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Journal of The Madras
Geographical Association

Vol. 14

No. 3



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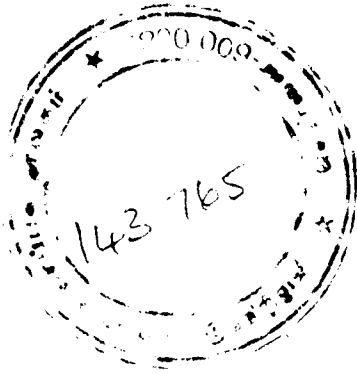
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Vol. XIV

July—September, 1939



The Journal of The Madras Geographical Association

PUBLISHED QUARTERLY.

EDITOR

N. Subrahmanyam, M.A., L.T., F.R.G.S.



THE MADRAS GEOGRAPHICAL ASSOCIATION,

Gopalapuram,

Cathedral P.O.,

Madras.

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question of uniformity in the division and classification of physiographic regions of India, is quite opportune. Before it is too late, I wish to point out to all collaborators in the field of Indian geographical research that a method can be evolved, whereby our work could be co-ordinated, all such regions systematically divided and subdivided and the divisions made acceptable to all.

The method adopted by me for my study of the *Indus Basin* is, with slight modifications, that of the Association of American Geographers³ (*Vide. Ann. Asso. Amer. Geog. Vol. XVIII, No. 4, Dec. 1928*) in the case of physiographic divisions of the United States of America. This method is really scientific and closely dependent upon geological investigations; for, while geologists consider "landforms to be a kind of final product or end or effect of geological agencies and physical processes, geographers must needs take them to be a beginning, a point of departure or cause of what nature has in store for man, as its best product". In fact, everything in nature, vegetable and animal life especially, depends upon the landforms and other physiographical conditions existing in a region. In making a division or subdivision, *homogeneity* is sought, as upon it the value of such a division largely depends. Thereby the physiography, geography and topography of a particular region are together taken into consideration.

Need of Physiographic Divisions of India.

A question may be asked: Where is the need of such physiographic divisions of a country like India? The answer is that there must be some natural physical background for workers in other departments, such as agriculture, economics, industry, sociology, anthropology, etc.

In studying problems of fixing provincial boundaries, of population, of anthropology, of natural resources and water supply, of roads and railways, etc., and in preparing statistics, industrial and others, there is a need of showing the influence of certain homogeneous physical environment on human life and of producing such homogeneous units as a background for all kinds of surveys. Before any large schemes, for example of irrigation, trunk roads or railways are prepared, a regional survey of the areas is now absolutely necessary. To give a definite example, if the soil survey

of Sind had been made before the Sukkur Barrage Project was taken in hand, the mistake, committed in cutting through a large number of sandbelts of canals, would have been avoided and the consequent problems of seepage and water-logging would not have resulted. Thus any province with its chief physiographic characteristics must afford a setting for the smaller field. Natural resources, such as minerals, salts, etc., must be considered at first, as they are also products of the past geological history of a region, formed under certain physical climatic and other conditions. Agriculture, irrigation, cattle grazing, etc., are all dependent upon these physical factors.

"For geographers", says C. Gillman,⁴ "it is probably a foregone conclusion that no human activity, least of all, that of the civil engineer, can divorce itself with impunity from geographical facts and geographical thought. To the multitudes, who work at their daily routine in field and office, however, this idea is not so obvious and they constantly overlook the fact that without geographical insight, they are liable to heap blunder upon blunder in perfect professional innocence".

Now, a geographical survey of any region must necessarily take full account of its physiography, and therefore the divisions, made of India on a basis other than physiographic, must be highly defective and narrow in outlook.

There is a movement ahead of fixing the provincial boundaries of India on a linguistic basis. If geographers can also help politicians to solve such problems, they will render valuable services.

Thus systematic physiographic divisions of India, irrespective of political boundaries, are absolutely necessary, especially in our country and in these days, when many All-India schemes are put forth.

Basis of Division.

In making a division of any region, the most prominent elements of physiography are to be considered:—

(1) *Structure*:—The result of geological agencies including the nature of rocks and their initial stage, before erosive agents act on them.

3. *Vide Fennemen, N. M., "Physiography of Western United States of America", New York, 1938, and "Physiography of Eastern United States of America", New York, 1938.*

4. Gillman, C., "Geography and the Civil Engineer," *Scot. Geog. Jour.*, Vol. 53, July 1937, p. 242.

(2) *Process*:—The destructive agencies, including climate, to produce its effect on the original structure, the erosion actually depending upon the structure and the forces at work.

(3) *Stage*:—The cycle of changes taking place during the process of erosion on the original structure, e.g., folded rocks have the folding persistent in the landscape of a region.

Thus the most outstanding characteristics of an area to be considered for our purposes are those which even a careless traveller might find in it, as its topography, influenced by its climatic peculiarities.

Prof. Ogilvie has very emphatically pointed out the defect of a lack of any systematic description of Indian land-forms by the Geographical Survey.⁵ This defect has to be remedied by us, geographers, who belong to the Section of Geography, Indian Science Congress.

For, this new science of land-forms, I refer our Members to the newly started Journal of Geomorphology (Publication by the Columbia University Press). I wish Indian geographers give their share and contribution to this excellent research, to enable us to produce a most accurate division of our land.

Difficulties of making Physiographic Divisions.

There are some inherent difficulties in making physiographic divisions of India:—

(1) *Co-ordination And Want of Organisation*:—In our country, we have nothing like an All-India Geographical Association to co-ordinate the work of various geographers. Even the Indian Universities do not seek any kind of co-operation in the matter. In fact, the geographical science is just in its infancy in our country. There are only a few centres, where geography is properly studied. By some Universities it is not even recognised as a branch of Science. It is only to the newly started Section of Geography, under the auspices of the Indian Science Congress, that we can look forward for a solution of this difficulty. I, therefore, suggest that until the formation of an All-India Geographical Association, all problems and difficulties in connection with geographical research should be referred to this body. The first thing to settle is this problem of the Division of India.

