guished Professor barely *a decade after* their unpleasant encounter. Again, Einstein is sometimes blamed for not giving Bose enough credit. It was he who translated the Bose paper pointing out its importance and it was Einstein, who discovered the Bose–Einstein condensation in a later paper.

1. Sreeram Chaulia, *Curr. Sci.*, 2005, **89**, 401–402.
2. Mallik, D. C. V., *Curr. Sci.*, 2005, **89**, 1455–1456.
3. Baade, W. and Zwicky, F., *Phys. Rev.*, 1934, **45**; *Proc. Natl. Acad. Sci. USA*, 1934, **20**, 254–259; 259–263.
4. Markov, M. A., *Phys. Lett.*, 1964, **10**, 122; Hayakawa, *Progr. Theor. Phys. Suppl.*, 1965, **33**, 538; Zeldovich, *JETP Lett.*, 1966, **4**, 120; Cowsik and McCelland, *Ap. J.*, 1973, **180**, 7.

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Disposal of dredge spoil from Sethusamudram Ship Channel Project

The Sethusamudram Ship Channel Project (SSCP) across the Palk Strait and Adam's Bridge between India and Sri Lanka is finally commissioned and it was inaugurated by the Prime Minister of India on 2 July 2005 at Madurai. The SSCP has already generated a lot of controversies over its implementation and the consequent environmental issues with regard to dredging and safe disposal of dredged spoil[1–3]. As per the present alignment, dredging is needed only in two stretches covering a distance of 89 km along the proposed 167 km long channel between Tuticorin and Kodiyakkarai – in a NS stretch for a length of 35 km (east of Danushkodi) in the Adam's Bridge and 54 km in the Palk Strait in a NE–SW direction south of Kodiyakkarai and east of Manalmelkudi (Figure 1). No dredging is needed for the rest of 78 km stretch (Figure 1) as the depth is more than 20 m.

The total quantum of materials that will be dredged from these two sectors amounts to 82.5 million cubic metres of which the Adam's Bridge sector will generate 48 million cubic metres while the Palk Bay sector will generate 34.5 million cubic metres of sediments. As per the plan, the materials dredged from Adam's Bridge area will be dumped in the Gulf of Mannar region at 20–30 km water depths within the Indian territorial waters about 30 km away from Adam's Bridge. Sediments dredged from Palk Bay will be dumped in the Indian Ocean at about 25–30 m water depths. Dredging Corporation of India is assigned to carry out the first phase of dredging in the Palk Bay to the tune of about 13 million cubic metres of sediments. During dredging several environmental management acts will have to be followed including cessation of dredging during the fish breeding and spawning period. Another condition is that the suspended matter at the dredging sites should not spread more than a km on either side of the channel route.

Dumping 82.5 million cubic metres in the highly turbulent open sea either in the Gulf of Mannar or in the Bay of Bengal east of Kodiyakkarai will naturally generate turbidity in the water column and submergence of large bottom community by the sand contained in the dredged sediments. Such environmental effect over vast areas for considerably long time-span will have long-term impact. It is suggested here that instead of disposing the dredged spoil in the distant open sea, it may be dumped at one or two specified areas within the shallow western Palk Bay so that considerable land area can be reclaimed. The Palk Bay region does not have any island within the Indian territorial waters. Ever since Katchatheevu (Figure 1) was transferred to Sri Lanka, there is a demand from politicians and fishermen communities of Tamil Nadu to get back the island for the use of fishermen. In case an island is made artificially using the dredged spoil within the Palk Bay it will help the fishermen as temporary landing area or the Coast Guard/Navy for regular monitoring of the territory in the future. Acquiring of land using dredged spoil is a common phenomenon globally. For instance, the Wellington Island near Cochin port was formed mostly by the dredged spoil. Such large-scale land reclamation is going on in places where acute land scarcity exists like in Singapore.

