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MASULIPATAM — A METROPOLITAN PORT  
IN THE SEVENTEENTH CENTURY, A.D.

By

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Masulipatam or Matchlibandar during the 17th Century was the most prosperous port on the east coast of India and was in every respect a rival of Surat, the chief port of the Moghul Empire on the West Coast. Masulipatam was already a port of international importance when Hooghly was coming into prominence and Madras was an unknown factor. The metropolitan nature of this port is corroborated by a British factor who in 1659 called it 'the Metropolitan port and factory'. This 'chief port of the Kingdom of Golconda' had become 'the most famous mart of the whole Coromandal Coast' and merchants from Europe and Asia used to assemble here to contract business and thus the port, in the words of a Dominican friar was 'resembling Babel in the variety of tongues and the differences of garbs and costumes'. Tavernier also found this port in a flourishing state since it could accommodate ships of large tonnage as 'this place is renowned on account of its anchorage, which is the best in the Bay of Bengal,' and he further endorses its international status as a port, since he found Masulipatam to be 'the sole place from which vessels sail for Pegu, Siam, Arakan, Bengal, Cochin, China, Mecca, and Hormuz and also for the islands of Madagascar and Sumatra and the Manilas!'

The town and port of Masulipatam had a meteoric rise and its history, as a port of considerable international importance, could be linked with that of the rise of the Kingdom of Golconda. The trade conditions at Masulipatam fluctuated with the political affairs of the state and the rise and fall of the trade curve at Masulipatam in the 17th Century represented stable or chaotic conditions respectively within the state. Any invasion of the Kingdom by the Moghul forces was always marked by a slump in the trade conditions at Masulipatam.

1. Foster : English Factory Records — 1655-66 : p. 261.
2. Tavernier : Travels - Vol. I ; p. 141.

As to the origin of Masulipatam, there is no reliable or authentic information available. It has a Sanskrit name Matsyapura 'from an old tradition of a whale having been washed on the shore' and this testifies to its existence and traces its origin from very ancient time but probably during that period it was a minor fishing town. However the author of the Tuzki-Walajahi in a footnote writes as follows: 'The port is said to have been founded in the 14th century by the Arabs. In 1478 it came to be occupied by the Bahmani Sultan Mohammad II'. Another author also ascribes its origin to the Arabs, 'who 400 years ago are supposed to have founded Masulipatam.' During the 15th or 16th century when the Bahmani Kingdom had not disintegrated and its boundaries stretched from the West Coast to the East Coast across the Peninsula, Goa was its chief and the unrivalled port. The town of Golconda was only the headquarters of an outpost of the Kingdom. The business of the Kingdom naturally gravitated to Bidar and Gulbarga, its two premier cities, and the products of the state found their outlet through the port of Goa. During this period Masulipatam, therefore, remained as a minor and an unimportant port of the Kingdom.

The rise of Golconda, as an independent Kingdom towards the early half of the 16th century and its gradual stabilization to prosperous conditions in the latter half of the same century, heralded the rise of Masulipatam as the most important mart along the coast of Coromandal. The Kingdom of Golconda producing a rich variety of products both raw and manufactured, and commanding an extensive coast-line was bound to develop a number of ports to cover the trade of this highly productive hinterland, and Masulipatam, by virtue of its situation, became the premier port of the region.

Masulipatam was not a port gifted with the natural facilities of a harbour and, in fact, as a port it had many disadvantages. Although it is on the bank of a river, yet it is 'unfit for ships or pinnaces, the entrance being shallow and narrow; the ships which come here must lie about a mile off shore. The ground is very soft; the ships lie at depths of 3 and 4 fathoms. The town is situated about half a league up the river.' The defects in its location are further pointed out by Methowld who describes it as 'a small town...ill built and worse situated'. These statements point to the disadvantages of Masulipatam as a port. There was no direct land communication between the ships and the town as the intervening land area was marshy and thus passage was difficult. This isolation of the ships from the trading centre and the absence of communication facilities, except by boats, were very much felt by the English factors when their ships were totally cut off from their factories in the town by local officers who 'had countered all attempts to get off goods and men by stopping communication between the ships and the shore with the result that English ships were suffering for want of water and provisions'. Further, most of the ships required for their berthing and anchorage, a minimum depth of 3 to 4 fathoms whereas the depth of water in the river channel fluctuated between 3 and 18 feet and therefore the ships had to anchor in the open sea and were thereby left to the mercy of the weather; and the Coast of Coromandal is notorious for bad weather in the

3. Burhan's Tazki-Walajahi: Part I, Page: 39. No. 1.)
4. Hakluyt Society: Relations of Golconda; pp. 1.
5. Ibid.
6. Foster. English Factories in India 1661-64. p. 173.

months of October and November when it is frequented by severe cyclonic storms which caused great damage to the ships in the roadstead of Masulipatam.

It had certain advantages also and one of them was its comparative freedom from silting. The river channel was free from bars and islands and therefore plying of boats all round the year, without the assistance of any pilot, was possible. During that period the Krishna Delta was encroaching towards the south and Masulipatam being located on the northern branch of the river was not disturbed by this deltaic advancement.

Just behind the port was the most fertile tract of the Deccan which formed its hinterland; the port itself was directly linked with the great capital of the Kingdom — Golconda, which served as a market of the wide variety of goods imported into the country through the port and lastly the proximity of a large ship-building centre — Narasapurpeta was an added advantage.

The hinterland of Masulipatam i.e. the Kingdom of Golconda produced a wide variety of goods, both raw and manufactured, highly valued in the international market. Testifying to the fertility of the region one anonymous author states that 'the coast for ten or twelve leagues inland abounds in provisions, the abundance increasing as one goes north', and John Crandon, the penman to the East India Company, found in Masulipatam 'the only delightful place to live in, on all the coast.' If for nothing else, Masulipatam would have earned international fame 'for the beautiful fabrics produced upon this coast' and these fabrics commanded a wide market in Europe, West Asia and South East Asia. Masulipatam as an emporium for calicos and paintings stood unrivalled in the country and in the words of Methowld 'the paintings of this coast of Coromandal are famous throughout India, and are indeed the most exquisite that are seen, the best wrought, all with pensill, and with such durable colours that, notwithstanding they be often washed, the colours fade not whilst the cloth lasteth.' The rich diamond mines of Kollur, employing 30,000 workers daily were only 108 miles inland from the port. Iron ore and steel of excellent quality were obtained in Nirmal and Indur. Indigo of the finest variety, matching in quality with Lahore indigo, was produced in the region adjoining Masulipatam, Kondapalle and Ellore. Salt, tobacco and saltpetre were the other important products of the state. Saltpetre provided an important raw material for the manufacture of cartridges. Thus the diverse products of Golconda could find a way out through the port of Masulipatam.

Narasapurpeta was the greatest ship-building centre of the region and its nearness to Masulipatam assured easy, efficient and low cost repairing facilities to ships coming from long distances. Schorer gives the following description of Narasapur and its ship-building industry: 'A place called Narasapur Peta lies 10 to 12 leagues beyond Masulipatam...Here there is a river, where the Moslems, the Portugese and the Gentus build their ships because timber, iron and other necessary materials are available and the wages are low.' This statement is further corroborated in the Anonymous

7. Hakluyt Society: Golconda Relations (Anonymous).
8. Ibid.
9. Augh Murray: History of British India p. 145.
10. Hakluyt Society: Golconda Relations (Methowld).
11. Hakluyt Society: Golconda Relations (Schorer).

Relations:<sup>12</sup> 'The river of Narsapur Peta is very large, wide and convenient. Ships of as much as 200 tons burden can be sheathed or built in it... Ships of even larger tonnage displacements used to be built here as the native merchants of Masulipatam used ships of 600 tons or even more in their overseas trading operations. Normally only merchant ships were turned out from this centre. They were managed by sails and used to be oval shaped, allowing thereby ampler space for the storage of provisions and other mercantile commodities. These ships were mostly built of teak growing in abundance in the region behind Narasapur Peta. Cables and other cordage for ships were made of coir imported from Ceylon and the locally available iron ore provided the raw material for the manufacture of anchors. There are frequent references to this ship building centre, also called Emaldee in the English Factory Records and ships when damaged by storms are found repairing to this port for necessary repairs. The 'ADVICE', a ship of the English East India Company, damaged in a stormy weather off the coast of Masulipatam was sent to Narasapur Peta for trimming (Oct. 1641).<sup>13</sup> Another ship of the company 'WINTER FRIGATE' which the company had ordered to be sold...had been refitted at Narasapur and was later sent 'on a voyage to Achin'.<sup>14</sup> The proximity of this ship-building centre further facilitated the coastal trading operations of the trading nations since local junks were handy and could easily be engaged for collecting goods from other centres along the coast.

The availability of credit facilities was a great advantage at Masulipatam. Numerous records are available of foreign merchants, in financial difficulties borrowing money from the local merchants on easy terms. Sometimes they could even get interest free loan.<sup>15</sup> In 1643, English factors are found 'endeavouring to borrow money at Masulipatam to begin an investment for England' and the same year most of the treasure received from England at Madras was sent to Masulipatam 'where the money was to be used in satisfying the most pressing of their creditors.'<sup>16</sup>

The Persians, the Arabs and the Gentus were the business communities of Golconda. The Gentus had little hand in the foreign trade of the country as they did 'not go much to sea', and it was primarily controlled by the Persians who were specially invited by the ruler of the Kingdom to settle in his domain and many of them settled at Masulipatam to engage themselves in profitable business. The sea borne trade of the region received further impetus when contacts with the trading nations of Europe were developed. Merchants from Armenia, Arabia, Persia, England, Holland, Portugal, France, Denmark, Siam, Malaya and the East Indies made Masulipatam their operating base for trading along the coast. They also extended their range of activity beyond the domains of Golconda, as a factor of the English East India Company at Masulipatam wrote in 1623 that 'goods are carried thence chiefly to Bijapur, Burhanpur and Agra'.

The trading activities at Masulipatam covered a wide range both in the nature of business conducted and the geographical area traversed. Prominent among the trading activities were coastal and inland trading operations both by the foreign and the native merchants, although the native

12. Ibid.

13. Foster: English Factory Records: 1637-41:

14. Ibid.

15. Foster: English Factory Records: 1646-50, XXVIII.

16. Ibid: p. 120.

merchants had an advantage over the foreigners in this respect. The foreigners, however, had exclusively monopolised the lucrative business of carrying freight goods, of the local merchants, to and fro, between Masulipatam and Persia, Red Sea, Malaya and the Indies.

Coastal trading was very brisk along the east coast and ships of the native merchants as well as those of the foreign companies were engaged in this operation. Realising the importance of coastal trading the English factors at Masulipatam requested their Company in England to send them 'two small vessels for the port to port trade,'<sup>17</sup> to enable them to collect cargo of pepper and cloth from Tanjore and other parts of the south for stocking them at Masulipatam. There was a very lucrative trade between Masulipatam and the Bay ports and the products of Bengal were readily obtainable at Masulipatam.

The geographical range of coastal trading from Masulipatam was upto Hooghly in the north and Cochin on the west coast. The diverse products of all these regions were well stocked in Masulipatam and from there they were distributed to various parts of the world.

Within the hinterland of Masulipatam, the City of Golconda was the greatest market, consuming most of the articles and also the costliest ones imported from foreign countries. 'Costly English cloths of £. 18 or £. 20 a cloth would sell at the Court of Golconda'<sup>18</sup> reported an English factor to the Company in England. The city was a great manufacturing centre of the kingdom and provided a number of exportable commodities. Some of the finest varieties of cloths, like guldars and ferret — cannes, wrought with gold, silver and silken threads could be obtained only in and around Golconda and were in great demand in Persia, Bengal, Siam and the Phillipines. Further, diamonds above 10 carats could be procured only at Golconda as the trade in this commodity was a monopoly of the King. Similarly the capital City was the greatest market for *bezoar* stones (stones of medicinal properties found in the paunches of a particular species of goats, inhabiting the North Eastern region of the Kingdom) and in the words of Tavernier: "Golconda.....is the place where there is the most considerable sale (of bezoar)," and he 'purchased about 60,000 rupees worth of bezoar.'<sup>19</sup> Moreover license for trading in the territory of Golconda could be obtained only at the capital and therefore a permanent representative of each of the foreign countries trading in the Kingdom was kept at Golconda to negotiate trading concessions with the court and also to control trading operations in the vicinity of the capital.