5. Ogilvie, A. G., *Op. Cit.*, p. 113.

(2) *Political and International Boundaries*:—Commenting upon my work on Sind, A. G. in a leading geographical magazine,⁶ remarked: "It is a pity that a geographer free to go beyond administrative boundaries should allow himself to be hemmed in by these. The area described is not strictly the Lower Indus Basin but that part of it included in the province. Similarly the limits of the author's 'Physiographic regions' sacrifice the 'homogeneity' he claims for them by sometimes following administrative boundaries. An official may not be authorised to make estimates outside his departmental area, but to do so is the non-official research worker's opportunity."

It is a great pity that in our country the help needed by a research worker in a particular region is not soon and willingly forthcoming and he is greatly handicapped for want of data beyond a certain political limit. Cordial co-operation between various provincial government departments is sadly lacking. There is red-tapism, considerable delay and downright discouragement given by a certain class of officials in this country.

It is also impossible to obtain any reliable data from the neighbouring parts of Sind, such as the Kalat, Las Bela and Rajputana States.

Besides, most of the Indian Government and Native States reports, including the Census Reports, are by provincial districts. A pioneer, particularly in the field of regional geography in India, is, therefore, hemmed in by political and international boundaries, in this matter of collecting the necessary information. I had, therefore, no other alternative but to take Sind equivalent to the Lower Indus Basin.

(3) *Physiographic Boundaries To Define*:—Another real difficulty is that of defining exactly the boundaries of physiographic divisions of India, there being very imperfect geological surveys in certain parts, and literature being hard to secure and some of the Memoirs and Records being out of print or out of date. If, therefore, we cannot actually draw such boundaries on the ground for the present, we shall have to be satisfied even with some theoretical boundaries for the present. It is only with the help of local collaborators that this difficulty can be surmounted to some extent.

(4) *Naming of Divisions*:—Apart from defining the boundaries, the task of giving appropriate names to the different divisions

6. *Jour. Scot. Geog. Mag.* Vol. 54, No. 4, July 1938, p. 244.

will not be easy. As in the case of the American researchers, it is possible for our purpose to take the most prominent representative characteristic of a division, a prominent place name or an important river or town in a particular division or sub-division, e.g., Southern Plateau Land, which includes river valleys of South India as well.

Physiographic Divisions to Supersede "Natural" Regions

Hitherto India has been roughly divided into so-called natural regions by a few British geographers without any regard to geomorphology and other local conditions. There has been nothing definite about their mode of division and there is no uniformity. Rather, there is much confusion and overlapping of boundaries. It is suggested that once an *authorised physiographic division of India* is made, such natural regions, as are haphazardly made, should be discarded by all Indian geographers, and *uniformity* both in the manner of division and nomenclature should be sought.

The following Natural Regions of India (see Sketch Map of India showing the same) are referred to as such an example of divisions, hitherto made:—

The "Natural" Regions of India.

J. N. L. BAKER AND OTHERS

1. West Coast
 - (a) North
 - (b) South
2. Deccan Region
 - (a) Bombay Deccan
 - (b) Deccan Southern
3. Higher Plains of Berar and Nagpur.
4. Central Highlands
 - (a) West.
 - (b) East.
5. Chattisgarh Plain.

DUDLEY STAMP.

14. West Coast.
 - (a) North.
 - (b) South.
21. Deccan Lavas Region.
21. Deccan Region Proper.

(Western part included in the Deccan Lavas Region. Eastern part in Godaveri Valley).

Included in the Deccan Lavas.
22. (a) Central Indian Highland.
- (b) Chota Nagpur Plateau.
22. (b) Chattisgarh Plain.

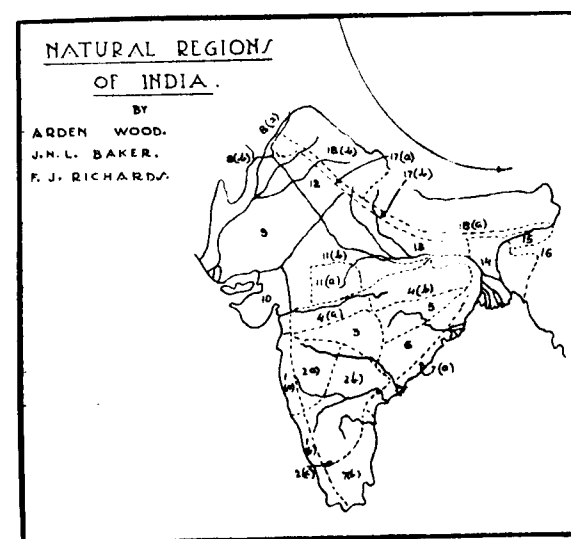
J. N. L. BAKER AND OTHERS

6. Berar-Orissa Highlands.
7. East Coast
 - (a) North
 - (b) South
8. N. W. Frontier Region
9. The N. W. Dry Area
10. Kathiawar and Gujrat.

(Transition between dry regions of Sind and wet ones of the W. Coast).
11. Aravalli-Vindhya Uplands.
12. Indo-Gangetic Plain West.
13. Indo-Gangetic Plain East.
14. The Delta Lowlands.
15. The Assam Valley.

DUDLEY STAMP

22. (c) Eastern Ghats Region.
16. Northern Circars Region.
15. Tamil Region.
5. N. W. Dry Hills Region.
7. Lower Indus Valley of Sind.
17. Thar Desert.
8. Punjab Plains (part)
13. Kathiawar and Gujrat.
18. The Rajputana Uplands.
8. Punjab Plains (part).
9. Upper Ganges Valley.
11. Lower Ganges Valley or Deltas Region.
12. The Brahmaputra or Assam Valley.



