is not only false data, but also a ridiculous statement. The UNEP report titled *'Dugong, Status Report and Action Plan for Countries and Territories'* states that dugongs have been noted even in deep waters between India and Sri Lanka. The Marine Protected Area in the South Asian Seas Volume 2: India Needs Region[1] states the following about the dugongs of the region:

The extensive seagrass beds around Musal Island off Mandapam Camp and around Appa and Balayamunai Islands, off Kilakarai are the main grazing grounds (Jones, 1967; Silas & Fernando, 1985) where large herds used to occur. Catches were higher in Palk Bay between Devipattanam and Pamban on Rameswaram Island than in the Gulf of Mannar between Musal and Appa Islands and the mainland. ***There maybe coast to coast migration between India and Sri Lanka through Palk Bay which is shallow while migrations across the deeper Gulf of Mannar may take place around the coast (Jones, 1976).***

5. The Rapid EIA mentions that the navigational route is to be 20 kilometers away from the Shingle Island. The EIA also mentions that the route will only be 6 kilometres away from the Van Tivu Island, which is also part of the Gulf of Mannar Marine National Park. This will be a violation of the MoEF's circulars that state that there is to be a buffer zone of 25 kilometres around all National Parks and Sanctuaries.

6. The EIA also does not give any data or details regarding impacts on the flow of currents once the barrier at Adam's bridge is dredged. The current flow will have impacts on sedimentation in the Gulf of Mannar and also on the coral reef areas in the region. This is despite common knowledge that sedimentation is damaging to areas

7. The Muthupet and the Vedaranyam areas are sensitive areas, which run parallel to the canal alignment. There are no details in the EIA about the impacts of oil spills on the coastal areas. This is significant especially when one notes that there is absolutely no oil spill modeling keeping in mind a worst case scenario.

8. The document most shoddily mentions that exotic species from the Bay of Bengal region can enter the Palk ay and vice versa. But it does not state what the impacts of such invasion of exotic species would be. In which case one wonder what impact has been assessed!

9. There is no mention of a disaster mitigation plan anywhere in this report, clearly meaning that the report seeks to conceal the fact that there can at all be any disaster in a busy shipping route carrying POL, crude, coal, naphtha and other such cargo!

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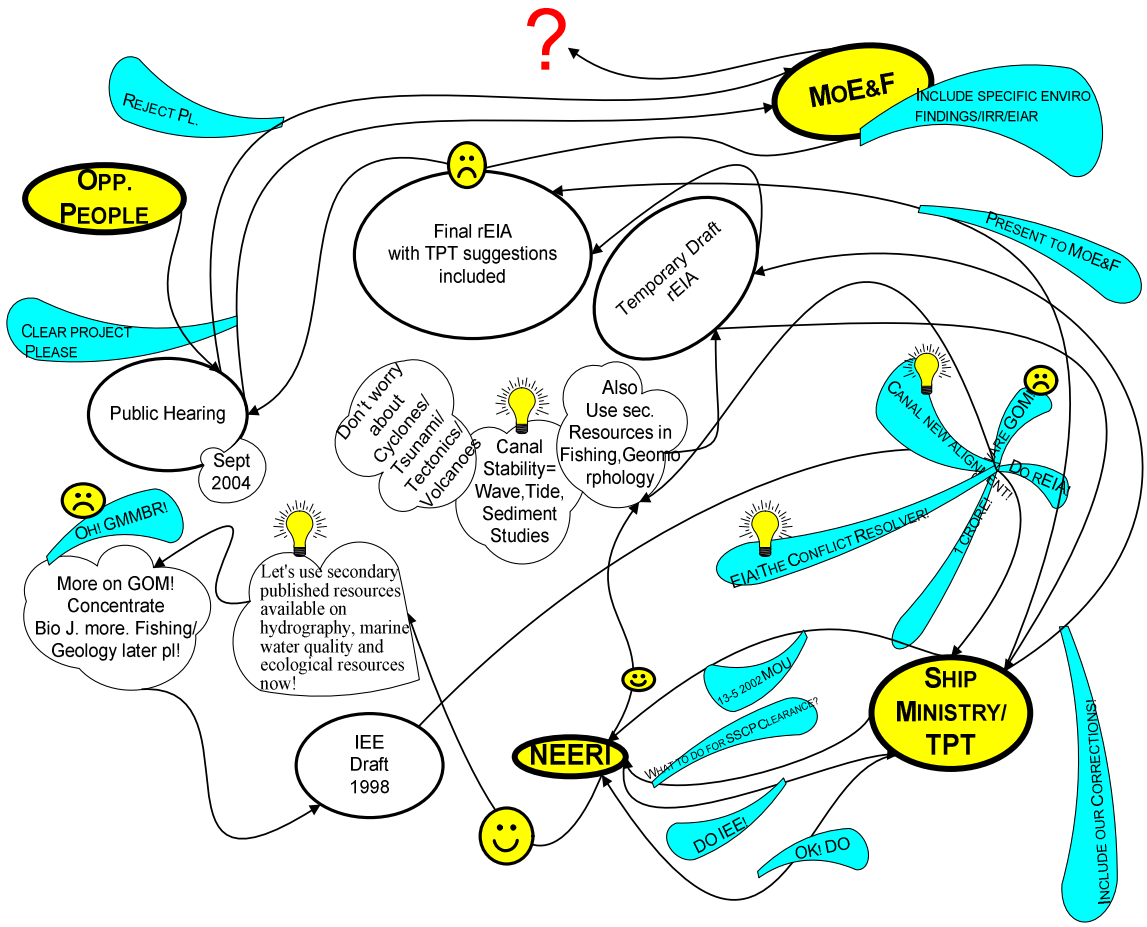
[1] Published by: IUCN, Gland, Switzerland Citation: Pernetta, J.C. (Ed). 1993. *Marine Protected Area Needs in the South Asian Seas Region. Volume 2:India.* A Marine Conservation and Development Report. IUCN, Gland, Switzerland. vii+ 77 pp.

10. The 51 million cubic metres of dredge spoil is proposed to be dumped in an area frequently referred to as a wasteland – the site is a well known proposed bird sanctuary! There is a proposal lying with the Tamil Nadu Forest Department for the declaration of the area as a Wild Life Sanctuary. The report predictably ignores this.

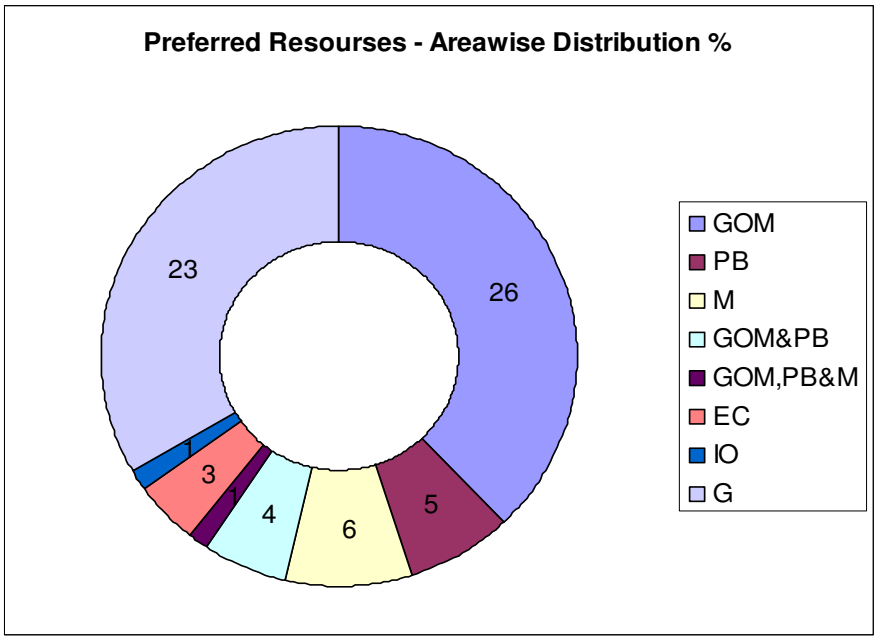
11. While the report faithfully makes passing mention of the impacts of construction activity and dredging etc on the traditional fisherfolk, including their displacement, it sheds no light on any compensation amply exposing the project's commitment to safeguard the livelihoods of the fishing communities.

2.2. The Process of EIA:

First, we shall go through a simple flow chart (also called a 'mind mapping diagram' by some) which describes the various parts and processes present in the activity of the EIA team's mental reconstruction of the project environment.