With the expansion of their business it had become imperative for the foreign merchants to have a few factories established in the interior of the Kingdom to procure the things at source, since prices of goods coming to Masulipatam from the interior used to inflate to such an extent that their purchase at Masulipatam, on account of the keen competition from the native merchants, proved an unprofitable proposition.

The transport of freight goods by the Dutch and the English ships was one of the important overseas trading operations performed by the foreign trading Companies stationed at Masulipatam. The freight trade was found highly profitable and European vessels were better equipped for safe and

17. Foster: English Factories in India: 1634-36; p. 296.

18. Foster: English factories in India: 1630-33; p. 296.

19. Tavernier: Travels, Vol. II, p. 116.

speedy navigation than the native vessels. The natives were thus attracted to transport their goods through these foreign ships to Gombroon. The English factors found this, 'experiment of carrying freight goods from Masulipatam to Persia.....a success.....for.....the resulting receipts were nearly £. 3,000.'<sup>20</sup> In 1655 the Persian freight trade had brought so much profit to the English trade on the coast that 'the money brought.....from Persia had discharged all debts and left a considerable surplus.' The nature of the profit accrued from freight trade is further obtained from a complaint that Winter<sup>21</sup> lodged with the English East India Company that 'Buckeridge had done the Company an ill-service by refusing to allow GEORGE AND MARATHA to be hired out for a voyage to Tennasserim instead of lying idle at Masulipatam. A sum of 2,000 pagodas had been offered.....while the Company's estate left in Siam was to be transported gratis.'<sup>22</sup> The English East India Company used to commission one ship every year exclusively for this freight trade.

The range and regional distribution of sea borne trade of Golconda was extensive and the commodities exchanged were of diverse nature. There was never a dull season at Masulipatam and never was it to be found empty of ships. It was always bristling with activity. The ships were to be found there in every season, either to unload the cargo or to be laden with fresh cargo for their new destinations. The foreign trade of the Kingdom with fresh handled by the Moores, the European trading Companies and private merchants from Europe. Among the Moores, the Persians had a major share in the sea borne trade of the Kingdom.

The Moores of Golconda were an adventurous and enterprising people and even prior to the arrival of European merchants they had commercial contacts with many countries of the Indian and the Pacific Oceans stretching from East Africa in the West to the Philippines in the East. Their ships used to sail for 'Bengal, Arakan, Pegu, Tennasserim, Achin, Priaman, Queda and Perak usually.....in September for if they wait longer they were in danger of missing their voyage. The Mecca ships usually sailed in January or the end of December.'<sup>23</sup> The natives had very great interest in the spice markets of the East Indies and the impact of their competition was very keenly felt by the European traders, as one complained that the 'competition of Bengal, Masulipatam and Pegu merchants much hindered the purchase of return cargo'<sup>24</sup> The enterprising Moores of Golconda who had extended their sphere of trading activity to Siam and the Philippines came into contact with merchants from China, Japan and even Peru. Pertaining to this, Tavernier has to say the following: 'But concerning this commerce by sea between America and the Philippine islands, the people of Bengal, Arakan, Pegu, Goa and other places, carry thither all sorts of cloths, and a quantity of worked stones, such as diamonds and rubies with many manufactured articles of gold and silver, silken stuffs and Persian Carpets.'<sup>25</sup> Tavernier does not directly refer to the merchants of Masulipatam but the nature of the articles of commerce being carried to the Philippines clearly point to their inclusion in this trade. As regards their trade with Siam, the President and Council of the English East India Company at Madras wrote to the Company at home that

'the Moores at present do supply that place with fine goods per via. Tennasserim, but they carry them 40 days by land and pay several customs; and are at above 50 per cent charges more than the goods that go by shipping.' The port of Ayuthia in Siam was the meeting place of ships coming from Japan, Cochin China, Maccau and Manila and thus offered great opportunity for the exchange of rich variety of things and the chief articles imported from Ayuthia were silk, gold, copper, tuttanague (zinc), amber, damask, benjamin (benzoin), eagle-wood, tin porcelain wares and aloes. The relation between Golconda and Siam had also reached the diplomatic stage, and in 1664 the King of Siam had sent an ambassador, with rich presents of elephants and other goods, to the Court of Golconda.<sup>26</sup> The most lucrative overseas trade of the natives, however, was with Persia where Golconda cloth and diamonds, Bengal sugar and tropical spices were in great demand and in return Persian horses, carpets and *attars* were exported to Golconda. The balance of trade, as between Persia and Golconda, was probably, always in favour of the latter since the native merchants always returned with surplus treasure from their Gombroon voyage.

Among the European nations participating in the sea-borne trade of Golconda were the Dutch, English, Portugese, Danes and French. These trading nations of Europe sent every year a fleet or caravan of ships carrying treasure for investment and goods for sale in Golconda. The strength of the caravan varied with the capital resources of the trading nations and their conditions of trade on the Coast. Of the European nations contracting business at Masulipatam or along the coast the Dutch were the most prosperous and were doing excellent business. Dr. Nihar Ranjan Ray<sup>27</sup> has summarised the trading activities of the Dutch on the Coast in the following words: 'The trade of this country being considered very important, orders were given that every means should be employed to increase it,.....due economy was to be practised in consequence of the enormous sums laid out by the Company. And on account of the profitable business—they were carrying on 'the Masulipatam factory was to be maintained.' Great importance was attached by the Dutch to the Persian trade and it 'was considered the most important of all for the Company' and since Masulipatam goods were highly valued and profitably vendible in Persia, it was but natural that they attached great significance to the trade with Golconda. The magnitude of their trading operations could be had from the fact that they paid annually 3000 pagodas as custom charges at Masulipatam besides making large sums as piscashes to the King. During the same period the English East India Company paid only 800 pagodas and when the Dutch factors offered a piscash of 1500 pagodas to the King in 1660, only a third of this amount was expected of English factors. It appears from a perusal of the English Factory Records that the representatives of the English East India Company posted on the Coast were jealous of Dutch prosperity and complained time and again to the Company about this. 'But how this poor trade here will maintain the charge can not be apprehended by us... for the Dutch are grown so potent that they have gotten the whole Coast trade in their own possession and have so dispersed their moneys that we cannot get cloth for money,'<sup>28</sup> complained an English factor to the Company in England. The financial superiority of the Dutch over the English was well established and they could always drive the English out of the market on sheer strength of their capital

20. Foster: English Factories in India: 1630-33; p. 25.

21. Chief Factor at Masulipatam & later an Agent of the Company at Madras.

22. Foster: English Factories in India: 1661-64; pp. 378-79.

23. Hakluyt Society: Golconda Relations: Schorer; pp. 59-61.

24. Foster: English Factories in India: 1642-45.

25. Tavernier: Travels, Vol. II; p. 83.

26. Foster: English Factories in India, 1661-64. p. 363.

27. Calcutta University has edited a book entitled 'Dutch Activities in the East.'

28. Foster: English Factories in India: 1642-45: p. 191.

resources. A letter from Masulipatam to England states as follows :— 'the Dutch abounding so with means and having given out such great quantities to merchants and weavers that little or nothing is procurable there.....If the Dutch succeed in securing control of the Coast line from Pulicat to Ceylon they will quickly oust the English from trade in 'Golconda ports by out-bidding them for piece goods.' The Dutch had the monopoly in cloves, nuts and mace and by reason of this they had a great advantage over the English in the Masulipatam market as 'great quantities of cloves, nuts and mace sold there at very great profit, brought them in gold, which they preferred to rials or the silver.'<sup>29</sup>

Next to the Dutch East India Company the English East India Company was an active participant in the foreign trade of Golconda. Its trade was in a flourishing state, and its annual investment in the hinterland of Masulipatam increased almost ten times within a decade (1631 : £. 10,380 ; 1641 : £. 105,00) and thereafter it fluctuated between £. 80,000 and 90,000<sup>30</sup> annually. The figures quoted above represent the investments made from the amount directly received from England and do not include the profit procured through the freight trade and the amounts received from Bantam and Surat. The bulk of the cargo received from England was in gold or silver and only 25 to 30 per cent comprised of merchandise. Broad cloth, lead, alum, tin, coral and wine were the chief items of goods brought to Masulipatam. The return cargo consisted of chintz, calicoes, spices, gumlac, steel goods, salt petre and indigo. The policy of exporting bullion to Masulipatam was a profitable proposition since gold when minted into the new pagodas yielded a net profit of 10 to 12 per cent. Golconda and Masulipatam were great marts for gold and a stock of this valuable metal could always fetch ready money for immediate investment. The profitable trade of the natives at Mocha was based on exchange of gold for goods. Silver was not rated as high as gold and it was many a time devalued on the coast<sup>31</sup> and consequently foreign merchants sometimes suffered severe setbacks in their business. To avert such a catastrophe the President of the English East India Company at Surat adopted the wise policy of 'directing thither (Surat) the greater part of treasure extended to the Coast to be converted into rupees and passed by exchange to Masulipatam'.<sup>32</sup> The rupee had always on edge over the pagoda in exchange value.

The participation of the European nations in the commercial activities of Masulipatam had vastly increased the geographical limits of its range of trading and commercial contacts. The ships from Europe not only brought Masulipatam into direct contact with the major ports of that continent but also with those of Japan and China since their ships extended their sphere of activity to those countries. The number and frequency of ships voyaging to and from Masulipatam and Gombroon, the Bay ports and the East Indies had improved too. As a consequence the status of Masulipatam as an international mart had considerably increased.

The inclusion of these foreign merchants in the commercial operations of Masulipatam had provided great impetus to the productive activities within the territory of Golconda. The hinterland of Masulipatam was capable

of meeting the special requirements in cloth of West and South East Asia satisfactorily. The manufactures of the state, therefore, were being encouraged by them ; and on account of keen competition among the Europeans as regards the purchase of these wares there was a great boom in the prices of these articles. The cloth industry of the state had attained its peak. Export and import business at Masulipatam was very brisk and the collection of custom duty from the English East India Co. alone had registered over five-fold increase within a period of six years (1630-35).<sup>33</sup>

However this prosperity enjoyed by the trading companies and the port was not an everlasting one and Masulipatam like any other trading centre suffered from cycles of boom and slump in its trade. Depressions in business conditions followed either a natural calamity like famine, or chaotic political and administrative conditions, on account of war with the Moghul forces or with the neighbouring kingdoms of the Deccan and on account of the high handed policies of corrupt native officials. Anglo-Dutch wars in Europe also adversely affected the business at Masulipatam.

The territory of Golconda was scourged thrice by catastrophic famines within a period of 75 years (1612-1686). The 1630 famine was described as 'a great and mortal dearth which began three years hence and still increaseth' and 'those lands which had been famous for their fertility and plenty now retained no traces of productiveness. The sense of tragedy is further heightened when it is observed 'that life was offered for a loaf but none would buy, rank was to be sold for a cake but none cared for it; the ever bounteous hand was now stretched out to beg for food; and the feet which had always trodden the way of contentment walked about only in search of sustenance' (*Badhahnama*). Another famine in 1648, though it affected only the region south of Masulipatam, had greatly disturbed the peace and tranquility of the state which is so essential for the prosperity of any Kingdom. However the last great famine, prior to the dissolution of the kingdom in 1687, occurred in 1659. It had brought the country to a state of virtual ruin and the trading operations to a standstill.

The insane, unwise and high handed attitude of the native officials at Masulipatam had contributed in no small measure to the ruin of the port. The British factors at Masulipatam were compelled by their antagonistic attitude to shift their chief factory from Masulipatam to Madras since they were living there under conditions of perpetual insecurity and 'fear of the 'morrow'. The obstinacy of the local Governor in 1647, in not allowing 'any merchant to buy any goods', seriously hindered open and free trading at Masulipatam.

To cap all these were the turmoils and troubles of war. The immediate hinterland of the port was plundered and pillaged in 1661 by the Bijapur forces and the army of Aurangzeb burnt the town to ashes in 1664. It had hardly recovered from these shocks when the process of decay was brought to a climax by Aurangzeb and his forces who invaded Masulipatam in 1687 to expel the Dutch and thereafter it was totally surrendered to the forces of decay and destruction.