J. N. L. BAKER AND OTHERS

16. N. E. Hill Tracts.
17. The Sub-Himalayan Region.

18. The Himalayan Region.
(a) Eastern.
(b) Western

(Not included here)

DUDLEY STAMP

1. The Eastern Hill Region.
3. The Sub-Himalayan Region.

- (a) Eastern.
(b) Western.

2. The Himalayan Region.

- (a) Eastern.
(b) Western.

- } 4. Tibetan Plateau.
} 6. Baluchistan Plateau.

There is considerable overlapping of boundaries and uncertainty of homogeneity in the above,⁷ though, on the whole, the divisions made by Dr. Dudley Stamp are more rational and welcome, as they are pioneer attempts.

Last year, Dr. S. P. Chatterjee of Calcutta prepared another sensible paper for our Congress, on the "Natural Regions of India," but based his classification not on physiography and geomorphology, but on forest flora, surface relief and climate. The soil, derived from parent rocks, is also a most important physical factor of such a classification and cannot be easily ignored. So, without any co-ordination in this matter, there will be a great loss.

Method of Division of India Proposed By Me.

The method, proposed by me, of dividing the land into regions, is mainly physiographic, as the physical basis is the chief criterion as stated above; that is to say, the *principal* divisions are made according to the geology and topography (rocks, drainage etc.) as controlled by the internal and external agencies working on them. Minor physical features are subordinated to the main features.

The findings of allied sciences, such as botany, zoology, meteorology etc., are next to be considered, while making Sections and Sub-Sections of the major Divisions. Local differentiations, such as belts of forests, grasslands, barren lands, rainshadow areas, marshes, etc., are to be ignored while dividing the country into the *principal* physiographic regions, which should be homogeneous masses of lands within which life, both animal and vegetable, must exist more or less uniformly.

Proposed Physiographic Divisions of India.

I now give below my own scheme of producing physiographic divisions of India for their acceptance or criticism by the Congress. (see *Map of India, showing Divisions*). India is most naturally rendered into 3 chief *Divisions*, viz.

- (1) Extra-Peninsular Mountains.
- (2) The Indo-Gangetic Plain.
- (3) The Peninsular Area.

These are, then, divided into *Provinces* (marked I, II, III, etc.) according to the chief physiographic characteristics of each, especially the erosional histories of the region. These *Provinces* are again subjected to 40 smaller divisions, called *Sections* (and marked A.B.C. etc.) according to the stage to which a particular land-form is reached, and other *chief* natural characteristics noticeable.

It is also possible to make sub-divisions of these *Sections* and entitle them Sub-Sections, on the same principles, e.g., laterite caps of the Deccan Trap Region, forest belts on the Western and Eastern Ghats, the Tambraparni Valley of the Tamil Section etc. But for want of time, I have omitted them.

(1) EXTRA-PENINSULAR MOUNTAINS

I. WESTERN HIGHLANDS

A. *Khirthar Mountains*.—Dry and folded ranges of mountains nearly 6,000 ft. Little rain and no soil. Considerable subaerial denudation, forming small plateaus. Mostly Tertiary rocks with poor drainage, and merging into the Iran Plateau.

B. *Kohistan Section*.—Lower ranges with slightly more rainfall. Subaerial denudation is greater, with resulting long anticlinal valleys in which a little soil is cultivable. Many hot springs of Sind.

II. GREATER HIMALAYAS.

A. *Northern Himalayan Section*.—Snow-covered mountains with highest peaks. Leeward side merging into the Tibetan plateau. Alpine flora in some parts. Older rocks are exposed due to the action of ice, etc.

B. *Southern Himalayan Section*.—Wetter parts, receiving the force of the Indian monsoon. Sources of most of the North-Indian rivers. Temperate forests in parts. Newer and highly contorted rocks outcrop in places.

7. "Geography," Vol. XIV, 1927-28, pp. 44 ff.

III. MIDDLE HIMALAYAS.

A. *North-West Dry lands*.—Hot and dry region; very hot summers and very cold winters.

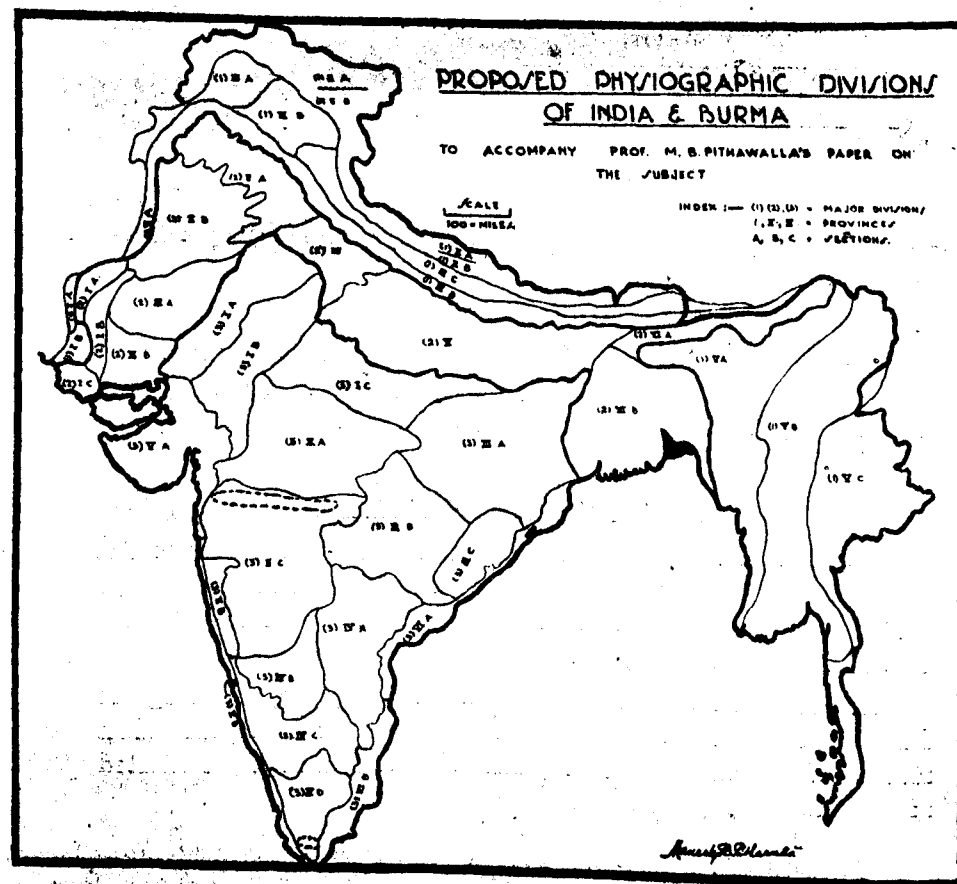
B. *Kashmir Valley*.—Lying between ranges of mountains, 15,000 to 20,000 ft. A most beautiful Dun or Valley, strewn over with lakes and cut by the Jhelum. Mountain passes. Forests on the northern side of mountains. Rainfall average 25". Snow melt in summer below 16,000 ft.