Usage of Secondary Resources of information formed a part of the IEE draft as well as in the preparation of the final rEIA draft. We shall now see what sort of secondary resources were preferred by the EIA team.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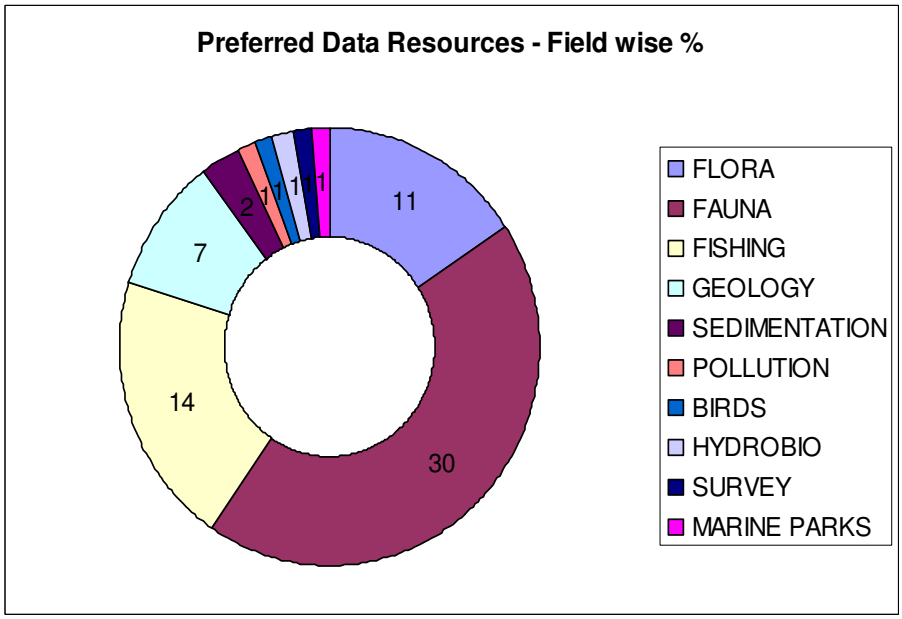
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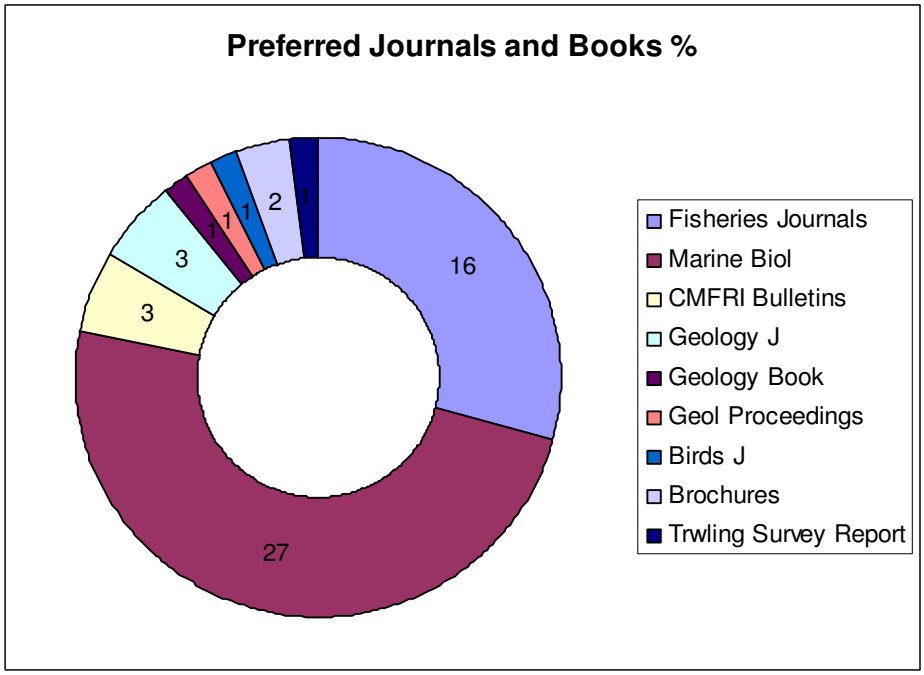

The above charts describe the nature of the secondary sources preferred by the EIA team. This information has been derived from an analysis of the 'bibliography' given at the end of the rEIA report. Apart from these resources, the EIA team preferred to use its own primary data while describing the Sedimentation, Wave Refraction and Ocean Currents of the study area and the Sea Floor Geology in the Adams Bridge area.

The EIA has given increased importance to the data resources related to the Gulf of Mannar (GOM) area. The data resources related to Palk Bay and Mandapam areas are just one fourth that of GOM. The data resources not specifically related to any geographical area has also received an almost equal importance as to that of GOM.

The EIA is more engrossed with the data related to the marine fauna of the area. Fisheries received the next importance which is followed by the data related to the marine flora.Data pertaining to Marine Geology has received less than one third importance as that of the fauna. Bird data have received 14 times lesser importance to that of fisheries and 30 times less importance to that of the marine fauna.

Journals in Marine Biology have been referred almost 27 times greater than the journals in Geology or Sedimentology. Books have been very rarely used. One Geology book has been used more than one time.

What does this prioritization (or say preference) pattern indicate?

It indicates that the EIA team has spent more time on the data related to Gulf of Mannar flora and fauna than on the Sedimentation or the Geology of the area. Birds have almost been neglected.

What are the factors that might have driven the EIA team to choose such an order of priority? Why GOM? Why not PB? Why Fauna? Why not Tectonics? Why neglect meteorology totally?

The order of priority is 1) Marine biology with a greater importance to the fauna of GOM, 2) Fisheries of the whole coast, 3) Geology pertaining to sedimentation studies 4) Birds receiving minimal importance 5) Nil bibliographic reference on Meteorology and Pollution.

Was this preference dictated by the needs of science or by the needs of any other space, say the political space?

The earlier question comes back to mind again. Why GOM? The most probable answer might be that it is a Marine Biosphere Reserve and hence more time and space should be dedicated to understand it so that impacts on it could be understood and evaluated in a better way. Fisheries had the second priority because it is the fisher folk who shall be affected by the project and hence they shall be the vociferous opponents of the project. Geology took one third the importance of the fauna because the basic, elementary data is enough at the present juncture where the main objective is to get the clearance for the project rather than an immediate construction of the canal. Birds could be tackled at a very later date, if at all. Meteorology becomes important only when the ships start navigating through the canal, is that not so?

It seems to us that this prioritisation is a direct response to the most frequently asked questions (faqs) from the civil society. 'Will this project affect the GMMBR detrimentally? Will it destroy the livelihood of the fisher folk? Will the canal not get sedimented easily as it is going to be located in the Adams Bridge where sedimentation is the order of the day?'

It seems to us that this EIA is a sincere scientific attempt by NEERI to answer these FAQs. This is definitely very important for obtaining a clearance for the project and also for resolving any conflict with the opposing actors. But is that what the practice of EIA is all about?

Definitely not; so how do we define the practice of EIA?

Heer, Hagerty (1977) define EIA as 'an activity that aims at establishing quantitative values for selected parameters which indicate the quality of environment before, during, and after the proposed activities'. 'EIA is the process in which environmental factors are integrated into project planning and decision-making so as to achieve ecologically sustainable development.'(Sinha). Jain, Urban, Stacey (1977) consider EIA as 'a study of probable changes in the various socio-economic and bio-physical characteristics and the environment which may result from a proposed or impending action'. Principle 17 of the Rio Declaration stated that: "Environmental Impact Assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."

NEERI, as they are the pioneers of EIA in our country, would agree to all these definitions. They might also claim that they are operating under the purview of these definitions. We don't doubt the integrity in their answers. The real problem is not in the definitions but in positing certain questions within these definitions. 'What is the number one parameter that should guide an EIA agency to select certain parameters for study?' 'What is it that shall guide an EIA team to select certain environmental factors so that they could be integrated into project planning and decision making?' 'Which are the socio-economic and the bio-physical changes whose probability you shall detect?'

The answer from a totally unexpected source:

"Predictions about the ocean environment have to be based on the history of the environment. Ideally, hundreds of years of data should be used to calculate the distribution of waves, currents, or winds and their expected maximum values. In actual fact, the data for a particular location usually cover a much shorter period, and therefore, are a poor basis for predicting the future from the oceanographer-statistician's point of view. Despite this, valid operating and design values can be obtained by one of several methods. ***The objective of the designer or operator of offshore structures, pipelines, vessels, etc., is to arrive at a design likely to survive but also capable of being reconstructed at reasonable cost after failure. Thus the correct selection of the extreme environmental condition the structure is going to encounter during its life, assumes crucial importance.*** Once the extreme environmental conditions have been evaluated, the designer can, after calculating the risks and costs specify the design criteria and proceed to select the size, shape and configuration of the structure." (A.K.Malhotra - *"Ocean Science and Technology"* p-32 1980)

What does this passage indicate?

It says that we should ask the first questions first. The first question about any structure would be a question pertaining to its stability. Will the structure remain stable even under such and such extreme

environmental condition? What if it breaks? What are the ways through which it might fail? What is the probability of such a failure?

The EIA has raised this question of course. Let us quote that passage here in full as this is the most crucial spot where the NEERI team chose to enter one particular road when there were many before it. 'The stability of the study area along the alignment is influenced by number of factors, primarily due to geological, biological, meteorological and oceanographic parameters, which distinctly vary from one sector of the coast to another. The ***most influencing*** (yes. this is the spot where the NEERI makes its choice) factors in coastal waters are the tides, waves and currents and they interact with each other to produce an energy input, which shapes and modifies the shore. Any attempt to study these problems require a thorough understanding of the factors and processes involved in the coastal geomorphological system, the pattern of sediment transport in the littoral zone, the volume of exchange of littoral drift from one region to another, the monthly and seasonal variation and the intermittent oceanographic factors acting on the system.'

Studies on tides, waves and currents in a coastal environment are definitely important. No doubt about that; but what is the basis for stating that they are the 'most influencing factors' (of stability) in coastal waters? They certainly play a very dominant daily role in determining the stability of that environment, the proposed canal and navigation. Without studying them we definitely cannot construct and operate a navigation channel. But… Will a thorough knowledge of them issue us the passport to a total stability (of the canal)?

How will NEERI prove its statement? Why does it think that the 'Tides, Waves and Currents' influence the 'stability' of the coastal environment more than say 'Geology and Meteorology'?

When the knowledge of tides, waves and currents is gained, can we rest assured that the whole knowledge pertaining to the stability of the proposed structure has been gained?

How can this choice exclude other spaces of importance?

NEERI makes the choice here and this choice has excluded other spaces in total in the report. The meaning of this is that NEERI team has believed that the knowledge of tides, currents and waves is equivalent to the knowledge of stability of the project.

What might be the reason for this attitude?

Threats from waves, tides and currents could be overcome; but if a scientific evaluation of the geology and meteorology of the project area produces an answer that the area may not be geologically favourable, then there won't be any other choice other than dropping the project itself because man is still weak before these forces.

So instead of evaluating these spaces *just assume and hope* that these spaces would be favourable for the project. With this basic assumption and hope, proceed then to study those spaces which even if may turn unfavourable could still be tackled.

It is this attitude, which has decided the narrative structure of the present rEIA. It is because of this we see the chapters on waves, tides, currents and sedimentation wonderfully written and the necessary chapters on geology totally neglected. Once this part had been written, the analytical priority to each space (like GOM fauna, fisheries etc) had been given based on the threat potential from each space for the project clearance. It is because of this, we believe, that birds have almost been neglected and GOM fauna and flora hilariously upheld.