Meanwhile the centre of business activity on the East Coast was slowly migrating to the Hooghly where the fertile plain of the Ganges offered immense possibilities of profitable investment. The unstable conditions at

33. Ibid. : 1634-36 : p. 318.

29. Ibid. 1622-23 ; p. 338.

30. Ibid : English Factory Records : 1630-1669.

31. Foster : English Factory Records : 1650-54 ; p. 350.

32. Foster : English Factories in India : 1637-41 ; p. 287.

Masulipatam further accelerated the pace and since 1662 definite instructions were issued by the English East India Company to its Agent at Madras to invest greater proportion of the treasure advanced by the Company, from year to year, in the purchase of goods from the Bay ports. After the invasion by Aurangzeb in 1687 Masulipatam was just a shamble of ruin, and in course of time it reverted to its original status of being a port and a town of insignificant stature and local importance. The town of Masulipatam, however, still bears the traces of its past and the ruins of the colonies of 'European Kingdom of Golconda and 'the most famous mart of the whole Coromandal Coast' was.

Seldom the life history of a port has so well coincided with the rise and fall of the Kingdom which it served so well.

## HYDROBIOLOGY OF THE YERCAUD LAKE, SHEVAROY HILLS, SOUTH INDIA, WITH SPECIAL REFERENCE TO ITS SUITABILITY FOR CULTURE OF THE CARP, CYPRINUS CARPIO

By

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### INTRODUCTION :

Yercaud Lake is situated at an altitude almost the same as that of Coonoor on the Nilgiris and has been stocked since 1944 with the Mirror Carp, *Cyprinus carpio*, the English Carp, *Carassius carassius* and the Tench, *Tinca tinca*. Whereas there were indisputable indications of the English Carp and the Tench having bred in the lake, it was reported that the Mirror Carp alone had not. While the Mirror Carp had bred prolifically in a much smaller piece of water, San Jose Estate Pond in Yercaud, in the Rally Reservoir in Coonoor and in the Ootacamund lake, it was not known why it had not bred in the Yercaud lake alone. So, a detailed study was undertaken into the hydrological and biological conditions of the lake, with a view to finding out whether there were any particular factor or factors inimical to the breeding, growth and development of the Mirror Carp. The results of this field study form the subject matter of this paper.

### LOCATION, SHAPE, SIZE AND DEPTH :

Yercaud lake was formed in the valley of the river Vaniar of the Shevaroy Hills, Salem District, by the construction of a trap dyke by a German Missionary in 1850. This century-old lake is situated at an elevation of 4,400 feet (1,340 metres) above mean sea level. It is bounded on the north by the ghat road and on the west and south by mountain slopes covered with trees and jungles. On its eastern aspect there is an open grassy area sloping gradually towards the lake, with a thick scrub jungle in its northern half. The common trees on the slopes are *Eugenia wightiana* and *Plectranthus didyma*. The shrubs comprise *Lantana* sp., *Cassia fistula*, *Zizyphus jujuba* and *Solanum xanthocarpum*. Twiners and climbers like *Jasminum angustifolium*, *Passiflora foetida*, *Smilax* sp. and *Asparagus* sp., are also common. The undergrowth is composed of *Lastrea* sp., *Stachytarpheta indica*, *Lecanum aspera*, *Cleistania* sp., and *Bideus* sp. Between the margin of the lake and the scrub jungle there is a narrow stretch of grassy land about 5 to 10 feet wide with *Leersia* predominating.

Into this lake the river deposits its silt while the surplus waters flow over a steep precipice into the plains below. The lake covers an area of about 28.5 acres and is somewhat crescentic in shape. Its perimeter is about 5,300 feet with a maximum length and breadth of about 440 and 350 yards respectively. The maximum depth of the lake is 13 feet near the outlet (Fig. I). It will be seen therefrom that the lake is deeper at the centre than at the periphery, the depth in the middle portions of the lake varying from 5 to 13 feet.

### CLIMATOLOGY :

The rainfall data from 1940 to 1951 in Yercaud town are shown in Table I. The total annual rainfall during the period varied from a minimum of 46.16" in 1951 to 95.31" in 1946. In January and February of the cold

weather season there is very little rainfall. During the hot weather period of March, April and May, there have been a few inches of rainfall (excepting in the years 1940, 1941, 1943 and 1948 in May when there were very heavy showers). June to November is the principal rainy season at Yercaud when an average fall of over 5" per month is usually recorded. Excepting in 1941 and 1946 when the monthly rainfall recorded was 22.33" and 12.27" respectively, there was very little rainfall in December during the other years. The rainfall is thus spread over the whole year, the annual average being about 50".

In Table II is shown the mean temperature in the several Hill Stations of India. The annual range of variation is from 65°F in December and January to 79°F in April and May. The difference between the maximum and the minimum is only 6°F. The hottest months in Yercaud are April and May and the coldest are December and January.

#### HYDROBIOLOGY:

The hydrobiological conditions of the lake were studied by us on three occasions, namely, 21st November 1947, representing the rainy season, 18th to 22nd January 1950 representing the cold weather and 17th to 18th May 1950 representing the hot weather conditions. The results of our field study are given below under appropriate headings.

##### (a) Physical conditions :—(Vide Table III)

**DEPTH:** The lake maintained an almost uniform depth of 12 to 13 feet water during the period of our investigation.

**COLOUR AND TRANSPARENCY:** The colour of the water was greenish on 21-11-1947 and 19-1-1950, and yellowish green on 17th and 18th May 1950, indicating a vigorous bloom of phytoplankton on all the three occasions. The surface layer was most transparent (30.0 cm on 21-1-1947, 17-5-1950 and 18-5-1950), and the bottom was very turbid (4-8 cm on 17th and 18th May 1950) due to sediments derived from the plant growths. The depth of visibility was 2' 6".

**TEMPERATURE OF WATER:** The surface and bottom temperature readings were recorded from the middle of the lake on six occasions as given in Table III. It will be seen that the surface temperature taken on a midday in the north-east monsoon period (rainy season in November 1947) was 21.4°C. The next set of readings taken during the cold weather (19th and 20th January 1950) showed the lowest temperature of 16.2°C, at 6 a.m. and the highest of 22.5°C at 4 p.m., the amplitude of variation thus being 6.3°C. The gain in heat by day was 6.3°C, and the loss by night was 3.4°C. On the third occasion (17th and 18th May 1950) which was the height of the summer season, a diurnal variation was found in the surface layer. The maximum temperature was reached at 2 p.m. (28.8°C) on 18th May 1950 and the minimum at 6 a.m. (25.4°C) on 18th May 1950 showing a difference of 3.4°C. The bottom layer was almost constant being 24.8°C indicating that there was no turn-over. There was, therefore, a definite thermal stratification both by day and night in May 1950. The maximum difference between the surface and bottom layers, was 4.0°C at 2 p.m. on 18th May 1950 and the minimum 0.6°C at 6 a.m. on 18th May 1950. This small difference in the early morning hours would seem to show that homothermal condition might be reached on foggy or rainy days even in May (Vide Table I) when the surface layer may not be heated to the same degree as on a bright sunny day. Chances of complete circulation taking place in the lake do not therefore seem to be remote.

TABLE No. I—SHOWING RAINFALL (IN INCHES) GAUGED AT  
BELMONT BUNGALOW, YERCAUD FROM 1940-1951

| Month     | 1940  | 1941  | 1942  | 1943  | 1944  | 1945  | 1946  | 1947  | 1948  | 1949  | 1950  | 1951  |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| January   | ...   | 1.23  | —     | 4.38  | 0.07  | 0.04  | 2.21  | 2.75  | 2.68  | —     | —     | 0.24  |
| February  | ...   | 0.11  | —     | 0.84  | 1.45  | —     | —     | 0.23  | —     | 0.80  | 7.41  | —     |
| March     | ...   | 0.07  | —     | 0.62  | 3.00  | —     | 2.22  | 1.70  | 0.21  | —     | 0.07  | 1.12  |
| April     | ...   | 5.25  | 6.85  | 4.87  | 2.61  | 2.25  | 2.82  | 2.82  | 2.15  | 0.86  | 0.06  | 5.68  |
| May       | ...   | 10.65 | 4.02  | 2.11  | 2.85  | 7.54  | 5.30  | 1.71  | 10.72 | 2.39  | 5.95  | 7.28  |
| June      | ...   | 1.89  | 3.86  | 5.52  | 6.24  | 3.56  | 7.36  | 8.61  | 3.65  | 5.02  | 5.88  | 1.31  |
| July      | ...   | 8.19  | 3.71  | 9.12  | 6.75  | 12.04 | 7.05  | 10.52 | 9.01  | 11.36 | 7.53  | 9.21  |
| August    | ...   | 10.95 | 13.75 | 6.58  | 9.18  | 14.85 | 10.30 | 17.99 | 10.48 | 12.59 | 10.85 | 5.20  |
| September | ...   | 13.17 | 9.16  | 7.56  | 12.94 | 6.65  | 11.64 | 15.77 | 3.96  | 10.35 | 7.32  | 6.30  |
| October   | ...   | 5.62  | 4.46  | 16.72 | 15.58 | 15.00 | 14.20 | 16.26 | 11.14 | 13.83 | 8.72  | 5.36  |
| November  | ...   | 5.98  | 3.28  | 5.91  | 9.37  | 6.14  | 19.94 | 1.89  | 12.85 | 3.26  | 2.85  | 4.36  |
| December  | ...   | 22.33 | 4.04  | 0.82  | 4.82  | 0.53  | 12.27 | 0.62  | 1.55  | —     | 0.76  | —     |
| Total ..  | 63.37 | 85.44 | 53.12 | 84.45 | 75.76 | 68.60 | 95.31 | 80.87 | 67.83 | 66.52 | 56.93 | 46.16 |

Kindly furnished by Mr. B. G. McHutton, Honorary Secretary, Shevaroy Planters' Association).

TABLE No. II—SHOWING MEAN TEMPERATURE (°F) IN HILL STATIONS IN INDIA

| Hill Stations             | Height<br>in Ft. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------------------------|------------------|------|------|------|------|-----|------|------|------|-------|------|------|------|
| 1. Darjeeling ...         | 8008             | 40   | 41   | 51   | 55   | 61  | 62   | 63   | 61   | 63    | 55   | 50   | 44   |
| 2. Simla ...              | 8000             | 40   | 44   | 53   | 61   | 66  | 80   | 75   | 78   | 70    | 67   | 52   | 46   |
| 3. Nainital ...           | 6200             | 42   | 46   | 56   | 61   | 69  | 69   | 67   | 69   | 65    | 61   | 50   | 47   |
| 4. Ootacamund ...         | 7361             | 54   | 56   | 60   | 61   | 61  | 57   | 63   | 63   | 63    | 56   | 54   | 53   |
| 5. Palnis ...             | 7000             | 51   | 53   | 60   | 61   | 69  | 69   | 69   | 69   | 69    | 69   | 69   | 69   |
| 6. Shevaroye<br>(Yercaud) | 5260             | 65   | 65   | 63   | 71   | 71  | 68   | 68   | 68   | 67    | 66   | 66   | 65   |

(Taken from a Manual of the Nilgiris District, edited by H. B. Grigg, Madras Government Press, 1880).

The temperature data also show that a progressive warming-up of the lake had taken place between January and May 1950, for the lowest recorded temperature at 6 a.m. in January was 16.2°C and in May was 25.4°C. Thus there was an increase of 9.2°C from the minimum. Again, the maximum recorded temperature at 4 p.m. in January was 22.5°C, and at 2 p.m. in May was 28.8°C, showing a difference of 6.3°C.

Therefore there was not only a warming-up of the lake but also a stable thermal stratification in May 1950.