C. *Himalayas Proper*.—Snow-line 16,000 ft. Complex geology with thrust faults etc. Crystalline Complex.

IV. SUB-HIMALAYAN REGION.

A. *Frontier Section*.—Largely occupied by the Nepal and Bhutan States. Newer and unstable rocks.

B. *Siwaliks Section*.—Hot and dry with 20" of rainfall. Ht. below 10,000. Sub-tropical forest, evergreen and coniferous. Hill stations of Northern India. Foothills of the Himalayas, formed of detritus brought down by the rivers (Siwaliks).



V. EASTERN HIGHLANDS.

A. *Assam-Burmese Yomas*.—Heaviest rainfall in India. Tropical forest land, covering Tertiary rocks.

B. *Irrawadi Basin*.—Broad and deep valleys. Rice land 80" rainfall. Oil wells in Tertiary folded rocks.

C. *Shan Plateau*.—Tableland with moderate monsoon current. Forests grow.

(2) INDO-GANGETIC PLAIN

I. LOWER INDUS VALLEY.

A. *Western Valley Section*.—Old alluvium. Seasonal hill torrents and springs. Rich drift soil. Floods common. Little rainfall.

B. *Eastern Valley Section*.—New alluvium. Old river channels and shifting banks. No springs, Irrigated and cultivated lands. Variable rainfall.

C. *Indus Deltaic Area*.—Uncultivable, swampy and sandy in parts. Changing mouths of the river. Rice cultivation only. Hydrographical changes.

II. UPPER INDUS VALLEY.

A. *Potwar Section*.—Higher ground upto 1,000 feet and little rainfall. The Salt Range the most prominent feature, a field museum of Indian geology. The Soan valley a relic of the Indobrahm.

B. *Punjab Plain*.—Cut through by the Punjab rivers. Good and deep drift alluvial soil. Wheat lands of India. Rainfall upto 25", including winter showers. Many hydrographical changes.

III. DESERT PROVINCE.

A. *The Pat Section*.—Covered with clay or silt and with longitudinal Bhits or sandhills. Dhands or salt lakes in the valleys. Outcrops of Jurassic rocks here and there.

B. *The Thar Section*.—Sea of sandhills. Rainfall slightly better.

IV. UPPER-GANGES VALLEY.

A. *The Doab Section*.—Best irrigated and highly cultivated land. Flat and fertile. Contains patches of *usar* or *reh* (salt) deposits.

B. *Rohilkhand Section*.—Damp and wooded country with little salt deposit. Rainfall upto 40". Plain sloping from Delhi (700 ft.) to Allahabad (400 ft.)

V. MIDDLE-GANGES VALLEY.

(No prominent Sections are possible).—Damp than the Upper Ganges Valley, with rice crops more important than wheat ones. Thickly populated. Rainfall 40" to 60".

VI. LOWER GANGES VALLEY.

A. *The Brahmaputra Valley*.—On the leeward side of the Assam hills. Less rain, but damp soil. Higher levels.

B. *The Ganges—Brahmaputra Plain*.—Fine, silty and flat region. Most thickly populated land in India. More than 60" rainfall. Full of Sunderbans.

C. *The Ganges Deltaic Area*.—Marshes, enclosing swampy islands, making the places unhealthy. Parts are under water during rains. Old water channels cut off.

(3) THE PENINSULAR

I. RAJPUTANA UPLANDS.

A. *North-Western Section*.—Sandy wastes. Poorly watered. Marwar harbouring migratory people.

B. *Mewar Plain*.—Morphologically varied. Typically irregular gneissic plain. Outcrops of Dharwar rocks with rich mineral deposits. Heart of Rajputana.

C. *South-Eastern Section*.—Pathar and Uparmal, a triple plateau of concentric scarps of Vindhyan sandstones.

II. DECCAN TRAP REGION.

A. *Central India Tableland*.—Full of Deccan Trap, Vindhya and Cuddapah rocks.

B. *Western Ghats*.—Highest parts of a denuded tableland. Very good rainfall and forested on slopes. Trap area prominent.

C. *Bombay Deccan*.—Leeward side of the Ghats. Less rainy and thinly populated. Black cotton soil. Laterite caps prominent.

III. NORTH-EASTERN TABLELAND.

A. *The Mahanadi Basin*.—Complex group of Archaean, Cuddapah, Gondwana rocks, coal and iron deposits. Rainfall 40" to 60".