NEERI EIA starts from the presumption that the Geology of the area is favourable to the SSC project. It has failed to raise the question 'What if it turns unfavourable?' Had it raised this question, the order of priority among the various data sets that its current report is exhibiting, would not have existed in the first place? Instead of allotting more time and space to waves, tides, currents, sediments, GOM and marine biology, it would have concentrated in locating those geological parameters that would make the canal unstable; it would then start identifying the very many possibilities of instability and the possible impacts of such an instability on the environment around and the ways and means to mitigate the possible impacts.

Unlike NEERI, we shall now take a short detour to look into ALL the parameters that might threaten the stability of the canal.

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3. Impacts of the proposed SSCP:

3.1. Impacts on Productivity and Ecology in GOM:

It is accepted that the project region is biologically rich in biodiversity, which is globally significant. About 3600 species of plants and animals are present in the zone with fringing reef (normally occurs in 5 m depth) and mangroves. Apart from that sea fans, sponges, pearl oysters, chanks and holuthuroids are also abundant in this region. Conservation of biodiversity is a prime duty of the Government of India as per the International Biodiversity Treaty and recently the Biodiversity Bill has been introduced to save the unique biodiversity of India. Gulf of Mannar Marine Biosphere Reserve is the only unique marine reserve because of the affluent algae, sea weeds, sea grasses, mangroves, corals, pearl oysters, chanks and mammals like Dugong, Dolphin and Whales. However, after emphasizing the rich biodiversity area there is a contradicting statement that (P.1.8 Fourth para) the presence of corals along proposed ship canal is negligible. (P.1.8)

The current direction was studied and concluded that sediments will move towards Gulf of Mannar to Palk Bay and it is not emphasized that the proposed canal would bring more sediment to Gulf of Mannar Biosphere Reserve accelerating the natural processes. (P.2.11)

Based on the sediment transport and geological formation of coral atoll reveal that it is important for the stability of the region. In this context how the sediments arising from the canal dredging is not related and had not been discussed in detail. On the other hand the NEERI tries to imbibe that sediment transport is less when compared to rest of the Indian coast and hence try to tell that the project is viable. Also the satellite imagery report says that erosion is towards Gulf of Mannar and Palk Bay side but didn't conclude anything! (P.2.12)

"The Krusadai island (the biologists paradise) harbours every animal phyla known on earth along with a living fossil which links vertebrates and invertebrates. Also seagrass species largest remaining feeding grounds for the globally endangered dugong are available in the island. Also several hundred species of crustaceans, molluscs, gastropods and fishes are found in the seagrass beds". (P.2.40) But, it is not concluded that how the proposed project is going to affect this world's richest biodiversity hotspots.

"It is mentioned that the biodiversity in Gulf of Mannar is now under severe threat due to destruction of sensitive ecosystems like corals and seagrasses through indiscriminate and intensive trawling, coral mining, dynamite fishing, commercial fishing of sea fans, chanks, sea cucumber, sea horses and endangered species like dugongs and turtles". (P.3.5) This reveals that the ecosystems are already fragile by the human activities and the proposed project will add to the synergistic effect on the already stressed environment. This has not been mentioned in the NEERI Report.

The coral formations in and around Rameswaram indicate that local emergence and are presumed to be formed around 4000 years ago. (P.3.9) However, it is justified (P.3.10) that "the presence of corals along the proposed alignment of Sethusamudram ship canal appears to be negligible because alignment of navigation route in Gulf of Mannar will be minimum 20 km away from the Biosphere Reserve whereas coral reefs extend to 1-2 km only from island. A Biosphere reserve of 10,500 km2 needs a buffer zone of at least 20 km. Also, there is a justification that available information is debatable which does not mean that the paucity of species richness in that area. Sampling procedures and the expertise will vary among individuals.

The coral reefs are very sensitive biological entities. Each Coral reef segment consists of thousands of polyps living inside a calcarious skeleton (Calcium Carbonate). These corals harbour an algae Zoozanthallae, which in the presence of sunlight produces oxygen, needed for polyp of the corals. If the sunlight is not allowed, to fall on the algae the coral will die. It is said that the canal goes 20km away from the coral reef. But to kill the coral reefs, there is no need to destroy them physically but if the habitat is

destroyed by the turbidity caused by dredging it will have damaging effect on the coral. Another problem with coral is that they will die if the minute sand particles driven by the current settle on the minute pores in which the polyps live. Once if it dies the same polyp or coral reef will not regenerate. Thus the sand and the silt excavated by the dredgers will kill the coral reefs. Further the coral reefs are the seat of biological diversity. We can list hundreds of animals including the beautiful coral fishes and Nudibranches. By killing the coral reef we are killing hundreds of species of animals.

The Marine sanctuary, which was protected by the efforts of the scientists like Dr.M.S.Swaminathan, will be lost forever. Another impact will be on the marine mammals of the Palk Bay and the Gulf of Mannar. The turbid water caused by the dredging will kill the sea grasses like Halophyla ovata and Cymodocea serrulata on which the dugongs feed. Dugong or the sea cows cannot live without the sea grass. The sea grass also requires sunlight. The turbid water will not allow the sunlight to penetrate in the sea grass beds. Further the sea grass beds are required for the prawn post larvae to settle and grow. So by damaging the sea grass bed we will destroy it irreparably. The simple argument that the canal is dug 20 km away from the coral reefs and will not harm the coral reefs has no meaning.

731 species of molluscs in the region is of worth mention and in any standard the richness is so vast and can simply the super rich diversity however, there is no mention that what would be fate of this high diversity rich areas. (P.3.14) Capture fisheries have 441 specie of fishes of which 100 are ornamental value and the rest have food value and harvest in the Gulf of Mannar (P.3.22) is 20 % of the total production of fishes in Tamil Nadu. (P.3.20) Selective removal of sixty marine species in Norweigian Sea has prompted the statement that “Is it Deforestation or Desertification when we do it to the Ocean?” Naga, The ICLARM Quarterly

3.2. Impacts due to Dredging:

The ‘Sethusamudram’ canal is dug in the sea with a length of 56km, 300m width and 12m deep with two way controlled traffic in the Adam Bridge. Between Srilanka and India excavation will be made in Palk Bay for 36km and 20km in Gulf of Mannar. The total length of the canal will be 56km including the 6km length in Adams bridge a area with series islands & shallow area. The total sand removed from the canal will be about 6200 million m^3 (Scale model analysis) or 6200 lakhs m^3. It is a very huge quantity. If this sand is spread on the land it will cover the 1 meter wide, 1 meter high and 6200 km is circumventing the entire Indian coast long wall. If so much of sand is dumped in the sea what will be the impact of it on the biota and sessile organisms. Surely they will die. The NEERI report says that the turbidity of water will increase and it will have adverse impact on the plankton, both zooplankton and phytoplankton which from the basis of life in sea. If there is no phytoplankton and zooplankton, there will be no fishes. Penetration of sunlight is very essential for the benthic animals. If the sunlight is blocked by the Silt-laden, turbid waters, no animal can lice on the bottom. This will have catastrophic effect on the fisheries. The prawns, which form the backbone fishery of the Rameswaram Island is a benthic organism and any change in the bottom of the sea, will affect the fisheries.

Thus the conditions created during the dredging operations will potentially cause:

- Disturbance of marine animals from the potential variations in the concentration dissolved oxygen.
- Uptake of contaminants by marine life possibly causing direct toxic effects or effects further up the food chain.
- Reduction of biologic species in special sensitive areas such as the coral reefs and mangroves.
- Translocation of species and removal of habitat.

Alterations to coastal or estuary morphology, for example alteration of sediment pathways and changes to siltation patterns, may affect coastal habitats and species in addition to marine ones.[2]

The EIA fails to assess the impacts of the dredged material on a disposal site:

The EIA fails to assess the potential impacts of the dredged material on the flora and fauna on the disposal site. The EIA has not identified the disposal site for 32.5 million m^3 of dredged spoil generated. Section 6.4.1 only mentions two potential sites: disposal on an undetermined area in-land at Pumban Island, or disposal in sea. However, there is no reference about the site selection criteria for dredge material dumping.

Page 6.9 mentions that disposal in sea would be a preferred option, at least in the case of the capital dredging of 51 million m^3 in Palk Strait. Despite the potential problem of transboundary migration of sand and pollutants, the EIA fails to do any further assessment. In addition, the disposal of millions of cubic meters of dredging spoil in the sea will also affect the living organisms in the disposal area. Despite this, the EIA has failed to present any assessment of the impacts in the marine species.

The sea bottom being sandy/soft mud; the siltation would necessitate periodic maintenance dredging. This situation may be confounded further with the coral activity in the Gulf, which might require continuous emergency dredging incurring unexpected expenditure. The periodic changes in the wind pattern needs extensive studies to determine the best suitable alignment of the canal with minimum number of bends for the smooth navigation of the vessels.

Impacts on Lands due to Dumping of Dredged Materials: The classification system of land uses as urban land, agriculture land, wastelands, water bodies and others is totally wrong when classifying the land uses there will be no lands mentioned to wasteland. It should be wetlands or salt water marsh or often non-vegetated wetlands. Wasteland classification should be Barren land which include beaches, sand and other gravel beaches, exposed rocks etc. (res. Sabins 1996) and hence it seems probable that by using a high technology which is not familiar even to the scientist the NEERI is trying to classify the water logged areas, marshy and swampy areas as wastelands in order to fill the dredged materials in the proposed project. Water logged areas and salt marshes and swamps are the important wetland types as per the IUCN classification. (Sabins F.F. 1996 Remote sensing, Principles and interpretation. W.H. Freeman and company New York 493 pp.) (P.4.4) This is true in the subsequent page (P.4.6) that marshy areas are identified for dumping the dredged materials.