(b) *Chemical conditions :*

**DISSOLVED OXYGEN :** The results of the oxygen determinations made on the three occasions in the middle portion of the lake are given in Table III. At 11 a.m. on 21-11-1947, the lake was covered over with a thick fog till midday and therefore the oxygen content at the surface was low (42.6% saturation). On the next occasion, there was intermittent bright sunshine with thick over-hanging clouds. The surface water was saturated to the maximum level (92%) at 12 noon. Subsequently there was a gradual diminution until at 6 a.m. on the next morning when the oxygen content was reduced nearly to one-half of the maximum level. On 17th May 1950, i.e., the surface water was almost fully saturated with oxygen to the extent of 97.5% at 6 p.m. Therefore during the night, there was a gradual depletion of oxygen with the result that at 6 a.m. on 18th May 1950 it was reduced to less than half. By day time, the oxygen content rose up at 2 p.m. to 95.4% saturation due to photosynthetic action. At no time was there supersaturation of oxygen. In the bottom layer, on the other hand, the oxygen content was very low on account of feeble photosynthetic action by the plants at the bottom from 2 p.m. to 6 p.m. without producing corresponding increase in temperature. Its absence at 6 a.m. and 10 a.m. on the 18th May 1950 indicated that the heavy macrophytic growth at the bottom was using up all the oxygen. Fish and other animal life were therefore not likely to reach such places by night or even by day until the plants synthesised oxygen.

Again, the data for the surface and bottom layers on 17th and 18th May 1950 showed that there was a permanent oxygen stratification also; which was indicated by the absence of oxygen at 6 a.m. and 10 a.m. of 18th May 1950 and thereby the gradual diminution from 6 p.m. of 17th to 0.0 at 10 a.m. of 18th. Thus the vertical distribution of oxygen confirmed the earlier finding regarding temperature that there was a permanent thermal stratification during the hot weather just as in the temperate zones.

**HYDROGEN ION CONCENTRATION :—**The figures of pH are given in Table III. It will be seen that with the advance of the seasons, from the north-east monsoon (November) through the cold weather (January) to the summer season (May), the pH of the surface water also increases indicating photosynthesis to a great extent. In the case of the bottom layer, it was acidic throughout the twenty-four hours of the day during the summer period. There is also a diurnal variation in the pH of the surface layer. On 19-1-1950 the highest pH of 7.8 was reached at 12 noon, and the lowest of 7.4 at 8 p.m. and at 12 midnight. On 18th and 19th May 1950 the highest figure of 8.9 was reached at 6 p.m. and the lowest figure of 8.7 from 2 a.m. to 10 a.m.

Again a study of the data for the surface and bottom layers of water on 17th and 18th May showed that the pH remained constant from 6 p.m.

of 17th to 2 p.m. of 18th May 1950. There was therefore a permanent stratification in pH also, thus providing additional confirmatory evidence in favour of the inference already drawn from the temperature and oxygen results.

**Free carbon-dioxide ( $CO_2$ ), Carbonates ( $CO_3$ ) and bicarbonates ( $HCO_3$ ):** The data for these factors are given in Table III. Free  $CO_2$  was found in the surface layer on the first two occasions but not on the third and the last occasion. Its absence indicated that it was utilised by the chlorophyll-bearing organisms and plants in the water during summer when photosynthesis would be more vigorous. In the surface, there was a diurnal variation. As the day advanced, the amount of free  $CO_2$  gradually diminished on account of its utilisation during photosynthesis and during night it increased due to respiration. This is well illustrated by the data for 19th and 20th January 1950. On 17th and 18th May 1950, when there was no free  $CO_2$  at all in the surface water, bicarbonates were utilised by the plant organisms in the water. This is shown by the increase in the carbonates and decrease in the bicarbonates by day and the reverse by night. In the case of the bottom layer, the free  $CO_2$  was found to increase from 6 p.m. onwards until 10 a.m. of the next day along with bicarbonates when the carbonates formed in the surface layer were found to decrease gradually.

**Chlorides:** 1.0, 0.8 and 2.1 parts per 100,000 of chlorides were present on 21-11-1947, 19-1-1950 and 17-5-1950 respectively. In spite of the fact that the town drainage was allowed to flow into the lake, the chloride content of the lake water was very low, indicating that surface contamination was not excessive.

**Nitrates, Silicates and Phosphates:** Nitrates were not detected at any time. But phosphates were present in very small amounts (0.015 parts) on all the occasions in the surface water and in greater amounts (0.046 parts) in the bottom layer. So also were silicates. The data relating to these factors are given in Table III. The figure for the surface layer indicated that (i) there was a decrease in phosphates by day due to their utilisation by phytoplankton followed by an increase in the early morning hours; (ii) phosphates on 17th and 18th May 1950 were nearly of the quantity present on 19th and 20th January 1950 showing that nearly half of the original amount had been used up; (iii) they were found to be nearly constant at the surface and the bottom. There were no conspicuous diurnal changes in the silicate content of the surface layer and they were found to be nearly half of that found at the bottom where it was constant on 17th and 18th May 1950. These facts showed that there were stratifications in phosphates and silicates.

#### (c) Biological conditions:

(i) **Aquatic vegetation:** There was an all round luxuriant growth of macrophytic aquatic vegetation on 21-11-1947. Portions of the lake were completely overgrown by a species of *Colocasia* sp. in 1947 which however, disappeared by 1950. Marginal vegetation was plotted in detail on 19th January 1950. The vegetation near the water edge consisted mostly of *Scirpus squarrosus* and *Cyperus distans* (Cyperaceae), *Colocasia antiquorum* (Aroideae), *Vernonia* sp. (Compositae) and *Polygonum glabrum* (Polygonaceae). The marshy area in the south-west corner of the lake is a fairly long one extending to about 800 feet into the lake and supports a good vegetation dominated by *Colocasia antiquorum*, *Panicum proliferum* and *Eragrostis* sp. There is a small lagoon in the centre of the swamp inhabited by patches of *Limnophila heterophylla* (Scrophulariaceae), the leaves of which are of two kinds, those above the water being normal, elliptic and serrated while the submerged ones were branching.

*Utricularia flexuosa* (Lentibulariaceae), *Hydrilla verticillata* and *Vallisneria spiralis* (Hydrocharitaceae) occur throughout the lake in scattered patches.

(ii) **Macrofauna:** (Other than fishes). The following forms of life were also found in the lake during our visits.

**Mollusca — Gastropoda:** *Viviparus dissimilis* & *Limnaea succinea*.

**Crustacea — Decapoda — Brachyura:** *Paratelphusa jacquemontii*.

**Insecta — Hemiptera:** *Laccotrephes ruber*, *Ranatra elongata* and *Metrocoris nepalensis*.

**Amphibia:** *Rana cyanophlyctis*.

**Ophidia:** *Natrix piscator*.

**Chelonia:** *Emyda granosa*.

**Mammalia:** *Lutra vulgaris*.

(iii) **Plankton:** Altogether forty-five planktonic organisms were recorded by us from the lake. They are listed below:

#### (a) Phyto-plankton:

1. **Myxophyceae:** *Anabaena flosaquae*, *Merismopedium aeruginum*, *Microcystis aeruginosa* and *Rivularia lens*.

2. **Chlorophyceae:** *Ankistrodesmus concolutus*, *Bulbochaets crassiuscula*, *Closterium moniliform*, *Coelastrum proboscideum*, *Cosmarium granatum*, *Euastrum inermis*, *Gonatozygon aculeatum*, *Netrium digitus*, *Oedogonium oblongellum*, *Pleurotaenium cristatum*, *Scenedesmus quadricauda*, *Spirogyra neglecta*, *Staurostrum dejectum*, *Stigaoecium lubricum* and *Zygnema pectinatum*.

3. **Xanthophyceae:** *Botrydium tuberosum* and *Botryococcus braunii*.

4. **Bacillariaceae:** *Achnanthes inflata*, *Amphora coffeiformis*, *Anomoeoneis sphaerophara*, *Cyclotella meneghiniana*, *Cymbella naviculiformis*, *Eunotia monodon*, *Fragilaria intermedia*, *Gomphonema intrictum*, *Melosira granulata*, *Navicula cuspidata*, *Pinnularia borealis*, *Bhopalodia gibba*, *Synedra ulna* and *Surirella tenera*.

5. **Dinophyceae:** *Ceratium hirundinella* and *Peridinium gatunense*.

#### (b) Zoo-plankton:

1. **Rotifera:** *Anuraea valga*, *Brachionus falcatus* and *Notus quadricornis*.

2. **Cladocera:** *Diaphanosoma paucispinosum* and *Bosmina longirostris*.

3. **Ostracoda:** *Cypridopsis* sp.

4. **Copepoda:** *Trododiptomus euchaetus* and *Mesocyclops leuckarti*.

On 21-11-1947 phyto-plankton was rich with a bloom of *Microcystis* spp., besides a high representation of *Desmids*, *Diatoms*, *Chlorococcales* and *Dinophyceae*. Zoo-plankton was fairly rich in *Copepods* and *cladocerans*.

(c) The diurnal variations of the planktonic forms noted on 19th and 20th January 1950 are shown in Table IV. It would be seen that *Microcystis aeruginosa*, *Trododiptomus euchaetus* and *Mesocyclops leuckarti* were present at the surface as well as in the bottom throughout the period. *Anabaena flosaquae*, *Melosira granulata*, *Navicula cuspidata* and *Peridinium gatunense* were present only at the surface layer.

(d) *Diurnal variations of the dominant forms*: Some organisms were found in swarms at some part of the day. They were (a) *Microcystis* spp; (b) *Ceratium hirundinella*; (c) *Peridinium gatunense*; (d) *Synedra ulna* and (e) *Mesocyclops leuckarti*.

(a) *Microcystis* spp: It was found in abundance at all times of the day on the surface but only few forms were found in the bottom.

(b) *Ceratium hirundinella* was found in swarms at 6 a.m. at the surface while at other times a few were present; it was not found at all in the bottom. At Ootacamund lake this organism was found in swarms a few metres below the surface in the presence of light. So, probably in this lake it had gone below the surface as the day advanced.

(c) *Peridinium gatunense* was found in swarms from 12 noon to 8 p.m. and at other times only a few were seen at the surface. It was not found in the bottom.

TABLE No. IV—SHOWING DIURNAL VARIATIONS IN PLANKTON OF YERCAUD LAKE

(From 6 a.m. on 19—1—1950 to 6 a.m. on 20—1—1950).

| Planktonic organism.              | SURFACE |       |        |        |        |        | BOTTOM |       |        |        |        |        |
|-----------------------------------|---------|-------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|
|                                   | 6 a.m.  | 12 N. | 4 p.m. | 8 p.m. | 12 MN. | 6 a.m. | 6 a.m. | 12 N. | 4 p.m. | 8 p.m. | 12 MN. | 6 a.m. |
| <i>Anabaena flosaquae</i>         | ...     | r     | —      | —      | r      | —      | —      | —     | —      | —      | —      | —      |
| <i>Microcystis aeruginosa</i>     | ...     | s     | s      | s      | s      | s      | f      | f     | f      | r      | f      | c      |
| <i>Staurostrum dejectum</i>       | ...     | —     | r      | r      | f      | f      | r      | r     | r      | r      | r      | r      |
| <i>Botryococcus braunii</i>       | ...     | f     | r      | —      | f      | f      | f      | —     | —      | —      | —      | —      |
| <i>Melosira granulata</i>         | ...     | r     | c      | f      | c      | f      | c      | —     | r      | —      | —      | —      |
| <i>Navicula cuspidata</i>         | ...     | —     | —      | —      | r      | —      | —      | r     | —      | —      | —      | —      |
| <i>Synedra ulna</i>               | ...     | —     | r      | f      | f      | f      | r      | —     | s      | c      | s      | c      |
| <i>Ceratium hirundinella</i>      | ...     | s     | —      | r      | c      | f      | s      | —     | —      | —      | —      | r      |
| <i>Peridinium gatunense</i>       | ...     | f     | s      | s      | s      | f      | f      | —     | —      | —      | —      | —      |
| <i>Anuraea valga</i>              | ...     | r     | —      | —      | r      | f      | r      | —     | r      | r      | —      | —      |
| <i>Brachionus falcatus</i>        | ...     | f     | r      | r      | r      | f      | f      | —     | r      | r      | r      | —      |
| <i>Notus quadricornis</i>         | ...     | r     | —      | —      | r      | r      | r      | —     | —      | —      | —      | —      |
| <i>Diaphanosoma paucispinosum</i> | ...     | r     | r      | —      | r      | r      | r      | —     | r      | r      | —      | r      |
| <i>Bosmina longirostris</i>       | ...     | r     | —      | r      | r      | f      | r      | —     | r      | —      | —      | r      |
| <i>Cypridopsis</i> sp.            | ...     | r     | r      | r      | r      | r      | r      | —     | r      | —      | —      | r      |
| <i>Tropodiptomus euchaetus</i>    | ...     | c     | f      | f      | c      | c      | c      | f     | c      | f      | f      | r      |
| <i>Mesocyclops leuckarti</i>      | ...     | s     | f      | f      | s      | s      | s      | f     | —      | r      | f      | f      |

(K: Noon; MN: Mid-night)

(r: rare; f: few; c: common and s: swarm)

(d) *Synedra ulna*: A few forms alone were found at the surface by day but were seen swarming in the bottom layers between 12 noon and midnight.