B. *The Godavari Basin*.—Gondwana System of rocks with coal and iron deposits. Less rainfall 30" to 40".

C. *The Eastern Ghats*.—Unevenly denuded Archaean rocks of good height. Rainfall 60" to 80" including the N. E. Monsoon current.

IV. SOUTHERN PLATEAU.

A. *Cuddapah Section*.—Rocks of the Cambrian-Silurian Age. Thin rocky soil. Effects of retreating monsoon.

B. *Bellary District Section*.—Scrubland. Rainshadow area. Cotton grows with less than 20" rainfall. Low levels.

C. *Nilgiri Hills*.—Dharwar rocks, rich in minerals. Good rainfall. Good slopes for tea plantations.

D. *Tamil Section*.—Archaean rocks of considerable denudation. Double monsoon and good cultivation in the valleys of the southern rivers.

V. WEST COAST PROVINCE.

A. *Northern Section*.—Gujrat-Kathiawar coastal plains. Low lands with hills here and there. Variable climate and getting drier and drier, as we go northwards. Good black cotton-soil, derived from parent rocks of the Deccan Trap family. Component parts under diverse conditions. Migratory character of the people.

B. *Southern Coast land*.—Very well watered and lying between the Ghats and the Sea. Few natural harbours; e.g. Bombay. Unbroken coast-land. Sandbanks with cocoanut trees and flat alluvial rice land behind. 80" rainfall. Facilities of coastal services.

VI. EAST-COAST PROVINCE.

A. *Northern Coastland*.—Outcrops of older rocks here and there. Godavari and Krishna delta-land included. Double monsoon with rainfall nearly 40". Forested on hillsides.

B. *Carnatic Section*.—Mainly alluvial tract with hills of Archaean rocks in between. N. E. monsoon rainfall good. Unbroken coast with a few ports.

Summary.—Now that Indian geographers have begun taking interest in the regional geography of India, I think it is absolutely necessary that our work should be co-ordinated in regard to the physiographic divisions at least. I have already adopted, with suitable modifications, the method of physiographic division, em-

ployed by the Association of American Geographers, for my pioneer regional study of the Lower Indus Basin (Sind). (*Proc. Ind. Aca. Sci. B. Vol. IV. No. 4*) and as I have found it quite suitable for our country, I am advocating it as one, which other workers in the field, may utilise with advantage, in order to avoid any overlapping or confusion of boundaries etc. There must be uniformity and homogeneity in the divisions of our country at any rate.

Such physiographic divisions, uniformly made, would be of immense scientific value, as a most reliable background for other surveys, such as those of agriculture, industry, economics, water supply, population etc. They will be, in fact, in great demand from Government, Municipalities, Corporations and other departments.

I realise the difficulties of producing a satisfactory division of India into physiographic regions, e.g., political or administrative boundaries, naming of divisions, study of land-forms and departmental reports or blue books, but they can be solved if an All-India Geographical Association is established.

The so-called 'natural' divisions of India made by previous workers in the field, should now be superseded by *systematic physiographic regions*, approved by such a responsible body, as I have suggested.

Applying the triple principle of structure, process of erosion and present state of land-forms, affected by subaerial agencies, I have prepared a map of India and Burma, showing 3 Major Divisions; 17 Provinces and 40 Sections.

For preparing minor Sections and Sub-Sections, the factors of vegetation, animal life etc., may be considered.

It is hoped that these divisions will be found satisfactory and adopted by other collaborators in preparing monographs on regional geographies of our country.

Reply to Critics.

I must say at the outset that the Members who took part in the Discussion should not have lost sight of the fact that all I have sought to be done by the Science Congress is to secure *uniformity* in the divisions of India, so that our geographical researches may be properly co-ordinated. There is no intention of mine to seek

any innovation and to impose it upon others. I must object to the statement made by a Member that "mere geographers" cannot and must not solve the problem satisfactorily, while the fact is that geography, as a Science, does take into account the findings of the allied sciences, e.g., Botany, Zoology and Meteorology. My point is that the *chief* parts of the country, (not only the 3 Major Divisions but also the 17 Main Provinces at least will have to be fixed *physiographically* as I have suggested, because the physical basis is and should be the criterion in such a case:—

- | 3 Major Divisions. | 17 Provinces. |
|---------------------------------|--|
| (1) Extra-Peninsular Mountains. | I. Western Highlands.
II. Greater Himalayas.
III. Middle Himalayas.
IV. Sub-Himalayan Region
V. Eastern Highlands. |
| (2) Indo-Gangetic Plain. | I. Lower Indus Valley.
II. Upper Indus Valley.
III. The Desert Province.
IV. Upper Ganges Valley.
V. Middle Ganges Valley.
VI. Lower Ganges Valley. |
| (3) Peninsular India. | I. Rajputana Uplands.
II. Deccan Trap Region.
III. North-Eastern Table-land.
IV. Southern Plateau.
V. Western Coast Province.
VI. Eastern Coast Province. |

The resultant of various other forces will be considered and everything will be taken into account, when fixing *details* about the minor subdivisions. That is why we have allowed the Discussion to be held under the *joint* auspices of the five Sections of the Congress, so that we may come to some reasonable agreement.

It is also argued that physiographic divisions of India would only be superficial without regard to the botany, zoology, climatology, etc. But on the contrary, in my opinion, they will be most natural and fundamental. The main Divisions, proposed by me, are based on geology, geomorphology and climate and they must be fixed *uniformly in the first place*.

The points, raised by my opponents as regards the inclusion of the factors of vegetation and other natural and local types, would

surely come in while fixing the Sub-Sections and also the exact boundaries of the regions. Minor differences, such as those pointed out, e.g., Forest belts etc., are to be ignored while fixing the *main* Provinces and Sections, as indicated by me. Also, homogeneous masses of land should absorb small features.