There is no evidence of detailed studies of the dumping sites for the dredged materials. No study of the near shore eco systems seems to have been carried out. A comparative study on the merits of near shore vis-à-vis mid-sea dumping areas would have to be undertaken. The possibility of creating artificial islands in the mid sea for the construction of control centers/radar towers etc. has not been explored.

No mention of conducting recent studies of radioisotope tracer investigation on bed load transport on the proposed dumping grounds has been undertaken. The studies conducted in 1966 by M/s K Ramalingam and A Mohankrishnan, if at all made use of; appears to be too old. Experts opine that the studies are to be conducted concurrently, as the progress of dredging could alter the sediment transport pattern in the rest of the proposed site.

Satellite imagery analysis in conjunction with genetic algorithm for the identification of an optimal dumpsite published by NEERI in 1998 for the earlier alignment of the same Project finds no mention in this report.

The report admits that the canal will facilitate movement of fish and other biota from one sea to another. This will only have negative impact. There will be entry of heavy and modern trawlers to

[2] http://www.ukmarinesac.org.uk/activities/ports/ph5_4.htm; http://www.ukmarinesac.org.uk/activities/ports/ph5_2_2.htm

hitherto inaccessible areas depriving the traditional fishermen of their livelihood. Due to the inefficient law enforcing (govt) agencies, there is already high poaching in the sea by heavy fishing trawlers, which would increase. There could be no way of assessing the extent of damage caused to the bio diversity by these vessels.

The proposed Sethusamudram Ship Canal would be long and narrow but surrounded by shallow water: The vicinity of Sethusamudram Ship Canal is not an ordinary body of water[3] but possesses characteristics that would further enhance the likelihood of a shipping accident.

The proposed Sethusamudram Ship Canal would be 44 nautical miles long, but the width of the canal would be only between 200 and 500 meters.[4] The seabed surrounding the proposed route of Sethusamudram Ship Canal is extraordinarily shallow, no more than 4 meters deep along a five-kilometer stretch of the proposed route through Adam's Bridge.[5] Moreover, the sediment within Adam's Bridge consists of strong, dense material (limestone shoals) rather than loose sediment.[6]

Hence, the transit of vessels through the proposed Sethusamudram Ship Canal would be akin to a tightrope walk in which even a small deviation from the planned route would entail catastrophic consequences: if for any reason a vessel passing through the canal went astray by a distance of a few hundred meters in Adam's Bridge, such vessel would likely crash into hard seabed in a manner entailing a major release of fuel oil.[7]

According to a study commissioned by the U.K. Department for Environment, Food & Rural Affairs, powered groundings are the most common type of shipping accident.[8] According to this study, the proximity of a shipping route to the coastline is one of the strongest risk factors for a powered grounding occurring within a shipping route.[9] According to this same study, the Dover Strait, in which, like the proposed Sethusamudram Ship Canal ships also pass through a narrow channel surrounded by shallow water, the predicted release of oil from shipping accidents is more than 230 tons of oil per year.[10] By extension, the marine environment in the vicinity of the Sethusamudram Ship Canal could also bear the burden of this much, if not more, oil release from shipping accidents.

3.3. Scoio-economic Impacts:

Fishing has been the sole occupation of 20 million fisher folks living along the coast of Gulf of Mannar and in Palk Strait. They have been in close proximity with the sea, so that, their life-style, culture, community and social life have centered on the sea. The main livelihood activities of the fishermen residing in the villages adjoining to the coastal area are (i) fishing, (ii) seaweed collection, (iii) chanks collection, (iv) coral mining, (v) fire wood collection and (vi) agriculture.

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[3] Any comparisons of the proposed Sethusamudram Ship Canal to the Panama and Suez Canals are inapt for the reason that the proposed Sethusamudram Ship Canal would be bounded by water, not land. Whereas it is physically impossible for vessels to ground themselves while transiting the Panama and Suez Canals, it would be entirely possible for vessels to ground themselves while transiting the proposed Sethusamudram Ship Canal.

[4] EIA, page 1-2. But elsewhere in the EIA, the width of the proposed canal is stated to be 300 meters. EIA, page ii.

[5] EIA, page 6-24, Figure 6.5 – Bathymetry Along Line 2.

[6] Adam's Bridge. http://encyclopedia.thefreedictionary.com/Adam's%20Bridge

[7] In fact, transit through the canal would be more like two tightrope walkers passing each other in opposite directions after the canal would be opened to two-way traffic. EIA, page 2.1

[8] DEFRA (1999) "Identification of Marine Environmental High Risk Areas (MEHRAs) in the UK." http://www.defra.gov.uk/environment/consult/mehra/pdf/chap5.pdf , at page 24

[9] Id. at page 22.

[10] Id. at page 40.

There are 87 fish landing stations between the south of Point Calimere and Pamban and 40 fish landing stations in the Gulf of Mannar. The fisher folk want irksome fishing regulations to be repealed. As of now, fishermen are allowed to venture into the sea between 5 am and 9 pm for three days in a week. However, bad weather conditions keep them shore-bound for 45 days in a year.

The NEERI report accepts that 200 out of 600 varieties of fishes are commercially important. If we look at the past, fish production in 1992-1996 recorded 55,325 tonnes. In 2001, a huge increase of 2,05,700 tonnes has been registered because of coral reefs.

There are 138 villages and towns spread in 5 districts through the coastal area from Gulf of Mannar to Palk Strait in Tamil Nadu State. More than 50% of the fishing populations in this area are in debt. If this project is implemented, socio-economic problem will multiply due to unemployment.

Impact on fishery: There are false statements being made that the fish production has increased 4 fold in Gulf of Mannar where dredging was done. But the fishermen who are not able to pay back the bank loans for the boats say that there is 75% reduction in the fish catch. In Tuticorin harbour fish landing would have increased because of landing of fishes caught in high seas by more number of boats. This does not mean that fish production has increased. The real indicator of fish production is the catch/unit effort (ie., how much fish is caught per boat) in the boats operating with in 5km for the coast. The traditional fishermen who use small boats and nets form maximum the majority of fishermen. They are the suffering lot living below the poverty line. It is a well-known fact their income is coming down. To say that fish production has increased from about 50,000 metric tons to 200,000 m ton is not correct. There is a claim that by digging a canal, the deep-sea fishes will migrate into the canal and there will be an exchange fishes. It is a preposterous claim, not supported by any scientific data. From one ecological niche to another ecological niche fishes cannot and will not migrate. Fishes and all the marine organisms are subjected to variety of hydrological and hydromorphological factors. Hence habitat change will kill them. They cannot tolerate a slight change in physical, chemical and biological parameters. Because a Minister is saying some thing unrealistic, it need not be a truth.

The Fishermen: The fishermen are a very fine tuned fishing technicians who have acquired this ability by decades of practice and experience. Can we displace them? Will they get themselves accommodated to a new way of life. The canal is cut across their areas of fishing activity. Passing of the ship and the 'Pilots' will surely hinder their free passage. Can they remove their nets & keep their boats safe in the sea without getting knocked out by the large ships. To say, that the fishing operations will be safe is far from truth. There are about 50,000 fishermen and more than 1000 mechanised boats in Rameswaram Island. Already they are fighting for their survival. With the declining catches and spiralling diesel price, they are under tremendous pressure. The NEERI report accepts the reality and agrees that the fishermen will be affected.

Blasting and its effect: It is a known fact that sound production is magnified many times in water than in air. Many animals, especially the marine mammals like dolphins, whales and dugong are very sensitive to sound. They depend on echolocation (producing sound & receiving the reflected sound) for food capture and navigation. The NEERI report says that there will be blasting of rocks in Adam bridge area. If so the sound produced by the blasting will drive away not only the whales, dolphins and dugongs of Gulf of Mannar and Palk Bay but also the fishes. Unfortunately, the officials (Under pressure from their political masters) and the politicians do not understand that they are playing with a fragile eco system of millions of years of evolution. The most compelling tragedy is that once we destroy the delicate ecosystem it cannot be revived. How can we replace the products of millions of years of evolution? Our reckless drive for 'development' should not blind us to reality.

Hydrodynamics: *The method of measuring the ocean current and its likely pattern is not mentioned in this summery. It is presumed that the age old observation and prediction system is made use of. The report does not indicate that hydrological studies on the impact of the deep canal (designed breadth 300 meters having 10 meter average depth) over the prevailing swift and*

seasonal ocean current has been carried out. Such studies only will quantify the siltation pattern of the canal and hence the amount of the periodical dredging required. The report mentions that the current velocity is "as mild as 0.2-0.4 m/sec" (.75 to 1.5 km/h), which seems to be too optimistic for any sailor familiar with the area. The report claims that hydrodynamic modelling studies using Depth Integrated Velocity and Solute Transport (DIVAST) model was used. This model is only a computer assisted prediction based purely on the input parameters, generates two dimensional -- that is direction and magnitude of the flow --and the third dimension of the rise /fall due to tidal variation is not accounted for. This method is often used and found suitable for water bodies that are dominated by horizontal unsteady water flow .Its use in open sea with considerable range of tide (in this case beyond 1 meter) is debatable.

The MoEF, Department of Environment and Forests, Tamil Nadu, Central Pollution control Board & PCB, Tamil Nadu who are responsible for according clearance and monitoring standards and the Authorities responsible for implementing various projects along the coast should consider the following important facts.

- Environment and social costs
- The value of costing of water bodies, mangroves, vegetation, aquatic life, saltpan lands, flora and fauna etc.
- A scientific evaluation of the benefits that will accrue and for whom at what social and environmental costs.
- Failures of official's incharge of all the mega projects (who have unlimited powers and authority) to achieve stated goals or violation of legal standards remain unaccountable.
- The loss of existing income for at least one generation is not coated. One whole generation at least will lose out on employment opportunities that existed in the traditional system of fishing, agriculture, horticulture, salt, etc. They will have no more traditional rights and ownership over their lands, agriculture, water bodies, biodiversity, marine life etc.
- Not detailing how much potable water these mega projects need, impact on livelihood and eco-system due to such extensive withdrawal and the actual cost of water that will be consumed by this mega projects at the cheapest rate with subsidies.
- No costing of land that was lost or is being lost for these three mega industries. The loss to the people due only to land acquisition will be about 6000 crores. This is being projected as wastelands / government lands and hence not costed. This is a fraud and amounts to land grabbing by the State.
- Costing of use of electricity at subsidised costs.
- Costing of loss of revenues due to the tax holidays, fiscal concessions, and public sector bank finances, public sector insurance coverage etc.