(e) *Mesocyclops leuckarti*: was seen swarming at 6 a.m. but had nearly disappeared between 12 noon and 4 p.m. but began to swarm again

at night on the surface. Only a few forms were found at night at the bottom.

Yercaud lake is situated at an elevation of 1,340 metres (4,400 ft.) and receives the drainage water from a part of the Yercaud town. A fairly large amount of silt is also carried into the lake after each rainfall from the cultivated slopes of the hills all round.

It is a shallow lake with a maximum depth of about 13 ft. Its water is highly turbid and yellowish-green in colour. The temperature of the surface water ranges from 16°C to 29°C and its bottom temperature during summer stagnation in May is about 25°C. The surface water is saturated from 40 to 92% during the cold weather and 40 to 98% during summer stagnation in May, when the dissolved oxygen content at the bottom is practically nil. Its water is soft with free CO<sub>2</sub>, carbonates, bicarbonates, lime, silicates and phosphates in appreciable amounts. Nitrates are absent. It appears to contain an excessive amount of organic matter of vegetable origin on account of the presence of an abundance of macrophytic vegetation, which is partly responsible for the paucity in the number of algal forms. The water is ordinarily neutral but becomes highly alkaline in summer due to photosynthesis.

The total number of species of phyto-plankton is limited to nine but the number of individuals of a few species is very great.

*Microcystis aeruginosa*, *Ceratium hirundinella*, *Peridinium gatunense*, and *Synedra ulna* are seen sometimes in swarms along with the zoo-plankton *Mesocyclops leuckarti*.

The alga, *Microcystis aeruginosa* is characteristic of eutrophic waters of European low lands and does not seem to occur at higher elevations of the temperate region (Ruttner, 1952). Ruttner (*loc. cit*) has recorded its presence in Telaga Pasir, and Telaga Ngebel in Java and Toba lake in Sumatra only—all mountain lakes situated at an elevation of 730—1290 metres in East Indies. Yercaud lake in which this alga is seen in swarms is situated at an altitude of 1,340 metres (4,400 ft.). The same alga is seen in abundance in lakes George and Baringo situated at an elevation of 3,000—3,150 ft. and not in the lakes Naivasha and Rudolf which are located at altitudes 6,200 ft. and 1,250 ft. respectively in East Africa. Beadle (1932—34) is unable to explain its absence in the two latter lakes. He has inferred from their colours that probably the organic content is not high in the two latter lakes.

From his study of the English lakes, Pearsall (1921) has shown that the stage of development shown by any lake is the fundamental factor in the abundance of fish and their food, "evolved" lakes supporting more fish than the "primitive" ones. Yercaud lake is a highly "evolved" one for reasons explained above and therefore should support an abundance of the cold water fishes—the German carp, the English carp and the Tench.

#### (D) Fish fauna:

(a) Nine species were found. They were *Cyprinus carpio*, *Carassius carassius*, *Tinca tinca*, *Macropodus cupanus*, *Rasbora daniconius*, *Danio aequipinnatus*, *Ophicephalus gachua*, *Macrones vittatus* and *Lepidocephalus thermalis*.

(b) Culture of Mirror carp, *Cyprinus carpio*: Fingerlings of Mirror carp were stocked in the lake as follows: —100 in February 1947, 300 on 24th December 1946, 340 on 29th September 1947, 250 on 19th September 1948, 250 on 31st October 1948 and 200 on 26th June 1949. The data obtained during trial nettings from 1946 to 1948 are recorded in Table V.

JL

Dr. J. L. ...

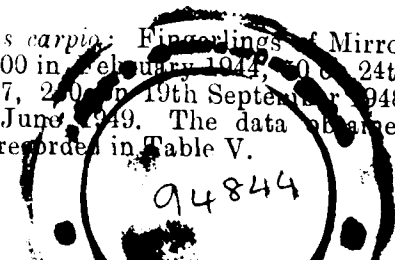
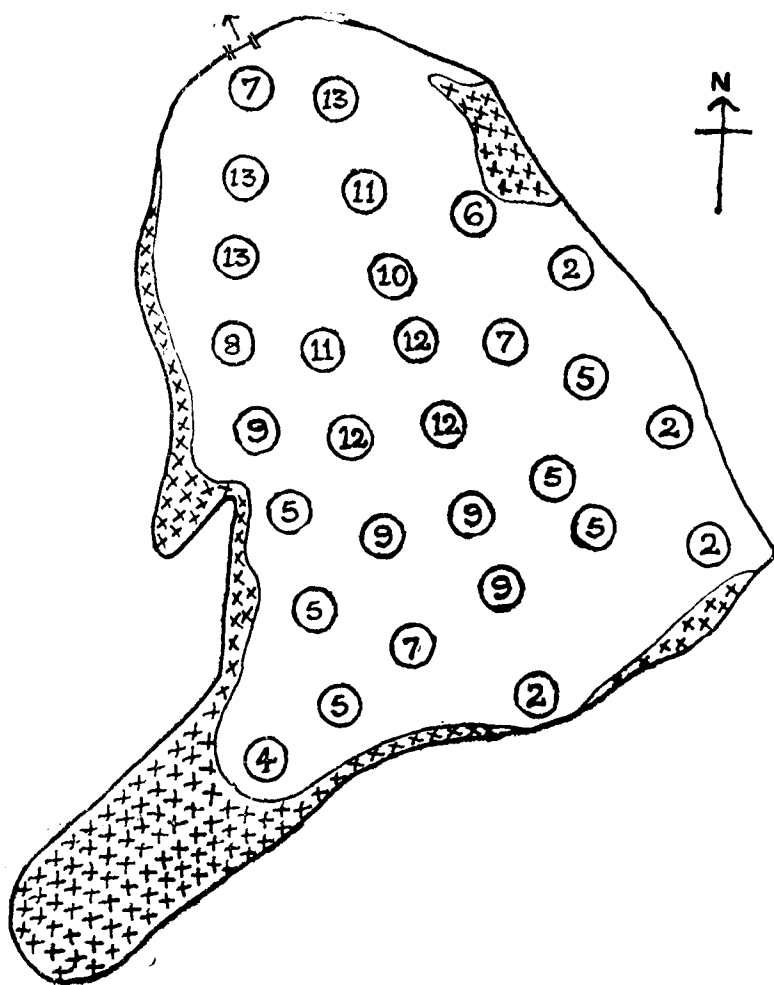


TABLE V. SHOWING PARTICULARS OF MIRROR CARP  
RECORDED DURING TRIAL NETTING CONDUCTED  
IN THE YERCAUD LAKE FROM 1946 TO 1949

| Date       | No. caught | Length in inches | Weight in lbs. and oz. |
|------------|------------|------------------|------------------------|
| 6-9-1946   | 2          | 30.0 — 31.0      | 15.0 — 16.0            |
| 25-5-1947  | 2          | 20.0 — 21.0      | —                      |
| 26-9-1947  | 2          | —                | 4.8 — 5.0              |
| 14-4-1948  | 1          | —                | 15.0 —                 |
| 24-10-1948 | 7          | 17.0 — 26.5      | 3.0 — 8.3              |
| 25-10-1948 | 10         | 19.0 — 29.0      | 4.0 — 9.6              |
| 22-5-1949  | 2          | 12.0 — 12.5      | 0.12 — 1.0             |
| 18-6-1949  | 9          | 11.5 — 24.5      | —                      |
| 20-7-1949  | 4          | 3.0 — 15.0       | —                      |
| 9-8-1949   | 2          | 12.0 — 13.0      | —                      |
| 21-11-1949 | 9          | 12.0 — 26.0      | —                      |

Mirror carp and Tench were released into the lake only a couple of months previously and the fingerlings netted did not afford any evidence to show that the original stock of fish had bred in the lake.



A scrutiny of these data shows that the Mirror carp population of the lake comprises of various size-groups varying from 3 inches to 31 inches. The first trial netting in the lake was made after two years of the initial stocking. Many of the specimens, 12 inches and above in size, had their gonads ripe and oozing. The fish which were first stocked in the lake in February 1944 measured 4 inches in size and had attained a size of 31 inches and weighed 16 lbs. (by May 1946) in a period of about 26 months. The growth rate works out to about an inch per month.

The second trial netting was made on 25th May 1947, when specimens 20 inches in size were netted. These are undoubtedly not those stocked in February 1944, for a very low growth-rate of 16 inches only in 39 months instead of one inch per month is worked out and this is highly improbable for this species. The lake, however, was stocked again only on 24th December 1946; and these fish would not have attained 20 inches within 5 months, i. e., on 25th May 1947. So the specimens caught during the second trial netting should be those which had bred in the lake. Again, on 20th July 1949 specimens measuring 3, 4 and 12 inches were netted. The previous immediate stocking was on 26th June 1949 with 200 young ones each 4 inches in length. On 21st November 1949, specimens 12 inches in size were obtained. These cannot be considered to belong to the lot stocked on the two immediate previous occasions, viz., 31st October 1948 and 26th June 1949, for those stocked on 31st October 1948 were 3 to 6 inches in size and could therefore have easily attained a length of more than 12 inches in 13 months. Under these circumstances, we justified in our belief that Mirror carp had bred in the lake.

During our visit in January 1950 further trial nettings were conducted with a coracle brought from Mettur and a boat belonging to the Yercaud Boat Club. The details of the catches are given in Table VI.

TABLE VI. SHOWING DETAILS OF CATCHES OBTAINED  
FROM THE LAKE IN JANUARY, 1950

| Serial No. | Date      | Total length in inches. | Weight Lbs. Oz. | Sex - stage of gonad |
|------------|-----------|-------------------------|-----------------|----------------------|
| 1.         | 18-1-1950 | 18.0                    | 3.0             | Miltar               |
| 2.         | do.       | 20.0                    | 4.8             | do.                  |
| 3.         | do.       | 27.0                    | 8.12            | Female, V stage      |
| 4.         | do.       | 20.0                    | 7.8             | Miltar               |
| 5.         | do.       | 21.0                    | 4.0             | do.                  |
| 6.         | do.       | 18.2                    | 3.12            | do.                  |
| 7.         | do.       | 20.0                    | 3.0             | do.                  |
| 8.         | 19-1-1950 | 17.0                    | 3.0             | do.                  |
| 9.         | do.       | 18.0                    | 3.0             | do.                  |
| 10.        | do.       | 18.5                    | 3.0             | do.                  |
| 11.        | do.       | 13.5                    | 1.1             | do.                  |
| 12.        | 20-1-1950 | 18.0                    | 2.8             | do.                  |
| 13.        | do.       | 10.2                    | 0.4             | Indeterminate        |
| 14.        | do.       | 10.0                    | 0.3½            | do.                  |
| 15.        | 21-1-1950 | 9.5                     | 0.3             | do.                  |
| 16.        | do.       | 10.5                    | 0.3½            | do.                  |
| 17.        | do.       | 10.0                    | 0.3½            | do.                  |
| 18.        | do.       | 10.5                    | 0.4             | do.                  |
| 19.        | do.       | 11.0                    | 0.5             | do.                  |

It will be seen from the above table that (a) the size of fish captured ranged from 9.5 to 27 inches; and (b) there were breeders of both sexes, the males predominating. As already stated the last previous stocking was done about seven months previously, i. e., on 26th June 1949 with 200 young ones 4 inches in length; and these would have grown to a length of more than 9.5 inches. This observation also lends support to the view that mirror carp had bred in the lake. The fact that one carp obtained by us from the Yercaud Panchayat Board pond, from the lot simultaneously stocked on 26th June 1949, measured 14 inches, adds confirmatory support.