In case a major part of the dredged spoil generated through the capital dredging is dumped at one place in the western Palk Bay (location A; Figure 1), having a water depth of about 12 m (30–35 km off Tondi), it will create an island with land area of about 6 km^2 (2000 m × 3000 m × 12 m). Location A is suggested as it is midpoint between Adam's bridge and Palk Strait and it is sufficiently away from the Mandapam group of coral islands and Muthupet mangrove swamps. On the other hand if the total dredged spoils are dumped at water depth of <10 m (location B; Figure 1) it will create land area of more than 8 km^2 (8000 m × 1000 m × 10 m). The dredged sediment from Palk Strait alone will create a small island if dumped in the shallow western Palk Bay, which will be a boon to fishermen for safe landing in case of an emergency. Dumping of sediment in a limited area will minimize spreading of suspended sediments to larger areas and havoc to bottom communities. Since the Palk Bay is very shallow with water depths ranging from 5 to 10 m along the coastal areas and less than 20 m in most other places (Figure 1), the sea becomes turbid during southwest and northeast monsoon periods[4] due to re-suspension of bottom sediments. However, in general the Palk Bay is very calm during most of the time because of the protection offered by the shallow Palk Strait on the north and Pamban Pass and Adam bridge on the south (Figure 1) and so powerful currents and waves do enter into Palk Bay. The sediments are primarily silty clay close to coast and sandy mud little away from the coast. The sediment contains high organic matter due to decay of sea grass. During NE monsoon huge quantum of fine sediments are transported into the Gulf of Mannar from Karaikal–Nagapattinam–Vedaraniyan coast[5–7]. Therefore, dumping of dredged sediments in a selected site within the shallow Palk Bay will not add further stress to existing marine environment. Furthermore, the amount of dredged spoil that

would come from maintenance dredging is estimated to be 0.1×10^6 m^3/year (ref. 1). As the dredged ship channels continue to yield sediments, the dredge spoil should be economically used with a long-term perspective.

The precise site of dumping can be finalized based on more detailed data on bathymetry, longshore currents and wave pattern. However, as the suggested sites are in the Palk Bay which is very shallow, the impact of currents and waves on the sediments would be minimal. Even if a small quantum of dumped sediments gets dispersed, the suspended sediments may not be able to reach the Gulf of Mannar (45–50 km from dump site) through the shallow and narrow Pamban Pass and affect the coral islands (Figure 1).

Alternatively, the dredged spoil from Adam's Bridge area can be used to enhance the size and relief of the northeastern Rameswaram Island. This can be achived by reclaiming the narrow spit between Kothandaramapuram temple (10 km east of Rameswaram town) and Dhanushkodi of the Palk Bay side, which is a shallow intertidal area of depth 0.5 to 1 m (location C; Figure 1). This 12 km long stretch with width varying from 700 to 1500 m is getting inundated partially during the NE monsoon but exposed during SW monsoon time and so an ideal ground for dumping. The narrow spit facing the Gulf of Mannar is highly susceptible to erosion while deposition occurs on the Palk Bay side[8,9]. As the SE spit of Rameswaram island is formed within the last 140 years[10] consisting of coralline loose sediments[9], the area is vulnerable to landform modifications by natural forces. Because of its low relief it is often inundated by seawater even at high tides and more during monsoons[9]. The vanishing of Dhanushkodi by 6 m high tidal inundation during the December 1964 cyclone was due to lack of sufficient elevation and width of this spit. The road and rail links to Dhanushkodi were discontinued subsequent to the 1964 event. If the 48 million cubic metres of dredged spoil coming from the Adam's Bridge is dumped along the NE Rameswaram island up to a height of 3–4 m, about 10 km^2 of land will be added to Rameswaram Island. If dumped on the land there will not be any suspended sediment impact on the marine environment. The cost of the new land thus acquired (either in Palk Bay or along the NE Rameswaram coast) would even be equal to the dredging coast of SSCP which is about Rs 2,427 crores. If the dredged spoil contains coralline limestone they may even be used for the cement industry.