A major challenge is to regenerate the coast from the implications of SSCP and maintenance and enhancement of the ecological diversity of the region. Achieving this will contribute to the general economic prosperity of the region, and the livelihoods of the coastal communities, in particular. This cannot be guaranteed by the implementors of SSCP project. However, economic activities and government policies cannot transgress the customary rights, especially of women, to land and other resources, as well as the vitality of traditional practices and indigenous knowledge of communities. If this is to happen, the rapid development of coastal areas, fuelled largely by macroeconomic policies supporting projects like SSCP as well as by the pressure to generate foreign currency through the mass production of goods for global export markets, must be stopped. Such unplanned and unsustainable development is generating huge profits for relatively few people at the expense of the many who are left with a degraded and polluted environment. The commercial rights of developers, hotel industry, industrial conglomerate etc are overriding the community's rights to livelihoods.

3.4. Impacts due to Oil Spill:

The EIA lacks an assessment of how the marine environment would be impacted by a major fuel spill from a cargo vessel: The discussion of how the proposed Sethusamudram ship canal would impact the marine environment is most limited. On page 6-11, the EIA states: "A potential source of pollution of the marine environment during the operation phase of the project relates to ship discharges – oily ballast, bilge water and sewage, and accidental spills. Likewise, the effects of anti-fouling paints of bottom dwelling marine organisms, particularly clams and oysters, when the depth is relatively shallow and there are a number of crafts moored in the location, can be significant. During the operational phase, the frequent ship movements in the canal, maintenance dredging of the canal which could increase turbidity, oil spill, bilge water, marine litter etc may have negative impacts if they are allowed to travel to the Gulf of Mannar Bioshpere Reserve which supports of very fragile ecosystem."

Surprisingly, the EIA contains no further quantitative or qualitative discussion about how vessel traffic through the proposed Sethusamudram ship canal would impact the marine environment.[11]

The marine environment in the vicinity of the proposed Sethusamudram ship canal is a vibrant yet fragile ecosystem that has hitherto been spared the impacts of a major oil spill. Considering the characteristics of the proposed Sethusamudram ship canal and estimates of vessel traffic, there is a high probability that one or more major fuel oil spills would occur during the life of the canal As the following discussion will show, the proponents of the Sethusamudram ship canal have a duty to provide a thorough analysis of how a major fuel spill from a cargo vessel would impact the marine environment in the vicinity of the proposed canal so that government officials and the public can make an informed choice about whether the claimed benefits outweigh the risks of long-term harm the project poses.

Major fuel oil spills from cargo vessels are frequent events that can have serious long-term impacts on the environment: Although spills of oil from tankers garner intense media coverage, spills of fuel oil from cargo vessels, which are more frequent, accounts for a large portion of the environmental damage resulting from accidental oil spills involving mechanized shipping. According to a recent publication: "The number of oil spills from tankers and barges in 19999 was only 12% the number in 1990. Much of this decrease can be attributed the decrease in oil transport by through U.S. waters of the last several years. At the same time, freight transport has increased somewhat, increasing the likelihood of spills from freighters."[12] For the period of 1990-1999, there were 46,728 oil spills from non-oil cargo vessels in the United States, accounting for the release of 3,384,730 gallons of oil, more than the amount of oil spilled by oil tankers during the same period.[13]

In the past 10 years, some of the most environmentally damaging accidental oil spills have involved cargo vessels, not oil tankers.[14]

For example: 1) the 1994 the Alexia and Enif collided in the Gulf of Mexico, releasing 95,000 gallons of mixed diesel and heavy fuel oil; 2) in 1997, the Kuroshima went aground at Summer

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[11] Recently, the Chairman of the Tuticorin Port Trust has stated that 'those who oppose the Sethusamudram project should adduce scientific facts and should not go by 'half-baked ideas' and 'misconceived notions.' The Hindu, September 10, 2004. This statement is a misunderstanding of the responsibility of a project proponent: those who support the Sethusamudram project should adduce scientific facts showing that the proposal would not create an unreasonable risk of harm to the environment. By this measurement, this EIA is a failure.

[12] Etkin, D.S. (2001) "Evaluation of Oil Spill Trends in the United States and Worldwide." http://www.environmental-research.com/publications/pdf/spill_statistics/paper4.pdf

[13] Talley, W.K. (2001) "Post OPA-90 Vessel Oil Spill Differentials: Transfers Versus Vessel Accidents." http://www.oduport.org/Oilspillpaper.htm

[14] Any promise by the proponents of the Sethusamudram Ship Canal to close the canal to oil tankers would not prevent oil spills from impacting the Gulf of Mannar, Adam's Bridge and Palk Bay. However, the proponents of the project are not even making this promise. In the Environmental Management Plan for the proposal, the proponents state: "The traffic of crude oil tankers will be allowed in this route with strict vigilance so as to avoid any possibilities of spillage in this region."

Bay near Dutch Harbor, Alaska, releasing 46,000 gallons of heavy fuel oil; and 3) in 1999, the New Carissa drifted aground off the Coast of Oregon, releasing between 50,000 to 70,000 gallons of heavy fuel oil, requiring salvage and clean-up costs that have exceeded $20 million.[15]

Inherent features of the proposed Sethusamudram Ship Canal create a high probability of a major fuel oil spill from a cargo vessel: The probability that sometime during the lifetime of the proposed Sethusamudram Ship Canal a vessel will suffer an accident causing a major fuel oil spill is very high. The EIA cites a 1996 study estimating that the traffic potential through the proposed canal would consist of roughly 11,000 ships per year, consisting of 3,791 vessels with a draught less than 30 feet, 3,875 vessels with a draught between 30-32 feet, and 4,211 vessels with a draught more than 32 feet. EIA, page 1-7.

Comparison of this estimate of the traffic potential through the proposed canal with data on shipping accident frequencies shows that a shipping accident within the proposed canal would be of high probability. According to one recent publication: "On the worldwide scale, about 0.75% to 1% of registered vessels are involved in significant casualty incidents each year, and 0.2% to 0.3% become total losses."[16] Considering the length of the proposed canal, a vessel travelling at moderate speed would spend approximately 1/400th of one year (0.0025 years) transiting the canal. If the canal reaches its estimated traffic potential, then the total annual duration of vessel traffic would be roughly 27.5 years. At a rate of only 0.2% vessel casualties per year, its possible to anticipate that there would be a vessel accident resulting in a total loss every 18 years. However, because of particular features of the proposed canal, the likelihood of a major fuel oil spill would be much higher than this.

Shallow marine environments are especially vulnerable to the effects of spilled heavy fuel oil: The principle fuel of cargo vessels is heavy fuel oil (bunker fuel)–a dense and viscous oil that is prone to sink and smother shallow marine ecosystems.[17] Unlike crude oil and diesel fuel, bunker oil persists for long time periods and resists the effects of oil dispersants.[18]

The characteristics of bunker oil would substantially augment the damage of a spill in the shallow marine environment of Adam's bridge. Should ever a vessel transiting the proposed Sethusamudram Ship Canal spill of significant quantity of bunker oil while transiting Adam's bridge, the spilled oil would sink and smother the seabed in the vicinity of the vessel, leaving authorities with no recourse whatsoever to contain or remedy the damage.

Coral reefs within the marine environment are especially vulnerable to the effects of spilled fuel oil: The EIA acknowledges the presence of coral reefs in the vicinity of the proposed Sethusamudram Ship Canal and acknowledges the vulnerability of coral reefs to spilled fuel oil. The EIA states: "Oil pollution is an extreme example of how chemicals, in this case hydrocarbons, can affect reefs. Research performed in many areas have documented coral mortality, decreased fecundity and recruitment failure in the response to chronic oil pollution."[19]

What the EIA fails to discuss, but which is evident from data in the EIA, is that dominant water currents in the vicinity of the proposed Sethusamudram Ship Canal, which are predominantly westerly during the Southwest and Northeast monsoons, would carry spilled oil from a vessel

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[15] Rauta, D. (2003) "Protection of Bunker Tankers." http://www.bunkerworld.com/events/download/papers/rotterdam2003/Rauta%2024%20IBC.pdf

[16] Risk of Marine Spills in the Pacific Islands Region and its Evolving Response Arrangements

[17] Ansell, D.V, et al. (2001) "A Review of the Problems Posed by Spills of Heavy Fuel Oils," Paper presented at: 2001 International Oil Spill Conference, March 26-29 2001, Tampa, Florida. Pages 11-12.

[18] Id.

[19] EIA, page 3-69.

grounded in the canal to the location of corals. Compare: EIA, Section 2.2.2.2 – Current Studies; and EIA, page 3-91, Figure 3.8 – Location of Corals in the Gulf of Mannar and Palk Bay.

Sea turtles within the marine environment are especially vulnerable to the effects of spill fuel oil: The EIA also acknowledges the presence of sea turtles in the vicinity of the proposed Sethusamudram Ship Canal. However, the EIA fails to acknowledge that this project might harm sea turtles. Page 6-11 of the EIA states: "Reported mass killings of turtles in this region is primarily due to their getting entangled in gill nets and also due to poaching by local people for turtle flesh. This observation indicates that the proposed canal project may not have any significant adverse impact on the migration and mass nesting of turtles."