Besides, in a country like ours, with many chance-political divisions and States, and so much harmful provincialism, it is necessary and safe to take up the regional studies of India by *physiographical*, (that is the most natural) and not by political or other artificial considerations.

I must repeat here most emphatically that the problem of uniformity and homogeneity in the Division of India, is very urgent and cannot be indefinitely put off. Unless it is solved by all of us satisfactorily now, much energy of research workers in Indian geography will be wasted and we shall not do credit to ourselves.

Fisheries of Cochin *

By

A. KARUNAKARA MENON, B.A., L.T.

The small, almost maritime state of Cochin lies between the 9th and 11th degrees of North Latitude and the 76th and 77th degrees of East Longitude, and covers an area of about 1361½ sq. miles. It has as its western boundary the vast Arabian Sea with a coast line about 35 miles in length. Bordering on it is a flat swampy belt rich with evergreen cocoanut palms, and between this low belt of land and the mainland, lies a continuous sheet of water, more than 35 miles in length, extending north to south, with a depth varying from three to sixty feet. There are at some places large lagoons between the sea and swampy belt, separated from the sea on the western side by mud banks overgrown with moss and weeds. The backwaters running parallel to the sea open out into it at two points—at Azhikode (near Cranganore) in the north and at the Island of Vypeen in the south. The backwater area is connected with the inland by two main rivers, the Chalakudi and the Alwaye, and numerous canals and channels. During the South-west Monsoon these rivers and minor streams bring with them enormous quantities of debris, mud and alluvial matter, besides a large volume of water. At this season of the year the backwaters (and even the sea to about a mile from the shore) lose their salinity to a certain extent.

The waters of Cochin are full of different varieties of fish. But much of this potential wealth of the State still remains unexploited, and fishing as an industry is still in its infancy. Much has yet to be done before it can stand comparison with the fishing centres abroad.

The fisheries of Cochin can be roughly divided into three classes—marine, brackish water and fresh water. Marine and brackish water fisheries are the most important. Fresh water surfaces of the State do not yield much at present, though excellent conditions exist for large scale stocking of fresh water fishes.

* Paper read at the Geography Section of the Indian Science Congress, Lahore Session, January 1939.

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Marine Fisheries.—Sea fishing on the West Coast, particularly in Cochin, is still in its primitive stage. People engaged in it as their life-work are having only a hand-to-mouth existence, with long intervals of unemployment and starvation caused by bad weather and irregularity of fish visitations in the shallow regions accessible to the fishermen in their frail crafts. A good deal has to be done in improving the condition of fishing as well as in that of the fishermen.

Most varieties of tropical climate fishes are to be found in the sea here. From small one-inch 'Kozhuva' to big sharks 20 to 25 feet in length, most varieties of scaled and unscaled fish are to be got in their respective seasons. The more common varieties, however, are the sardines and mackerel fishes, which are found almost throughout the year, especially in summer months. Other varieties of small sea fish such as 'Kurichil,' 'Thody,' 'Kuri' and prawns are mainly seasonal fishes and are used mainly for food. Another species known as the 'Pampada'—a flat bodied snake-like fish is got on the high seas in increased quantities as we go southwards into Travancore waters. The peculiarity of this fish is that it can be easily dried and preserved for long, so that it can be exported to distant places. Among larger varieties may be mentioned the Tiger fish, the Arkya, the Kadal Karup, and the Kola which at their best weigh about 50 to 70 lbs. and afford excellent material for food. Occasionally these are seen in the inland brackish waters also. Different varieties of sharks and porpoises abound in the western seas, especially in the deeper regions about 10 miles off the coast, the utmost limit that fishermen of Cochin would go. The fishermen of Cochin are poorly equipped with materials to trap these big fishes, many of which grow to 15 to 20 ft. in length. But by sheer accident sometimes they happen to lose their way into the flimsy nets and get caught. In Travancore and British Malabar fishermen are more successful with these fishes. The 'Adakam Koti' net made of wiry rope to a length of about 2000 feet is the favourite device of Travancore fishermen. Being an expensive concern employing about 20 to 30 boats and over 300 men at a time, it has become a capitalistic venture, where the actual worker gets the least. The Muslim fishermen of North Malabar are far more successful and less exploited than their southern brethren. Such is their skill that their success is popularly ascribed to some black art.

Cochin fishermen are more successful with these fishes when they happen to get into the brackish waters and lagoons. But the porpoises are protected by law in these areas. It is said that the

Dutch, while they were in power in Cochin depended on the porpoises to do dredging in the harbour area, and hence made it penal to catch them there. The sharks are noted for their food value as well as fat. A variety of shark with a double edged saw-like horn on its head, sometimes measuring nine inches in width, and three feet in length, is the one particularly prized. It is a dangerous game to hunt them, for its saw can be fatally turned against the adversary. Cochin fishermen irrespective of caste or creed dedicate themselves to St. Peter the fisherman and start upon the game during the most rainy parts of the month of June, when the feast of St. Peter falls. Rope nets are cast in which the saw of the fish is entangled, and after a regular fight lasting for hours the fish is killed and dragged ashore, where the brokers and middlemen settle the price, and the ceremonies and formalities of cutting him up begin. A full grown fish it is said would fetch something between Rs. 150 and 200.

Brackish Water Fisheries:—The backwaters and lagoons lying contiguous to the sea and connected to it by openings, abound in numerous varieties of fish. Most varieties of sea fish are found here, including even some of the large species. But there are some very prolific varieties special to these waters only. The 'Karrampa', Kathiran', 'Katla', 'Nata' etc.. are small but fleshy varieties which can be had at all seasons. The 'Thiratha,' a pretty variety weighing about 10 lbs. is a monsoon season fish available in abundance for about three months of the year. A pair of its eggs which would weigh about 1½ lbs. and fetch about 8 to 12as. has always a ready market outside.