Another trial netting operation conducted by us in May 1950 yielded results given in Table VII, from which it will be seen that (a) the catches contain fish of different lengths and ages; (b) the shortest mirror carp was 6.5 inches, caught on 18-5-1950, and (c) the lengths, weight and gonadal conditions of the samples netted by us showed that the hydrobiological conditions of the lake continued to be ideal for the growth and development of fish. Our results were however, vitiated by the stocking of 64 fingerlings of mirror carp (2½ to 6 inches) on 8th February 1950 by the local staff.

TABLE No. VII SHOWING FISH CATCHES MADE IN MAY 1950.

| Serial No. | Date      | Total length in inches. | Weight Lbs. Oz. | Sex - stage of gonad. |
|------------|-----------|-------------------------|-----------------|-----------------------|
| 1.         | 16-5-1950 | 14.5                    | 1.2             | ...                   |
| 2.         | do.       | 17.0                    | 2.1             | Miltar                |
| 3.         | do.       | 16.5                    | 1.12            | do.                   |
| 4.         | do.       | 24.0                    | 6.0             | Female—V stage        |
| 5.         | do.       | 18.0                    | 2.8             | Miltar                |
| 6.         | do.       | 18.5                    | 2.10            | do.                   |
| 7.         | do.       | 12.0                    | 0.9             | do.                   |
| 8.         | 17-5-1950 | 13.5                    | 1.6             | do.                   |
| 9.         | do.       | 10.0                    | 0.6             | do.                   |
| 10.        | do.       | 10.5                    | 0.7             | do.                   |
| 11.        | do.       | 10.0                    | 0.6             | do.                   |
| 12.        | do.       | 28.0                    | 8.0             | do.                   |
| 13.        | do.       | 18.0                    | 3.8             | do.                   |
| 14.        | do.       | 17.5                    | 2.8             | do.                   |
| 15.        | do.       | 8.7                     | 0.4             | do.                   |
| 16.        | do.       | 9.2                     | 0.4             | do.                   |
| 17.        | do.       | 8.1                     | 0.4             | do.                   |
| 18.        | do.       | 7.0                     | 0.3             | do.                   |
| 19.        | 18-5-1950 | 6.5                     | 0.3             | do.                   |
| 20.        | 19-5-1950 | 17.0                    | 2.1             | ...                   |
| 21.        | do.       | 18.0                    | 2.6             | Miltar                |
| 22.        | do.       | 14.2                    | 1.4             | do.                   |

## V. DISCUSSION OF RESULTS

Zobairi and Choodamani (1948 a and b) have described the life history of the scale carp, *Cyprinus carpio*, var *Communis* (Linn), which is one of the three varieties of the German carp, popularly known as Mirror carp, the three varieties differing among themselves only in the matter of their scaling. They found that all the three varieties bred well in the Nilgiris from October to May every year and that January to April was the peak season for breeding. The eggs are demersal and adherent settling on aquatic weeds.

The adult Mirror carp, they found, to be an omnivorous creature with a definite leaning towards vegetarianism. The fry measuring 5.5 cm. takes in Diatoms and Desmids besides being carnivorous. Its growth rate is 2.5 to 4.2 cm. per month.

The trial netting operations have shown that Mirror carps have grown very well and therefore, there is no doubt about the suitability of Yercaud lake for its culture. But the only point requiring further investigation and a satisfactory explanation is to find out whether conditions of existence essential for its successful natural reproduction are found in the lake or not. They are suitable spawning grounds, water level to cover it to sufficient depth to keep the eggs and fry from drying, warmth enough to hatch the eggs and to nurture the fry, and adequate food suitable for the different stages of development of the fish to adult life. These factors will now be examined.

The spawning ground for the Mirror carp is the shallow margin of the lake all round which contains sufficient water all the year round and also adequate weedage for deposition of eggs. The maximum depth of water between 1947 and 1950 was 12 to 13 feet uniformly. In other words there was no rapid decline in the water level which is often the case in many fish ponds in the plains. The shallow spawning areas of the lake were thus ideal for breeding as in Ootacamund lake.

Zobairi and Choodamani (*loc. cit.*) state that the fish bred in the Nilgiris from January to May and again from October to December. A comparative study of the mean atmospheric temperatures of Ootacamund and Yercaud shows that the latter is definitely warmer by about 9 to 12°F on account of its lower elevation. Can this be a hindrance to successful spawning? Two arguments may be advanced to show that temperature is not likely to be a hindrance. (1) In San Jose Estate in Yercaud which is located at a slightly lower elevation than the Yercaud lake, Mirror carp bred all right. It is a small rectangular pond measuring 320' × 70' × 6' located about 4 miles from Yercaud which was studied in January 1950. Trial netting from this pond brought out different sizes, groups ranging from 2" to 6". The physico-chemical conditions are given below:—

|                               |     |                         |
|-------------------------------|-----|-------------------------|
| Turbidity                     | ... | 21.0 cm.                |
| pH                            | ... | 7.4                     |
| Dissolved oxygen              | ... | 3.962 cc/l              |
| Free CO <sub>2</sub>          | ... | 0.128 parts per 100,000 |
| CO <sub>2</sub>               | ... | nil                     |
| HCO <sub>3</sub>              | ... | 1.450                   |
| P <sub>2</sub> O <sub>5</sub> | ... | nil                     |
| NO <sub>3</sub> N             | ... | —                       |
| SiO <sub>2</sub>              | ... | 0.36                    |

The bottom of the pond is rocky and contains a fine brownish sediment of Fe<sub>2</sub>O<sub>3</sub>. Submerged and emergent vegetation was sparse, except long trailing filaments of grass which were found growing from the bank on one side. The plankton in this pond was less rich in quantity than that in the Yercaud lake.

The rocky bottom, the absence of aquatic vegetation and shady trees along the margin, the shallow depth of 2" - 6" and the 4,500 feet elevation — all these factors may be expected to increase the temperature of the water to a level higher than that in the Yercaud lake. Yet, the fish had bred well in this pond.

Again, English carp and Tench which are stocked also in the Ootacamund lake breed there like the Mirror carp. At Yercaud lake also they have been found to breed. So, it cannot be stated that temperature could be a factor inimical to the breeding of Mirror carp alone in Yercaud lake.

#### VI. SUMMARY

1. The physical, chemical and biological conditions of the Yercaud lake were studied on three occasions representing three different seasons of the year in order to find out why the Mirror carp, an exotic cold-water fish which was stocked in it in 1944, had not bred successfully.

2. A thermal and chemical stratification was formed in the lake during the hot-weather. Nocturnal cooling did not cause a 'turnover'.

3. The hydrobiological conditions were found to be quite suitable for the culture and breeding of the mirror carp.

#### ACKNOWLEDGMENTS

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### FIFTH SAILING OF "MIKHAIL LOMONOSOV"

*The "Mikhail Lomonosov," a research ship of the U.S.S.R. Academy of Sciences, has returned to Kaliningrad from her fifth sailing. In an interview Alexander Ivanov, D.Sc. (Physics-Mathematics), chief of the expedition, told the following which we publish below.*

This has been the fifth sailing in the Atlantic for the "Mikhail Lomonosov," a new research ship of the U.S.S.R. Academy of Sciences. In three months she covered nearly 15,000 miles.

The task of our expedition was to study the latitude changes of different physical and oceanographical processes in the Atlantic. Proceeding with this work, the "Mikhail Lomonosov" came up to heavy ice-fields in the Arctic in the area between Iceland and Greenland, then descended to the latitude of Rio de Janeiro. Thus, our expedition investigated an oceanographical cross-section of some 5,000 miles on the meridian of 30° W. Longitude.

During this cross-section exploration our researchers conducted multi-purpose observations. They studied the circulation of ocean waters, the changes in the thermal and chemical state of the air, physical processes in the atmospheres' wind waves and ripples, the propagation of light in water, the relief of the ocean bottom and the deposits there, and the radioactive contamination of the ocean waters.

Besides, the expedition on board the "Mikhail Lomonosov" investigated the latitude cross-section from the Shetland Islands to the meridian of 30° W. Long.

In the course of this sailing 63 deep-water tests were made, including four 24-hour observations with the vessel riding on a deep-water anchor. Our expedition, as a result, collected valuable data on the nature of thermal and dynamic processes occurring in the area of work of the expedition, and the interaction of the masses of water, land and atmosphere.

Thermal and dynamic phenomena in the ocean and atmosphere depend first of all on thermal energy coming from the Sun. A group of thermal energy experts, headed by M. Kozlov, studied this problem. The material they collected offers an opportunity of defining the principal quantities characterising the problems of the thermal and dynamic regime in various areas of the Atlantic.

The group of experts engaged in sea agitation problems, headed by B. Orlov conducted visual and instrumental observations of storm phenomena, and checked up on the correctness of monogram calculations for wind wave forecasts.

The hydrological exploration we carried out makes it possible to establish the features of the vertical structure of Atlantic waters over nearly 88 degrees of latitude.

With the assistance of automatic reels and rotators we obtained data on the nature and speed of currents in the water depths of the Northern Hemisphere. Comparing them with information brought back by other expeditions, it was established that no noticeable changes in the hydrological

conditions in the open parts of the Atlantic from 40° North Lat. to 22° South Lat. were discovered. This conclusion was likewise confirmed by the hydrochemists.

Of considerable interest are the tests of radioactivity in the ocean. As is known, vast quantities of water are carried by currents from this basin to our northern seas. Somewhat increased radioactivity has been detected in some parts of the ocean. For instance, contamination of this kind was discovered at the equator on the surface and at a depth of 200 metres.

The biologists of our expedition collected material in different zones of the ocean characterising the presence of tiniest living organisms, on which, notably, depend the quantity of fish. The greatest masses of plankton were spotted where the cold and warm waters mix and also off the Azores.

Considerable data on the structure of the ocean bottom has also been collected. Continuous depth sounding was promoted over a distance of 12,000 miles. This work made it possible to ascertain new details about the sea-bottom relief. Notably, it led to the discovery of several submarine volcanic mountains, rising 1,000 and more metres from the sea-bottom. Deep underwater valleys were also discovered.

The investigation conducted in the fifth voyage of the "Mikhail Lomonosov" represents the first systematic multi-purpose oceanographical survey along the longitudinal axis of the Atlantic Ocean. Soviet scientists have collected a great deal of valuable data on the physical, hydrological, aerometeorological, geological and biological conditions in an extensive area of the Atlantic. They have also established the changes in these conditions in different physical geographical zones.

During this voyage the "Mikhail Lomonosov" called at Rio de Janeiro, Dakar and Liverpool. The Soviet specialists in this expedition worked hand in hand with scientists of the German Democratic Republic and Poland.

The expedition participants collected material of tremendous scientific value and characterising a vast section of the Atlantic Ocean.

## THE SINO-INDIAN DISPUTE — A GEOGRAPHICAL ANALYSIS\*

By

S. D. MISRA.

"Geography has ordained that the great sub-continent surrounding the central mountain core look not towards but away from each other"

E. S. KIRBY, *The Disunity of Asia*.

The first-half of the 19th century witnessed the rise of colonialism while that of the 20th sounded its death-knell. The 'People of Straw' and the followers of 'the Naked Fakir' formed Nations and framed the Charters of Democracy; the 'Cannon Fodder' built cannons. Upsurge of Nations and 'Asia for Asians' shook the East and the West—the little powers assumed big powers and the children of to-day are witnessing, what is perhaps, the greatest drama in human history—the United States of Africa.

But the blessing was not unmixed—the question arose of the 'Afro-Asian Leadership'. Egypt seems to be out to absorb the Arab world besides the petty states in Africa north and south of Sahara; while on the Mainland of Asia, the dice is between the two—India and China. In a wider setting the conflict is not merely between these two giants (mighty in their own ways) but between Communism and Democracy, between East and West (guardedly!). It is certain that the bonds between Russia and China are indissoluble while nothing is certain (despite the guarded speculations in certain quarters) about the Indian 'Neutrality' (seemingly qualified though at times). Should an armed conflict arise between these two Nations, the misfortune would be that the Theatre this time would be the East, consuming best men on both sides at a period when either can ill-afford, in view of the internal building up—so vital for both the houses. Perhaps, the horizons are not so dark, yet the possibilities are not completely ruled out.