However, this conclusion does not take into account how a spill of fuel oil would impact sea turtles. According to the U.S. National Oceanic & Atmospheric Administration: "In recent years the typical incident threatening sea turtles is not from crude oil from a tanker, but rather from a fuel oil spill from grounded fishing vessels or cargo ships."[20]

Basis precepts of environmental impact assessment law would require a detailed assessment of how a large fuel oil spill from a cargo vessel would impact the marine environment in the vicinity of the proposed Sethusamudram Ship Canal: The fundamental purpose of the environmental impact assessment process is to inform decision-makers, including the general public, about whether the potential environmental impacts of a proposed project outweigh the potential benefits of a proposed. How will decision-makers know whether the potential environmental impacts of the proposed Sethusamudram Ship Canal outweigh its potential benefits unless the proponents of the project submit a detailed, quantitative assessment of what impacts would result from a scenario in which a typical cargo vessel carrying bunker oil suffers a powered grounding within Adam's Bridge and other sensitive locations along the route of the proposed canal, releasing a majority of its fuel oil into the surrounding environment? Only after this analysis is complete could decision-makers understand what might be lost were they to approve this proposal.

Conduct of such an analysis is not the engagement in speculation. There are detailed procedures available that the proponents of this project could use to perform a quantitative assessment of what impacts would result from a scenario in which a typical cargo vessel carrying bunker oil suffers a powered grounding within the project area.[21]

4. Sustainability and Stability of the Canal:

The canal is proposed in the Adams Bridge, a geomorpholigically a unstable area. By nature, the current flow is from the shallow Palk Bay to deep Gulf of Mannar. The strong seawater flows along with sand from Palk Bay to Gulf Mannar. The current in this area are strong and fast. Sea is rough between April and August. During June to August sea experiences very strong wind. The northeast monsoon set in during October to December. The Gulf of Mannar is influenced by both south west and north east monsoons. Though southwest monsoon does not give much rain it releases tremendous wind force making the sea cloppy stormy from April to July. The unique geographical and the strategic position of the Gulf of Mannar expose it to the influence of both northeast monsoon and southwest monsoon. There is great tidal inequality extending to 50cm during full moon. During north east monsoon (Oct-Dec) the water current velocity is about 6 km per hour. The water currents set southward during northeast monsoon (Oct-Dec) and north wards during south west monsoon (April-July). Annually millions of metric tons of sand shifts from Palk Bay to Gulf of Mannar through Adam Bridge, where we propose to have the 'dream canal'.

It is stated by the NEERI report that a net exchange of 6000m^3 of sediment is found move from Palk Bay of Guld of Mannar through Pamban pass and 25,000m^3 of sediments move from Gulf of Mannar to Palk Bay through Arimunai near the proposed canal. The Geological strata in Adam's Bridge area show soft & hard

[20] U.S. NOAA (2003) "Oil and Sea Turtles: Biology, Planning, and Response, Chapter 6: Case Studies of Spills that Threaten Sea Turtles."
http://response.restoration.noaa.gov/oilaids/turtles/pdfs/chapter6.pdf
[21] U.S. Coast Guard: Facility Response Plan Contents Checklist 33 CFR 154 Subpart F (12/98).

sand up to 12 meter, the proposed depth of the canal. The particle size of the sand vary from 65 to 600 u. The average depth of the Palk Strait is 8m. So to get the require draft the bottom has to be dug. The water current in the sea is mainly influenced by the wind velocity. Can we can prevent the sand from falling into the canal from 3 sides? As the sides of the canal are not lined are protected by any artificial wall, we cannot prevent siltation. We should understand that we are dealing with one of the powerful agencies of the nature, the sea. I have seen and experienced the fury of this natural element. It is awful. Man stands as a dust in front of it. A strong tidal wave is enough to level the canal in which we dumped the Rs.2000 crores of the poor Indians. Once if the canal is levelled, are we going to spend hundreds of crores of the taxpayers' money to desilt? Most of the money will be swallowed by the dredging companies. Stopping the sand from filling into the canal and its removal periodically will be an expensive operation. It will be near impossible for the dredgers to operate during October to December because of cyclone, strong wind and the tidal waves. We have to put up a perennial 24 hourly fight against Nature. The time can only say, who is the victor?

It may be said that if the canal us made according to the first plan of Mr. Tylore in 1860, we can vouchsafe the sustainability of the canal as it was proposed on land though there are many other problems. But now as the canal is on the sandy sea bottom, we cannot be sure of its sustainability. Another grave danger from the sand dredged from the canal is its shift to the Rameswaram Island. It will pose great problem to the fisherman villages and fish landing centers & the Jetty. The sea has a tendency to wash ashore any material dumped in it. If the dredged silt is deposited on the banks of Rameswaram Island, it may kill all the living corals. Similarly the artificial land to be reclaimed by dumping the silt excavated near Dhanuskodi may not be permanent. It can be washed way by the tidal waters, as Dhanuskodi Island is cyclone prone area. In short siltation of the Canal will be the greatest problem the canal has to face.

4.1.Factors having the potential to threaten the stability of the Canal:

Stability of the dredged channel and the stability of the dumping site of the dredged material should be considered together when we are analysing the issue of stability; both of them should remain stable for the canal to operate successfully. The factors that might threaten their stability should be evaluated thoroughly before we spend the scanty financial resources of our nation.

These factors might be classified under three headings namely:

1) geological
2) meteorological

4.2 Geological Factors:

These factors could be classified further as

a) Geophysical factors
b) Sedimentation issues

4.2.1 Geophysical Factors:

Earthquakes, Tectonics: The project region sprawls over an area of 10500 sq.km. It is located within the $8^0$35'N to $9^0$25'N latitude and $78^0$8'E to $79^0$30'E longitude. (rEIA p1.8). There are two earthquake events that have been recorded in the area just south of the project area in the recent past.

The first record belongs to the year 1938. Its epicentre was supposed to be in 07.50 N, 79.00 E, which is just south of the project region. Its magnitude is questionable but is thought to be 5.8. Its intensity has been recorded as VII. The second record is from 1993. Its epicenter was at 06.818 N, 78.301 E. Its depth (D) was identified to be 10.0 km; Its Body Wave Magnitude (Mb) was 5.2; Its Surface Wave Magnitude (Ms) was 4.7.

There is a record that an earthquake, which originated at the Car Nicobar islands on 31 December 1881 (with an Mw 7.9) had generated a ***tsunami*** in the Bay of Bengal and this had been felt at Pamban. This fact stresses the importance of studying the history of the earthquakes in an area roughly around 300 km

around. The 26th June 1941 earthquake of Andaman Islands (12.500 N, 92.500 E) (Mw7.7) had also generated a ***tsunami*** and this had reached Chennai.

The first recorded Bay of Bengal earthquake is on 28th January 1679. It is suspected to have originated at the Andaman islands. The more recent Pondicherry earthquake of 26th September 2001 had its epicenter in the ocean crust (11.945 N, 80.227 E, Mw 5.4.

Even though all the above said earthquakes have not occurred within the project area, a review about them is important to evaluate the impact of such quakes and the quakes that might occur in the region itself on the structural stability of the canal and its dredged dump. It is important to assess the probability with which the dumped dredged material might get dispersed due to these and other earthquakes to GOM and PB and also to the coast of Sri Lanka.

The rEIA has neglected this basic issue in toto:

However it mentions the role of tectonics in relation to the reduction in the seabed depth in the project area. Let us quote this passage in some detail:

'Recent depth contour map of 1999 has been compared with bathymetry map of 1975 (that is a 24 year period); it reflects that the sea floor level has decreased along the coastal areas and around the islands in the study area. It might be due to the emergence of land or lowering of sea (due to tectonism) and sediment deposit…. The average depth reduction of sea floor along the coast has been estimated as 0.51m over this period. .. The annual sediment deposit on the GOM sea floor is about 0.001m/year (Basanta Kumar Jena 1997), or 0.024m for a period of 24 years. As found from the present study, the decrease of depth for the period of 24 years is about 0.51m. Sedimentation accounts for about 0.024m reduction in the total of 0.5m from clearance depth. The remaining 0.486 m reduction in depth may be due to emerging of land or lowering of sea level (by tectonic activities). Based on the above data, the rate of emerging of land or lowering of sea level can be estimated as 0.02m/year." (EIA p.2.26)

If the sea bed depth reduction due to tectonics is presumed 0.02m every year, the land would have emerged 2 meters in the next 100 years by tectonics alone. This is during normal times; but what if an earthquake hits the area? What are the possibilities that the canal and its dredged deposits would not be affected detrimentally? This issue gains importance as there is much talk and research on the phenomenon of neotectonics in the peninsular region. In such a situation, shouldn't the EIA given a top priority to this issue?

Under Sea Volcanoes: Let us quote from GRK Murthy et al. (1994) at length to get an idea about the tectonic setup of the GOM depression and also about the submerged volcanoes present in it.

'The international Indian Ocean Expedition of 1975 had collected a good deal of magnetic and gravity data on the southern part of the Gulf of Mannar depression to understand the tectonics and evolution of the basin. (Udintsev, 1975) Nainini and Talwani (1982) and Kahle et al (1976) have brought out the isostatic gravity anomaly map of the Mannar depression. Sastri et al (1973, 1981), Prabakar and Zutshi (1993) have studied the structure and basement morphology from seismic information of the adjoining areas.'

'According to Eremenko and Gagelganz (1966), the Ind-Ceylon trough/GOM is considered to belong to the Mesozoic-Cenozoic group of basins. The regional alignment of tectonic features is NE-SW, parallel to the Eastern Ghat trend. They have opined that the basement has a horst-graben configuration resulting from faults with considerable throw. The depth of the basement is nearly 1 to 6 km in all the three depressions (the other two are the Palk and the Cauvery depressions), but the thickness of the sediments is slightly less in the Mannar depression. Kumar (1983) has reported ***the presence of basltic rocks from the borehole drilled in the northern part of the Mannar depression*** *(emphasis ours).*'

'The bathymetric contours (NHO Chart, 1974) clearly reveal the physiography of the GOM. A broad bathymetric trough trending nearly NE-SW between water depths 1000 and 3000 m is noticed. The bathymetric data along AA' also indicate a broad trough between water depths 2000 and 2500 m. the profile also indicates a channel like feature of about 15-20 km width lying within the trough. It is interesting to note that the maximum and minimum of the anomaly are lying over the flanks on either side of the axis of the trough.'