But the most important of the brackish water fishes is the prawn, which is more a jelly than a fish. The ever-keen demand for it from the markets of Burmah and neighbouring places has proved the best encouragement for prawn fishing, which is admittedly managed best in Cochin and Travancore than any where else. Many of the ricefields bordering on the backwaters are used as part-time fisheries. Soon after the harvest the fields are filled with water and closed up. Prawn sperms happen to be in the water and soon they develop. They become mature in 30 to 35 days when the water in the fields are drained through sluices opening into nets at ebb tide. When once the prawns are transferred into the nets, the fields are again filled at high tide and closed up for another prawn harvest.

Perhaps included in the prawn family is the blue lobster which is a North-east Monsoon visitor of the backwaters. Though got in

plenty it has not any commercial importance. It has only a very limited food value.

Fresh Water Fisheries.—The scope for fresh water fishing is very limited in Cochin. But in Travancore it is not so. The rivers of Travancore abound in many varieties of fish. But both in Cochin and Travancore fresh water fishing is resorted to only to meet exigencies of local consumption. Some of the common fishes found here are the carp, 'Veral', 'Puttuthi', 'Karimeen', 'Kuri', 'Velluri', 'Kayal Chemmin', etc. The crude methods of fishing resorted to in these fresh water areas like poisoning are highly detrimental to the fishing industry. The waters are being depleted day by day, while no attempt is being made to rear at least the rare varieties. Both in the fresh water and brackish water areas there is ample scope for increased production on well-planned lines. The capture of fish when they are with eggs is a destructive process and has to be stopped. Several varieties can be bred in special localities and their output increased. The example of Japan is well worth imitation in this respect.

Fishing Communities.—Valans and Arayans form the important fishing communities of Cochin. Fishing and boat service have been their traditional occupations. Till recently they have been enjoying great privileges in the State both social and political and the headmen of the community wielded great influence and authority. Many of the Muhammadans and Christians who have taken to fishing as their occupation are said to be converts from the above-mentioned Communities. As has been pointed out elsewhere a great deal has yet to be done to improve the economic and social condition of these fishermen, many of whom are entirely dependent on middle-men. If India is to have a navy it is undoubted that a good percentage of the man power required to work it will have to be recruited from fishing folk such as these, so that the quality of human stock among them deserves to be well preserved even in the interest of national defence.

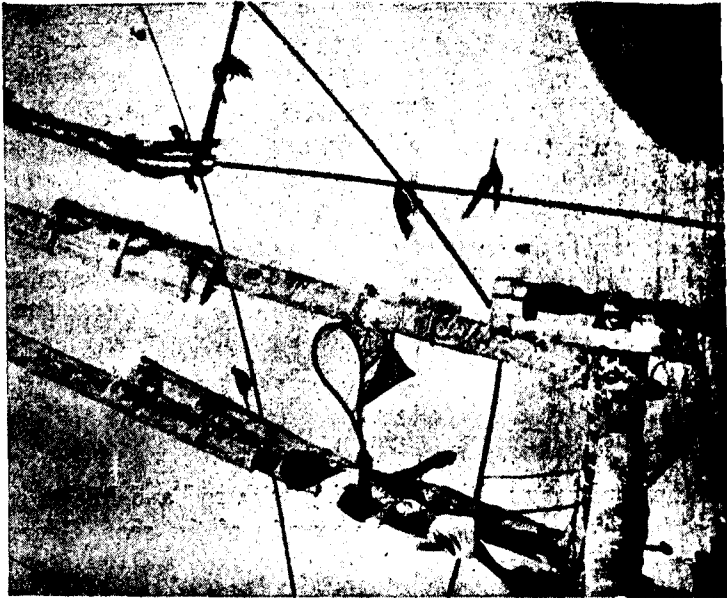
Methods of Fishing.—Of the methods adopted in fishing in the State the most common is fishing with nets. Nets vary in size and shape. In the backwater areas the one that is commonly used is the stake-net. In selected sites stakes are planted in the water in rows, ranging from 10 to 200. The place where the stakes are planted are called in Malayalam "Oonni Padus," the oonni padus being leased out. Nets made of cotton and coir in the shape of long conical bags narrowing to the tail and held up by means of hooks are fastened to the stakes. The tail-end is opened and is

tied by means of a rope. The prawns and other fishes that enter the nets become packed up and are unable to go back. The catch is later on emptied into a boat through the tail-end which is then untied. Other kinds of nets used in the backwaters are, as they are called in Malayalam, "Kandali," 'Narimeen Vala', 'Chavitto Vala', 'Vati Vala', 'Veesu Vala,' and 'Kona Vala' etc. A vala simply means a net.

Another interesting one is the 'Cheena' Vala (China net) with an elaborate frame-work by means of which the net is suspended and let down into the water like a bucket and drawn up again after a few minutes. The name 'Cheena Vala' is a misnomer, the net being only a Portuguese introduction. Even now its various parts are known only by Portuguese names. The name 'China net' was given to it only out of the old practice of ascribing everything, new or curious, to Chinese origin.

Another ordinary method is fishing with rod and line in small boats in the backwater and in the margin of the sea. Generally prawns are used as baits.