One of the major negative impacts of the proposed SSCP is the possible threat to the coral habitats in the Gulf of Mannar area. In the light of this, the present suggestions demand serious consideration. Even if there is erosion of sediments from the dumping sites suggested here, they may not cause any havoc to the coral islands of the Gulf of Mannar in view of their greater distance and existing coastal geomorphic settings. Further, as the alternatives suggested here are relatively less expensive and safer environmentally, the authorities may reconsider wasting of huge quantum of valuable sediments resources by dumping in deep open sea.

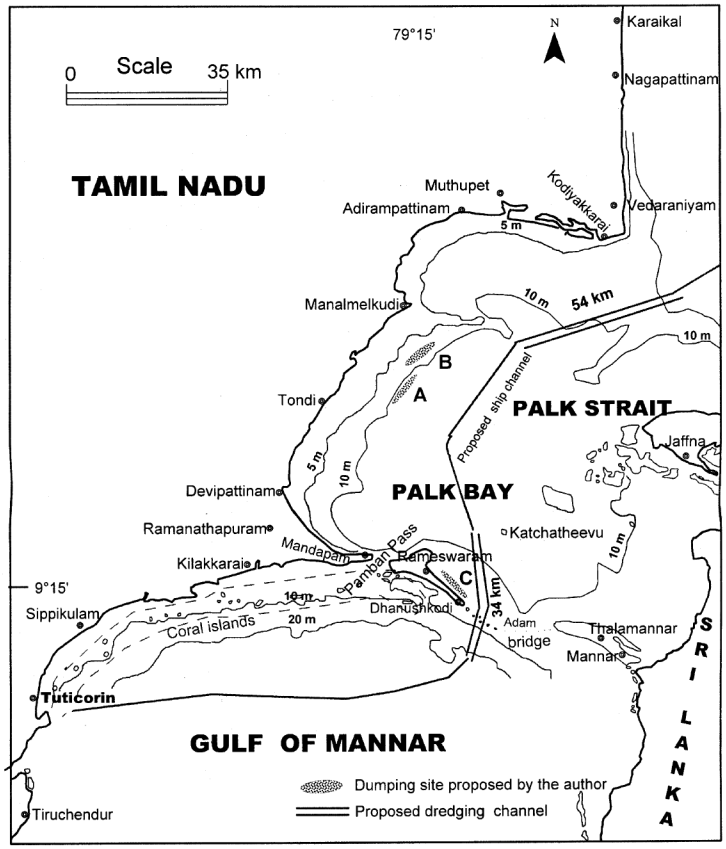

Figure 1. Alignment of Sethusamudram channel project and proposed dumping sites.

1. Ramesh, R., *Curr. Sci.*, 2005, **88**, 536–537.
2. Rajendran, C. P., *J. Geol. Soc. India*, 2005, **66**, 361–370.
3. Ramesh, R., *Doctors for Safer Environment*, Coimbatore, 2004, p. 71; www.geocities.com/sethushipcanal
4. Chauhan, P., Nayak, S., Ramesh, R., Krishnamoorthy, S. and Ramachandran, S., *Photonirvachak*, 1996, **24**, 105–114.
5. Sanil Kumar, V., Anand, N. M. and Gowthaman, R., *Curr. Sci.*, 2002, **82**, 1381–1389.
6. Chandramohan, P., Jena, B. K. and Sanil Kumar, V., *Curr. Sci.*, 2001, **81**, 292–297.
7. Jena, B. K., Chandramohan, P. and Sanil Kumar, V., *J. Coast. Res.*, 2001, **7**, 322–327.
8. Thanikachalam, M. and Ramachandran, S., *Photonirvachak*, 2003, **31**, 157–173.
9. Loveson, V. J. and Rajamanickam, G. V., *Indian J. Geomorph.*, 1998, **3**, 59–74.
10. Rajamanickam, G. V. and Loveson, V. J., *Sealevel Variation and its Impact on Coastal Environment* (ed. Rajamanickam, G. V.), Tamil University Publication, Thanjavur, 1990, pp. 389–396.

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