'Due to complex horst graben structure of the sub basins in the GOM, we attempted to explain the total observed anomaly assuming uniform magnetization in the modeling. The basement depth at 4 km obtained from spectral analysis is in agreement with the observations of Eremenko and Gagelganz (1966). But the modeling indicated a relief in the depth of 5 to 11 km to the top of the anomalous body. If this is assumed to be the basement structure then the model indicates the presence of a sediment thickness of about 7 to 8 km to the top of the anomalous body. If this is assumed to be the basement structure then the model indicates the presence of a sediment thickness of about 7 to 8 km in the central portion of the profile AA'. However there is no evidence of the presence of sediment thickness of this order in the area. This suggests the possibility of an intrusive body within the basement. Carl (1966) has reported a shallow earthquake of magnitude less than 7, very close to AA'. The location of the epicenter of this earthquake lies over the northward extension of the fractures trending in N-S direction. ***Volcanoes with underwater summits were also reported (Udintsev,1975 and Sastri et al., 1981) in this area and are shown in the above figure. This suggests the presence of volcanic vents in the area. So the anomalous body inferred from magnetics could be related to such volcanic vents.*** The high susceptibility value of 0.02 cgs suggests that the body could be more basic in nature.'

'The spectral analysis of the marine magnetic data along AA' across the Gulf of Mannar reveals two depths at about 4 and 9 km from the sea surface. The two dimensional model under the constraint of spectral depth shows the presence of an anomalous body within the basement. The depth to the top of the body varies from 5 to 11 km from the sea surface with a regional relief, of about 6 km. This relief coincides with a broad gravity low. ***The reported volcanic vents in the vicinity suggest the possibility of the anomalous body and the volcanic vents in the vicinity may together indicate the presence of a major tectonic structural feature in the Gulf of Mannar.'***

The above study delineates the importance of studying the tectonic structure of the GOM and PB depressions with respect to the stability of the Sethu Samudram Ship Canal Project and also the stability of dredge dump it shall be creating. It should be also noted here that the study has quoted from Kumar (1983) that Basaltic Rocks were found in the boreholes drilled in the northern part of the GOM depression; basaltic rocks is a volcanic rock.

The NEERI rEIA has neglected this issue in its report. This negligence might turnout to be costly to all of us and to our nation in the future if the MoE&F considers accepting this report as a scientific one.

Sedimentation Studies: This portion of the rEIA is well written. It deals with the coastal geomorphology, tides, waves, longshore currents and the seasonal sedimentation pattern. It contains information both from the secondary sources as well as from its own studies in the area. It has collaborated with the National Ship Design Research Centre (NSDRC) of Vishakapatnam to generate the primary data.

4.3. Meteorology:

The report does not have a separate chapter on meteorology of the area. However it talks about the seasonal cycles with respect to tides, waves and currents. We feel this approach might not help to ensure the safety of the canal.

This approach of studying meteorology only with respect to other parameters like waves, tides and currents, for example, has not allowed describing and theoretically understanding one of the most important events of our modern geographical history: the devastation of Dhanuskodi by a cyclone and tidal waves.

The report has not committed even one word for this tragic event of 22-23rd December, 1964 in which 1800 people were killed.

This makes us ask again 'Why so?' Why this deafening silence? What meaning should we infer from for this attitude?

If we rely only on the NEERI EIA to get a picture of the area, then we shall be having just Dhanushkodi… yet another place in the map… located at such and such lat/long….not the Dhanushkodi which was turned into a mass grave by a cyclone… where an entire rail bridge collapsed with a train load of passengers into the sea…

Yes. This is NEERI's pattern. Remain silent on all those issues you might not be able to give a project favourable rational explanation.

Yes. Silence is used as an important tool by NEERI to construct its EIA narrative.

This silence might earn a licence from MoE&F for the project; but can it ensure that such a tragedy will not occur in the Adams Bridge part of the SSC, which incidentally happens to run just east of our unfortunate Dhanushkodi?

4.4. Saving of time is a false statement:

It is claimed that about 36 hours will be saved as the about 450km will be reduced in travelling through the canal. But in reality a ship I full steam will require atleast an 2 hrs or more to stop. Series of procedures have to be followed including anchoring. Then the pilot has to be summoned. He may take 2hrs are more to reach the ship. The ship has to be started, anchors have to be lifted and the ship has to be led through the canal slowly. The navigation speed in 56km of the canal will half to that of in the ocean. All this will take more than 15hrs. The oceanic ships and the commercial liners will be very careful about their safety. The ships have to pay royalty to the Indian Govt. including 'pilot' charges. I may cost about 7000 U.S. Dollars or more. We have to calculate how much is net saving of time and money. How many shipping companies will be willing to undergo all these formalities.

Another important factor is the economic viability. It is claimed that 2000 ships may use canal. It is not based on data or authentic information. The canal cannot be an all-weather canal as October to December experiences turbulent sea. When we analyse the cost-benefits, the benefit derived from the canal will be marginal. If ocean liners and commercial ships do not take this route, the profit derived will be less and the project will run into loses. Who will repay the loss? The Govt. may have to make it. The poor taxpayer has to pay! It should be noted that many foreign countries have set up dredging companies in India and it will benefit only these few dredging companies. If the project fails the dredging companies will disappear after receiving the money. The commission and the kick-backs and the dredging charges will be born by the poor Indian tax payer.

The EIA on page 1.6 of the EIA states: "The cost estimates for the proposed canal project were worked out by PTCS Ltd. based on the same quantities of dredging as in the 1983 report but with updated rates for the year 1996. The costs of dredging for various segments of channel for three different drafts viz. 30, 31 and 35 feet were worked out along with cost estimates for other components of the project including those of navigational aids and floating crafts. The construction period for 31 feet draft was estimated as four years with a capital expenditure of Rs. 760 crores. The operation and maintenance cost was estimated by PTCS Ltd. at Rs. 4.52 crores per year.

"An economic appraisal of the Sethusamudram Ship Canal project taking into account cost estimates and cost benefits of the proposal, were made by PTCS Ltd. Based on Net Present Value (NPV) method of appraisal, an Internal Rate of Return (IRR) of 10 to 17% on the project investment was arrived at."

Since the EIA doesn't include the PTCS report, we have no way of knowing how valid was it's economic assessment. However, I'd bet that it is full of incorrect assumptions and does not take into account the pilotage costs and the difference in cost between fuel oil and diesel fuel that your friend correctly points out.

There is a huge risk of vessel grounding in the proposed canal and that comparisons to land-based canals, such as the Suez, Panama and St. Lawrence are inapt because one can't ground a ship while it is in a land-based canal but can if the canal is surrounded by shallow open water. More importantly, these land-based canals are sheltered from wind and waves, while the proposed Sethusamudram would not be. Also, owing to the length of the canal, how one could avoid ships passing each other in opposite directions, unless ships are made to line up at one end or the other until a convoy of ships going in the other direction completed

their passage. The proposed Sethusamudram canal would have no locks (there is no mention of these in the EIA) primarily because unlike a river, the water level in the canal would be the same from start to end"

4.5. Navigation – It is not feasible:

The report mentions of adopting a unique method for the conservation of the fauna. The *Pilot should be trained or environmental watcher will board the ship to watch the marine animals viz. turtle, dolphins, sea cow etc. in the region and navigate the ship safely avoiding any fauna.* It is a hitherto unheard and unique proposition in which a pilot is to be trained and will be required to manoeuvre the ship of size say- 20,000 dead weight tone (DWT)(having 7 meter draught) in a narrow channel avoiding turtles and dolphins! Just this one point alone shows the scale and level of Economics.

It so a well known fact that even in the developed countries, vessels will have to wait at the mouth of the canals/channels/ports awaiting canal clearance, pilots, tugs, high water etc. This is often true in the cases of Panama/Suez/Kiev Canals and in very well organized ports namely Rotterdam, Singapore etc. In the above cases it is inevitable because an alternate route/system is not easily available. On the contrary in case of the Sethusamudram Canal there is an unhindered alternate route available with an extra 24/30 hours ships time depending upon whether the vessel is coming from west coast of India/Tuticorin

When we work out the finances, both the recurring/non recurring costs for the shipping company will have to be considered. It should start from the cost of establishing and maintaining a liaison office/agency at the canal site. The toll charges are not going to be low, as the authorities have decided to recover a substantial percentage, if not the entire cost of the Project with in 15 years or so. Added to this is the compulsory light house dues, other taxes and cess. It has been indicated in the report that Pilot is compulsory and probably an extra

Some of the vessels will require changing over to diesel fuel for manoeuvring and some ships captains do requisition this regime of the vessel's engine in pilot waters incurring five times the cost of cheaper heavy oil, which is normally the fuel of the vessel. The expenditure incurred towards the constant patrolling by armed vessels of the law enforcing authorities will also have to be borne by the shipping companies.

If we add up all these expenditure in cash and ships time, vis a vis that of the circuitous route, we will arrive at the conclusion that both the sides are almost equal and the circuitous route has an added advantage of not committing the crew and the vessel to greater risk. Mariners consulted were unanimous in their opinion that they will prefer the circuitous route over the canal route, if they have a choice.

6. History of World Canals:

We should also look into the other world canals. Before 4000 B C, King Menc built a canal in Upper Egypt, which was considered to be the first of its kind. In 1666 A D, the Pierre Paul Riguet dredge, Languedoc canal [also known as 'Canal Du Midi'], was constructed to connect Atlantic Ocean and Mediterranean Sea, which was the first canal that connects two seas.

Suez Canal: The man-made waterway, the Suez Canal of present, was originally 15 meter deep to allow 50 feet of draft to pass. The work was started to increase this to 22 meter deep by 2010 so as to allow super tanker passage. In the Suez Canal, in particular, only 90% sand and 10% rock were dredged. Notably, out of total 1.5 million Egyptians who worked on Suez Canal, 1,25,000 had died. The above canals were dredged on land and not on coral reefs as in our area.