For the students of Geography, the Tibetan question has more than local significance (in time or place). For us it involves a revaluation of the *Heartland Concept*. The whole affair appears to be a part of the larger scene incorporating a larger landmass (than India and China occupy)—the whole of the 'World Island'.

'Who rules Eastern Europe, commands the Heartland'—is much too obvious from Fig. 1, for almost all of what Mackinder called the 'Pivot Area' is under the direct control of the U.S.S.R. 'Who rules the Heartland,

\* Thankful acknowledgements are due to Dr. C. G. Smith of Oxford University, (now Visiting Professor of Geography at the Osmania University, Hyderabad) for permitting me the use of Figs. 1, 2 and 3; for a general discussion the writer is thankful to Dr. George Kuriyan of Madras University (now Visiting Professor of Geography at the Indiana University, U. S. A.)

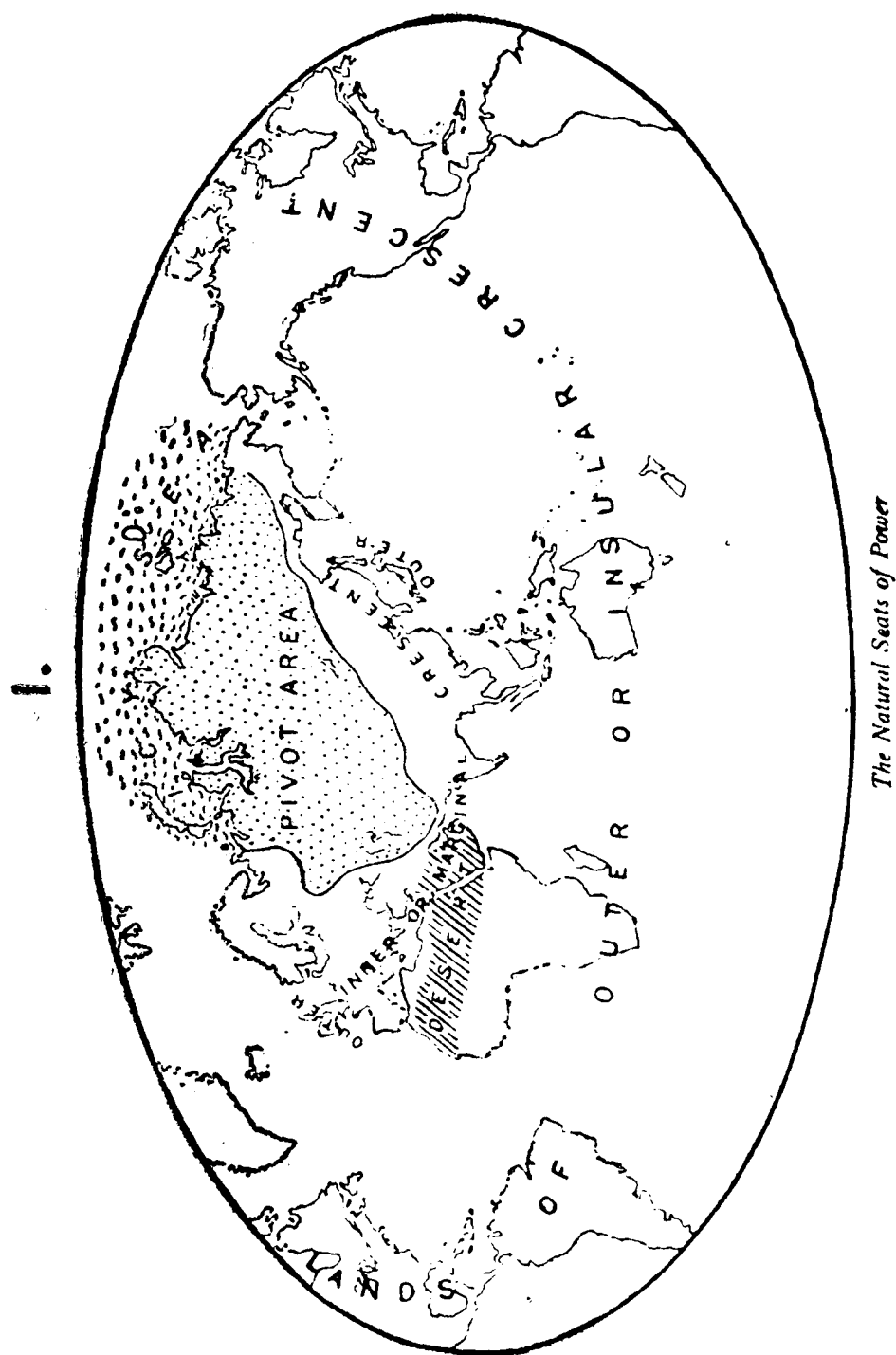
1, 2 and 3— all adjectives given to Asians by the West; though 2 was meant specifically for Mahatma Gandhi.

4. Payne, R. — *The Revolt of Asia*, London, 1948.

5. Datta, S. K. — *Asiatic Asia*, London, 1932.

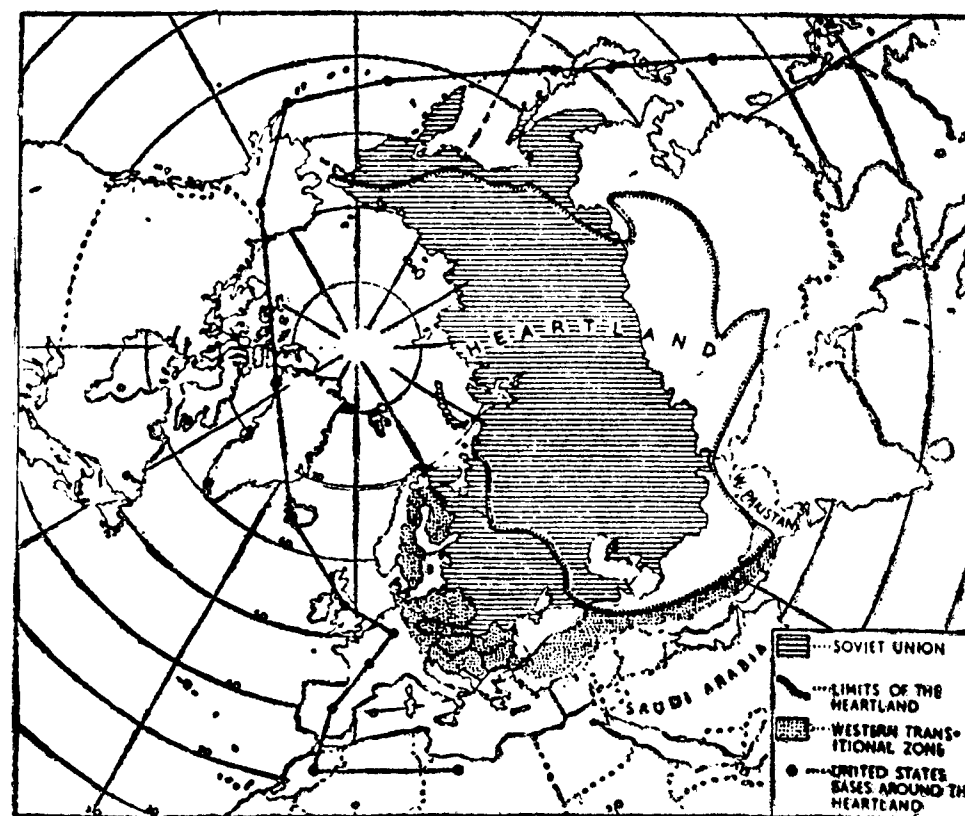
6. "There can be no doubt at the present time that China's bonds with the U.S.S.R. unlike India's with the West, are made of hoops of steel which cannot now be broken" *The Eastern Economist*, 1957-58, p. 26.

7. The oft-quoted and too well known triplet of Mackinder is deliberately avoided here.



commands the World Island' seems to be the present crisis at the root of all the global cold war. The U.S.S.R. (with its ally China) 'rules' the Heartland. Thus the conflict appears to be between the 'Land Power' and the 'Sea Power' or the 'Heartland' of Mackinder, against the 'Rimland' of Spykman, whence the U.S. bases (Fig. 2). All around the Heartland (specially on the southern margins) the U.S.S.R. as though wants to break through, whence a N.A.T.O., a S.E.A.T.O., or a M.E.D.O. The need, on the Russian side, appears to be partly a quest of warm waters, partly oil, partly a search for *Lebensraum*, as the *Oecumene* is strictly limited in the Heartland (see the 'steppe and the sown' in Fig. 3), but perhaps mostly the desire is the territorial aggrandisement.

2.



Vulnerability or invulnerability of the Heartland are the matters outside our theme<sup>10</sup>, suffice it to say that the Tibetan question is an outcome

8. For a purely Geopolitical account see Percy, G.E. and Fifield, R. H.—*World Political Geography*, New York, 1952, Ch. III.
9. For details see *Stalin's Post-war 5 year Plan* (Moscow, 1945), in which 'Expansion of Communism' is one the major objectives.
10. For these details see East, W. G.—*The Changing World*, London, 1956, pp. 434-448 and also Rawson, R.R. in *The Changing Map of Asia*, London, 1950 pp. 375-879.

3.



of this strategy—a part of the greater global struggle and is not merely a localised issue.

As such, the pleas<sup>11</sup> that China is much larger than India and minor border additions or subtractions are matters of no significance to China, that China is not interested in a geographically inhospitable environment<sup>12</sup> and that it has plenty to do to set her house in order rather than aim at territorial extensions and invite trouble—all these fall to pieces for “the real cultural and economic boundary lies at the foot of the mountain mass and not on its crest; since British maps often neglected to show the latter boundary, it is not surprising that Chinese maps habitually displayed the former”.<sup>13</sup> Thus considered even locally, in the present context, China aims

11. All these are contained in Chou's letters to Nehru, published in the Indian dailies.  
12. Rawson, *Ibid.*  
13. Spate, O.H.K. in *The Changing World*, *Ibid.*, p. 510.

at swallowing these border areas (crossing the McMahon line) which would mean a definite loss to India and not much of gain to China; for the Tibetan wool is used as far as Amritsar and Dhariwal and is the major source of the ‘family-industry’ of wool-spinning and weaving all over Kashmir, Himachal Pradesh, Kumaon and Assam<sup>14</sup>.

Much is also made of the ‘tradition’ or ‘the cultural bonds’ or ‘much in common between India and China’.<sup>15</sup> From Ashoka to Gandhi, “the persistent culture of India is a Hindu, tolerant and religious culture; the culture of China is set in a seemingly ethical, but non-religious mould in which Caesarism and fierce regimentation have found congenial soil in which to throw their dangerous roots”.<sup>16</sup> Further depicting the ‘Blood and Iron’ tradition of China from Shih Huang-Ti to Mao, the French Scholar Rene Grousset has put in words in *The Rise and Splendour of the Chinese Empire*:—

“Only the annals of the kings of Assyria, the Sennacheribs and...can display such a wealth of atrocities. In 331 A.D. Ch'in...decapitated 80,000 men; in 318 A.D. they cut off 82,000 heads; in 312 A.D. they beat Ch'u and 80,000 heads fell. In 307 A.D. they contended themselves with a score of 60,000 heads, but in 293 A.D. King Chao Hsiang won for himself a trophy of 240,000 heads. In...275 A.D. 40,000 heads fell...and further 150,000. In 960 A.D. more than 400,000 were decapitated.....”<sup>17</sup>

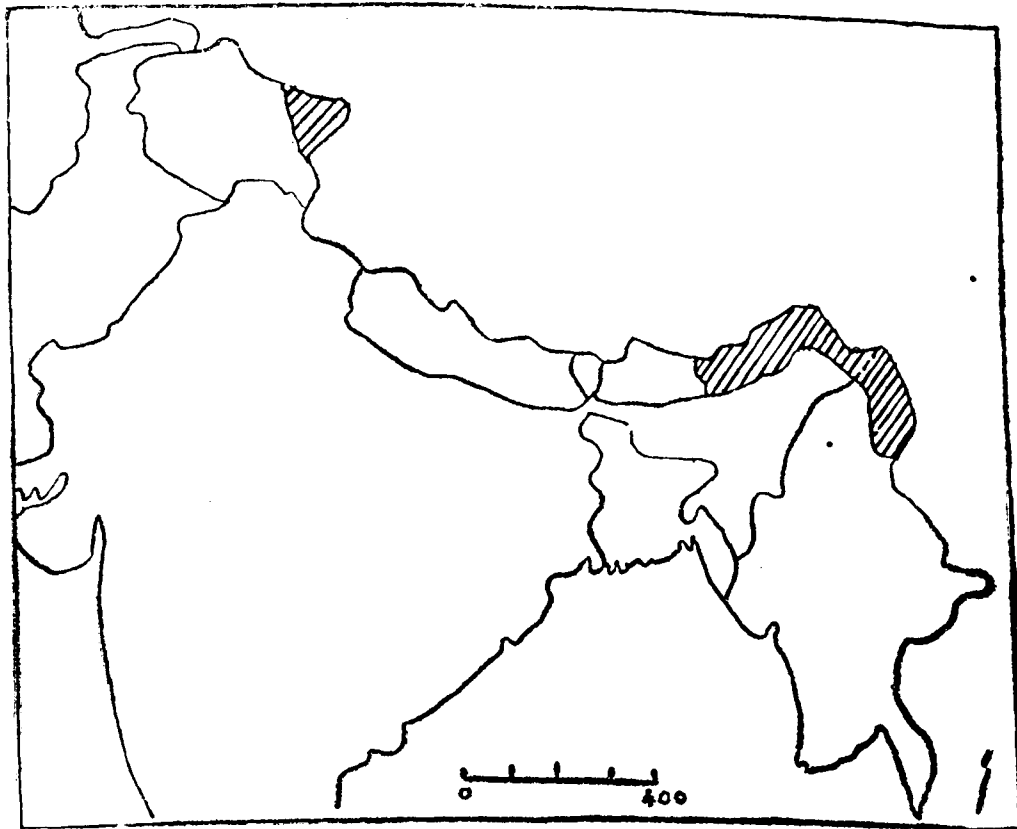
So much for ‘much in common’ or ‘Asian Brotherhood’.<sup>18</sup> Let us now look inside these countries. Despite the hectic propaganda on ‘Family Planning’ the population in India shows (apparently) no significant signs of decrease (or even a tendency to be static). If, as it is likely, the 1961 census shows a retarded birth rate there should be no reason to be unduly optimistic, for it has to be viewed in relation to the (likely) retarded death rate and also the longevity in age (small though but significant it is). At the same time the ‘Peace Missions’ from Korea and elsewhere have returned (or are returning), the inflow of refugees from East Pakistan has not stopped completely and the immigration of Indians (once emigrated) from abroad—Ceylon, East and South Africa, Madagascar, Zanzibar, Burma, Malaya, and elsewhere—has started ‘unofficially’. On the top of all this we have Dalai Lama (State Guest) with his small battalion of 5000 (or more) followers—all for ‘Traditional Affinities’!

Inside China, the restriction on the size of families has been lifted<sup>19</sup>, with such policies lead and how far these have been in the interest of global peace (?) is very clear from the example of Nazi Germany.

Finally (if there is any finality in such matters) whether the ‘Border Dispute’ is the Chinese *Expansionism* or the Indian *Imperialism*, the fact remains that this is an issue of a significance more than local—involving the matters of global strategy, the conflict of ideologies and concerning millions of peoples on the largest of the continents. It would be dangerous to make

14. Other imports across the passes are borax, salt, furs, hides and skins. For more details see the relevant volumes of Imperial and District gazetteers.  
15. Viz. Nehru's letters to Chou, besides his public speeches; all published in Indian dailies.  
16. *The Eastern Economist*, op. cit., p. 21.  
17. *Ibid.*, p. 23.  
18. or rather proverbial—*Hindi-Chini Bhai Bhai*; also in point is Karam Singh's story as ‘Prisoner of war in Ladakh’ published by the *TIME* Magazine, New York, Dec. 1959.  
19. Chandrashekar, S. *China's Population*, Hongkong, 1959, p. 64.

any forecasts in such matters for, the politicians are still crossing swords—apparently to come to nothing substantial and of durable standing. Temptation for both the sides is strong: for China the border areas are more of a territorial gain than economic; for India the loss is twofold—besides economic, these areas directly under the control of China to-day (Fig. 4) are



Source: *LIFE International*, Oct. 1959, p. 12.

Fig. 4. Disputed Areas have been shaded.

as large as the State of Kerala. Surely for the hug of the Red Bear, India could hardly afford to make a gift of the Himalayas—for in Assam is *India's Lebensraum*<sup>20</sup>. Also it is doubtful if the strictly monastrial Buddhists of the Ladakh (notwithstanding the alleged celibacy of priesthood)<sup>21</sup> and the diluted of China could be congenial bed-fellows!!

“Asia.....  
who cost her mother Tellus keener pangs,  
though feminine, than any of her sons:  
More thought than woe was in her dusky face,  
For she was prophesying of her glory;  
And in her wide imagination stood  
Palm—shaded temples, and rival fanes,  
By Oxus or in Ganges' sacred isles”<sup>22</sup>

KEATS *Hyperion*.

20. Spate O.H.K. *India and Pakistan*, London 1957, p. 564.

21. Rawson, R.R. *The Changing Map of Asia*, op. cit.

22. Spate, *Ibid*, p. 385.

## APPEAL

I am making this personal appeal as President of the Indian Geographical Society to all my friends, old students and others who are working in the field of Geography. As you probably know the Indian Geographical Society was founded in 1926 and during the last 34 years we have been publishing the *Indian Geographical Journal*, the Organ of this Society, continuously without any break in spite of severe financial strain. It is also worthwhile, to bring to your notice that this Society has never increased the rate of subscription, which from its inception has constantly remained static at Rs. 8/- per year. On account of the enormous increase in the cost of paper, printing and postage, especially during the last ten years, which is now almost three to four times what it was twenty years ago, I have been forced to feed on my accumulated resources and to-day I find myself in the position of the captain of a ship lost in the sea of bankruptcy. It would be impossible to keep the Journal going at the present rate of subscription. Suggestions have been put forward that I should try and introduce new features like advertisements, etc. Personally, I am not in favour of converting the Journal into an advertising medium, just because of want of money. I hope you will appreciate my point of view and realise that the Journal of an academic nature, devoted to the promotion of scholarship, should, as far as possible, confine itself to activities of science without giving undue importance for commercial advertisements.

During the last five years we have been making attempts for financial assistance from the University and the National Institute of Sciences of India for increased grants, but not with much avail.

If there is a substantial increase in the number of subscribers then, I feel fairly confident that it would be possible to continue to publish the Journal, maintaining its characteristics as a scientific journal, at the same annual rate of subscription. I am, therefore, making this appeal and would request you to enrol yourself as a Life Member of the Society by paying Rs. 100/-; and if you enrol now as a Life Member, the available stock of back volumes of the Journal will be sent to you free of cost, provided your request reaches me before the sets get exhausted.

I shall also request you to influence the Geographers in your area to become Ordinary Members. The Annual Subscription for ordinary membership is Rs. 8/- in addition to which there is an entrance fee of Rs. 2/-.

Looking forward to receiving your application for Life Membership and a large number of applications from the Geographers of your area for Ordinary Membership.

Yours sincerely,

GEORGE KURIYAN,

President.

University Examination Hall,  
Madras-5, India.  
31st December 1959.

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2. The objects of the Society shall be :—
- To promote and diffuse geographical knowledge ;
  - To secure for Geography its proper place in schools, colleges, and universities ;
  - To help to improve the methods of teaching Geography ; and
  - To help geographical studies on India.
3. These objects shall be secured by :—
- Holding meetings and conferences ;
  - Issuing a Journal and other occasional bulletins ;
  - Organizing geographical exhibitions and excursions ;
  - Helping in the preparation of Geography books in the languages current in India ;
  - Forming a central reference library of geographical literature, and collecting maps, charts, plans, models, slides and instruments ;
  - Encouraging the formation of local branches for the promotion of local studies and activities and for the furtherance of the objects of the Society ;
  - And adopting such other ways and means as are deemed necessary to further the objects of the Society.

### *Membership*

4. The membership of the Society shall be open to all those who are interested in the promotion and diffusion of geographical knowledge.
5. There shall be two classes of members, Full and Associate.
6. Full members may be Honorary, Life or Ordinary.
7. Honorary members are those who shall be so elected by the Council by two thirds of its total strength. They shall be exempted from liability to pay any subscription.
8. Those who pay an amount of Rs. 100/- in one instalment, or Rs. 120/- within a period of 24 months may be elected Life Members by a majority vote of the Council. They shall be exempted from payment of any further subscriptions.

9. An applicant for membership shall become an Ordinary or an Associate member if proposed by a full member, seconded by another full member, and approved by the majority of the Executive Committee.

10. An Ordinary Member shall pay an entrance fee of Rs. 2/- along with his application for membership and an annual subscription of Rs. 8/- payable in not more than four equal quarterly instalments at the option of the member.

11. Full members (Vide Rule 6) shall be entitled to all the privileges of the Society, including the rights to vote, to hold office, and to receive the Journal free of cost.

12. Associate members shall be exempt from any entrance fee. They shall pay an annual subscription of Rs. 2/- payable in two equal half-yearly instalments at the option of the member.

13. Associate members shall be entitled :—

- to attend all lectures, meetings, conferences, exhibitions and excursions ;
- to use the reference library ; and
- to receive the extract from the Journal, "*Geographical News and Notes*." They are not entitled to vote or hold office.

14. The official year of the Society shall be from 1st January to 31st December.

15. All subscriptions fall due on the 1st January of each year and are payable within the first quarter of the year. Instalment payments shall be made before the end of the quarter or half-year, as the case may be.

16. Members in arrears of subscription shall not be entitled to the privileges of membership in the following year. If the arrears are not paid by the end of that year, their names shall be removed from the list.

17. The Annual Meeting of the Society shall be held not later than the end of March. The results of the Election for the year will be announced and the Annual Report presented at this meeting.

### *Management*

18. For the conduct and management of the affairs of the Society there shall be

- Office-bearers ;
- an Executive Committee ; and
- a Council.

19. The following shall be the office-bearers :—

- a President,
- not more than Five Vice-Presidents,
- a Secretary,
- an Assistant Secretary, and
- a Treasurer—all elected by the General Body by correspondence before the Annual Meeting ; and

The Executive Committee consists of the President, the Vice-Presidents, the Secretary, the Asst. Secretary, the Treasurer and the Editor.

## FINANCE

The financial statement for the year ending 31st December 1959 is set forth in the Auditor's Report. Receipts for the year under various heads amount to Rs. 2041.41/- while expenses have been Rs. 2142.60/. Including the last year's opening balance of Rs. 176.95/- a sum of Rs. 48.76/- is now in the Bank.

The Society is particularly grateful to the authorities of the University of Madras for making an Annual Grant of Rs. 150/. Furthermore, the Vice-Chancellor has been pleased to allow the effects of the Society to be accommodated in one of the rooms of the Department of Geography at the University Examination Hall; this has given the Society a permanent habitation and the Society takes this opportunity to place on record its deep sense of gratitude to the Vice-Chancellor. The Society also expresses its gratitude to the National Institute of Sciences of India for having donated a sum of Rs. 500/- towards the publication expenses.

## ACTIVITIES

The Society has now completed 34 years of existence and is still finding it very difficult *for financial reasons* to publish the four numbers of the Journal.

Under the auspices of the society Dr. C. G. Smith, Lecturer in Geography, University of Oxford, gave two lectures on (i) *Geo-politics* and (ii) *Israel*, at the University Examination Hall on the 16th and 17th November 1959.

The recognition of the value of the Society's earlier contributions in the development and diffusion of Geographic thought is really an inspiration and strength for further work. The Society pledges to work for the advancement of the subject as it did during all these years and looks forward with full optimism despite its poverty to another year of useful work.

University Examination Hall,  
Madras-5.  
31-12-59.

GEORGE KURIYAN,  
*President.*



தமிழ்நாடு ஆவணக்காப்பக நூலகம்,  
எழும்புரம், சென்னை-600 008.

துவணைத்தாள்.

**சே எண் :** -                      **பி, எண் :**

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