Kiel Canal: Kiel Canal was one of the wonders of the 19th century, a waterway that would provide direct access between Germany's Baltic and North Sea coasts and the fulfilment of a strategic dream that had fascinated that country's naval planners. Like the Panama Canal, the Kiel Canal was designed for the rapid movement of warships from one sea to another, but it quickly proved indispensable for commercial vessels wishing to make the substantial savings in

time and money which would be gained from not making the long passage through the Kattegat and around the Skaw.

Some 53 miles long, with locks at Brunsbüttel where the canal joins the
River Elbe and at Holtenau where the waterway runs into Kiel Bay, the waterway is at sea level, with the locks designed to prevent tidal effects. Built for the biggest battleship then being contemplated, the waterway is deep and capacious, with adequate passing places. As an engineering feat it was remarkable, with the waterway requiring the draining of marshes, the construction of enormous embankments and high level bridges. From Kiel to Hamburg there is a saving of some 525 miles, or the best part of two days steaming.

The Kiel Canal was the principal reason for the growth of the port of Kiel, which was an insignificant port before the waterway was opened, but rapidly expanded into an important port and naval base, which it remains today.

The canal, however, has been suffering in recent years. Cost cutting owners have elected to make the longer passage around Schleswig-Holstein, to avoid canal dues. Fast ferries in particular have tended to avoid the canal. Additionally, the astonishing growth of the North Sea ports of Hamburg, Bremen / Bremerhaven, Amsterdam, Rotterdam and Zeebrugge, with their huge river and canal assisted hinterlands, have effectively drawn off trade that would otherwise have run north to the Baltic ports and thence been transported out via the Kiel Canal. Furthermore, the collapse of the oviet system and the several years of readjustment meant that a major customer of the waterway saw its activities considerably shrunk. The Keil Canal appeared to be facing a period of stagnation.

Everywhere in the world the canals are dug by cutting an isthmus and not a strait.

7. International Conventions/National Laws and SSCP:

SSCP will violate the constitutional safeguards, international law and several Central and State enactments, notifications and Supreme Court directives such as,

a) The Environment Protection Act 1986 and Rules:
   - The CRZ notification dated 1991 and Supreme Court Order of 1996.
   - EIA notification dated 1994 and Public Hearing Notification 1997.
b) The Wild Life Protection Act 1974
c) Water (Prevention and Control of Pollution) Act 1974.
d) AIR (Prevention and control of Pollution) Act 1981.
e) UN Convention on the Rights of the child.
f) UN Convention on Bio-diversity
g) UN Convention on Elimination of all forms of discrimination against Women.
h) Violation of the Constitution of India Article 21 said with 14, 19 and 39.
i) The UN Guidelines on Pollution
j) The UN Convention Law of the sea
k) The Ramsar Convention.

The importance of protection of these fragile coastal zones of Gulf of Mannar are also recognised by various international conventions like The United Nations Conference on Environment and Development (UNCED) – 1992,), the Convention on Biological Diversity (CBD), the International Convention for the Prevention or Pollution form Ships (MARPOL 73/78), the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the International Convention of Civil Liability for Oil Pollution Damage (CLC), Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, the Basel Convention on the Control of

Transboundary Movements of Hazardous Wastes and their Disposal. It has not, however, ratified the articles of association of the United Nations Convention on the Law of the Sea (UNCLOS).

1. UN Law of Sea Convention, 1982:

Article 207 of UN Convention on the Law of the Sea (UNCLOS) signed in 1982 and ratified in 1994, states that "States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from the line-based sources, including rivers, estuaries, pipelines, and out fall structures, taking into account Internally, agreed rules, standards and recommended practices and procedures", thus highlighting the need for regulatory measures in relation to the protection of marine environment from the land-based pollution, which forms an integral part of the coastal zone protection. Article 10 talks about the role of State in integration of fisheries in coastal area management and states that, "States should ensure that an appropriate policy, legal and institutional framework is adopted to achieve the sustainable and integrated use of the resources, taking into account the fragility of coastal ecosystems and the finite nature of their natural resources and the needs of coastal communities".

The dangers posed by the project violate the UN Law of Sea Convention, 1982.

- Part II, Section2, Article 6 deals with Reefs, Article 9 tells on Mouths of Rivers, Article 10 speaks about Bays.
- Part V, Article 61 - Conservation of the living resources, Article 64 - Highly Migratory species.
- Part V, Article - 65 and Part VII, Section 2, Article 120 also speaks on Marine Mammals.
- Part VII, Section 2, Article 116 speaks on fishing rights.
- Part XI, Section 2, Article 145 and Article 237 emphasizing that protection of Marine Environment is obligatory. In the same part Article 146 urges the need for protecting the Human life, Article 149 and Part XVI, Article 303 both deals with Archaeological and historical objects.
- Part XIII, Section 3, Article 254 dealt with Rights of neighbouring land-locked and geographically disadvantaged States.

Indian Government should have considered obtaining "no objection" from the Government of Sri Lanka as per UN law of Sea Convention, 1982.

2. International Convention for the Prevention of Pollution from Ships (MARPOL 73/78):

1. *International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) will be complied with.* India is a signatory to the above proceedings, which has jurisdiction over the entire Indian waters and does not signify anything special in this case, as it is made out to be.

2. *Spillage of oil or any other toxic material including paints, anticorrosive agents etc will not be allowed to spill.* MARPOL 73/78 takes care of the regulation. However the method of implementation is not spelt out.

3. *Discharge of bilge, ballast, treated sewage, solid waste, oily wastes and spillage of cargo will not be allowed in the Gulf.* Strict rules and regulations exist in the MARPOL 73/78 but its implementation is next to impossible. All vessels do take preventive methods for the deliberate spillage/leakage. However if a vessel is bent upon spilling, no external agency, even if they are on board, will be able to detect it through conventional methods. The problem is confounded in the night and in low visibility.

3. The United Nations Conference on Environment and Development (UNCED in Rio de Janeiro in 1992):

The United Nations Conference on Environment and Development (UNCED in Rio de Janerio in 1992 in its Agenda 21 acknowledges the need for the increased awareness of the socio-economic importance of the coastal marine environment. Agenda 21 recognises that coastal environment is an essential component of the global life – support system and a positive asset that presents opportunities for sustainable development. Agenda 21 setsforth rights and obligations of states and provides the international basis upon which to pursue the protection and sustainable development of marine and coastal areas at the National, sub-regional, regional and global levels.

In accordance with chapter 17 of Agenda 21, promote the conservation and management of the sea through actions at all levels, giving due regard to the relevant international instruments to:

(a) Maintain the productivity and biodiversity of important and vulnerable marine and coastal areas, including in areas within and beyond national jurisdiction;

(b) Implement the work programme arising from the Jakarta Mandate on the Conservation and Sustainable Use of Marine and Coastal Biological Diversity of the Convention on Biological Diversity, including through the urgent mobilisation of financial resources and technological assistance and the development of human and institutional capacity, particularly in developing countries;

(c) Develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012 and time/area closures for the protection of nursery grounds and periods, proper coastal land use and watershed planning and the integration of marine and coastal areas management into key sectors;

(d) Develop national, regional and international programmes for halting the loss of marine biodiversity, including in coral reefs and wetlands;

(e) Implement the Ramsar Convention including its joint work programme with the Convention on Biological Diversity and the programme of action called for by the International Coral Reef Initiative to strengthen joint management plans and international networking for wetland ecosystems in coastal zones, including coral reefs, mangroves, seaweed beds and tidal mud flats.

4. Johannesburg plan of action:

Advance implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities and the Montreal Declaration on the Protection of the Marine Environment from Land-based Activities, with particular emphasis during the period from 2002 to 2006 on municipal wastewater, the physical alteration and destruction of habitats, and nutrients.

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About the book…

Rama Setu is an ancient monument of national and international importance.

The book is a compendium of overwhelming archaeological, scientific, textual and cartographic evidences to declare and protect Rama Setu as a World Heritage Site and providing details of scientific and security aspects of Setu Samudram Channel boats and ships, between Tuticorin port and ports on the eastcoast of Bharatam.

Setusamudram channel project should be restored to its original design parameter as a land-based canal project, west of Dhanushkodi, without impacting upon Rama Setu (also called Adam's Bridge).

Sir A Ramaswamy Mudaliar Committee Report of 1956 clearly stated that any idea of cutting a channel through Rama Setu should be abandoned because of the problems of maintaining a mid-ocean channel and the turbulence of the Indian Ocean waters.

By aligning the channel close to the medial line, an international waters boundary is likely to be created between India and Srilanka with serious consequences for National security, in violation of the consistent stand so far taken by the two countries, declaring the Gulf of Mannar and Palk straits as Historic Waters, hence internal waters under the Law of the Sea (1958).

Vaanara Sena carrying stones, in their arms and on their heads, to build Rama Setu, followed by Sri Rama, carrying a sword. A panel in Prambanan (Brahmavana) temple, Java, Indonesia (9th century).

Fisherfolk are concerned that such a boundary, under pressure from US Navy, will prevent the exercise of their

historic rights to the aquatic resources in the Indian ocean.

Tsunami protection measures should be made an integral part of the project to prevent the devastation of Tamilnadu and Kerala coastline and desiccation of thorium resources of Manavalakuruchi, Aluva and Chavara, in case of another tsunami caused by recurrent earthquakes in the Indian Ocean region.

This turbulence is now enhanced by the events such as the tsunami which struck the Indian ocean coastline on December 26, 2004 resulting in the death of over 2,50,000 people and loss of property.

The compendium of multi-dimensional facets of Rama Setu and the Canal project, is an appeal to reorient the canall alignment avoiding any destruction or damage to Rama Setu which should be preserved and protected as World Heritage. Indeed, this millennial heritage of Bharatam is the very idiom of Sri Rama as vigrahavaan dharmah, Sri Rama as the personification of dharma venerated in many countries of the world and in particular, along the Indian Ocean Rim which constitute an Indian Ocean community (Hindumahaasaagar parivaar).