Fishing by the help of series of missiles is also a common feature in the waters of Cochin. Kudumbi fishermen venture far out into the sea by about dusk and harpoon the sharks with their 'Chattuli'. 'Thumbithan' is another implement used. It is a long narrow tube about ten feet long with a sharp dart attached to a long string inserted into it. The experienced fishermen on seeing a fish shoot the dart by blowing the tube and the dart strikes the fish, which is gradually drawn out. Ordinary bows and arrows are also used by some people to capture fish. Spearing the fish with the help of a weapon called 'Mupalli' is a common practice in the backwater. When it gets dark fishermen walk along the shore close to the waters with blazing torches held aloft in the hand and with a scythe in the other. The fish is lured to the surface by the light and then the fishermen strike at it with their scythes. 'Ottal' is another common implement used. It is made of finely split bamboo in the shape of belly-jar with a wide-mouthed bottom and a narrow open neck. Fishermen go with this in one hand and a torch in the other. When the fish is lured to the surface they plunge in the implement suddenly into the water and the fish found inside are taken out by the hand through the narrow opening. Numerous other methods of catch also are in vogue—like dissolving certain poisons in the water to kill the fishes; causing dynamite to explode under water; etc. But these are all



CHINA FISHING NETS—COCHIN.

thoroughly destructive methods and should be discouraged in the interest of the fishing industry. If fishing is to thrive as an industry, scientific methods adopted in countries like Japan and Norway have to be studied and copied here. The wealth of the deep sea has yet to be explored by trawling and other scientific methods. Trawling was once attempted in the sea here but had to be given up for want of the facilities to dispose of the large quantities of fish caught. An export market can be created and the trawler reintroduced.

Catch How Disposed of.

The majority of the population of Cochin, Travancore and Malabar—all except high caste Hindus are fish-eaters. Fish, where available, is an invaluable element in the diet of a rice-eating population. The masses especially the extremely poor people consume every kind of fish that comes in their way. 'Sardine' occupies almost the first rank in respect of food value and it is the cheapest of all. But the pity of it is that by the time they are taken inland for consumption they become tainted and many people content themselves with such tainted fish food. Fresh fish supply to the interior parts of the country is an imperative necessity and unless ways and means are found out for these there cannot be any improvement in the dietary of the people. Tinned Sardines from Norway and Japan fetch very high price even now in Indian markets. In point of quality our Sardine is superior to the Norway variety which is deemed the best. But with all that, we have to import foreign stuff because scientific methods of preserving fish are not resorted to here. With only a few thousands of rupees as capital it is quite possible to organise business lines and secure for our sardines a high and a certain place in the world market. The late Sir Frederick Nicholson of the Fisheries Department had a canning industry established at Calicut for instructional purposes. It has not been availed of for lack of propaganda.

In other ways also sardines have special value. It is an excellent manure especially for the cocoanut palm. In its best season, when supply far exceeds normal demands, it would sell dead cheap and cocoanut growers make capital out of the situation. Sardine oil is another valuable yield. It has recognised medicinal and dietic values. But no organised attempts have been locally made to benefit thereby. Sardines are boiled in big cauldrons from which the oil is skimmed off and the

residue is used as manure. The common use the oil is put to is to varnish the native boats thereby to enhance their durability by keeping them water-proof. Messrs. Stane & Co. devised a mode of pressing out oil from sardines and started a sardine oil business. But Japanese sardine oil came in and undersold the local product.

Fish-curing and drying on primitive lines are done by various private agencies. Under the auspices of the Government attempts are being made to improve these methods and if they prove successful a big trade in fish may follow. The Travancore Government have of late started refrigeration as a mode of preserving fish, making cycle deliveries weekly from ice-packed box. But it has met with violent opposition of local fishermen who resist change. Should it succeed, Malabar fish may find markets farther afield than Malabar. The fins of the shark are priced as a great delicacy in Burma and China, and have been exported thither in large quantities from of old. The Travancore Government are now making experiments whereby shark oil may be put on the market in competition to cod-liver oil.

Fish manure either as sardine stuff or prawn scales is having a good market locally, but if scientifically prepared it can surely command a wider market. In the same way sea-shells, fish-bones, etc., can be put to various uses like button-making. Oyster-fishing affords scope for a very big industry and trade. Oyster shells baked in kilns and powdered afford excellent mortar for building purposes. Large quantities of this used to be exported to Bombay and other places, but due to unbusinesslike methods the trade has to be confined to local areas only.

Prawn industry is said to be the most thriving industry in these parts. As soon as they are caught from backwaters or fields they are boiled and dried in the sun. When dried they are peeled off their skin by being put in sacks and beaten on the ground. The peeled skin is a good variety of manure. The inner pulp is a delicious food in some markets especially in Burma, and sometimes fetches over 375 rupees per candy. Under favourable conditions one acre of paddy field may yield about 800 rupees worth of prawn, so much so that people who know how to do so often neglect paddy cultivation in favour of prawn breeding.

Recent Irrigation Changes in the Cauvery (Tanjore) *

By

T. KRISHNASWAMI, M.A., L.T.

In this paper an attempt is made to survey the Mettur or the Grand Anicut Canal region in the Tanjore district and to note the effects of the Canal on the area in all its varied aspects. It is barely five years since the Canal has been functioning and it is rather too early to gauge with any finality the full consequences. In the absence of reliable statistical data, it will only be possible to indicate the general tendencies which have been deduced from the facts noted and observations made of the region in question during these few years. As and when fuller statistical information is made available by the various departments of Government, it is proposed to supplement or modify, if necessary, the conclusions arrived at which, in the nature of things, can only be tentative.

Considerable stress is often laid by Indian financiers on the fact that "Indian finance is a gamble in rains". The full force of the statement could be appreciated only when the reactions of a flood or a drought on the agricultural life of the country is envisaged. Where the uncertainties of Nature are so great, man tries to minimise the risks involved by conserving rainfall in reservoirs. The storage in addition to avoiding flood-risks involved in times of heavy rainfall makes the surplus water so stored available in seasons of drought. Moreover regions deficient in *natural* rainfall and devoid of other irrigation sources could be benefited by the canals carrying water from the reservoir to the fields. But before the costly method of Reservoir-cum-Canal irrigation is attempted, proper utilisation of the run-off or surface drainage is necessary. This is a cardinal principle that should be recognised and borne in mind by all engineers before launching on any irrigation project.

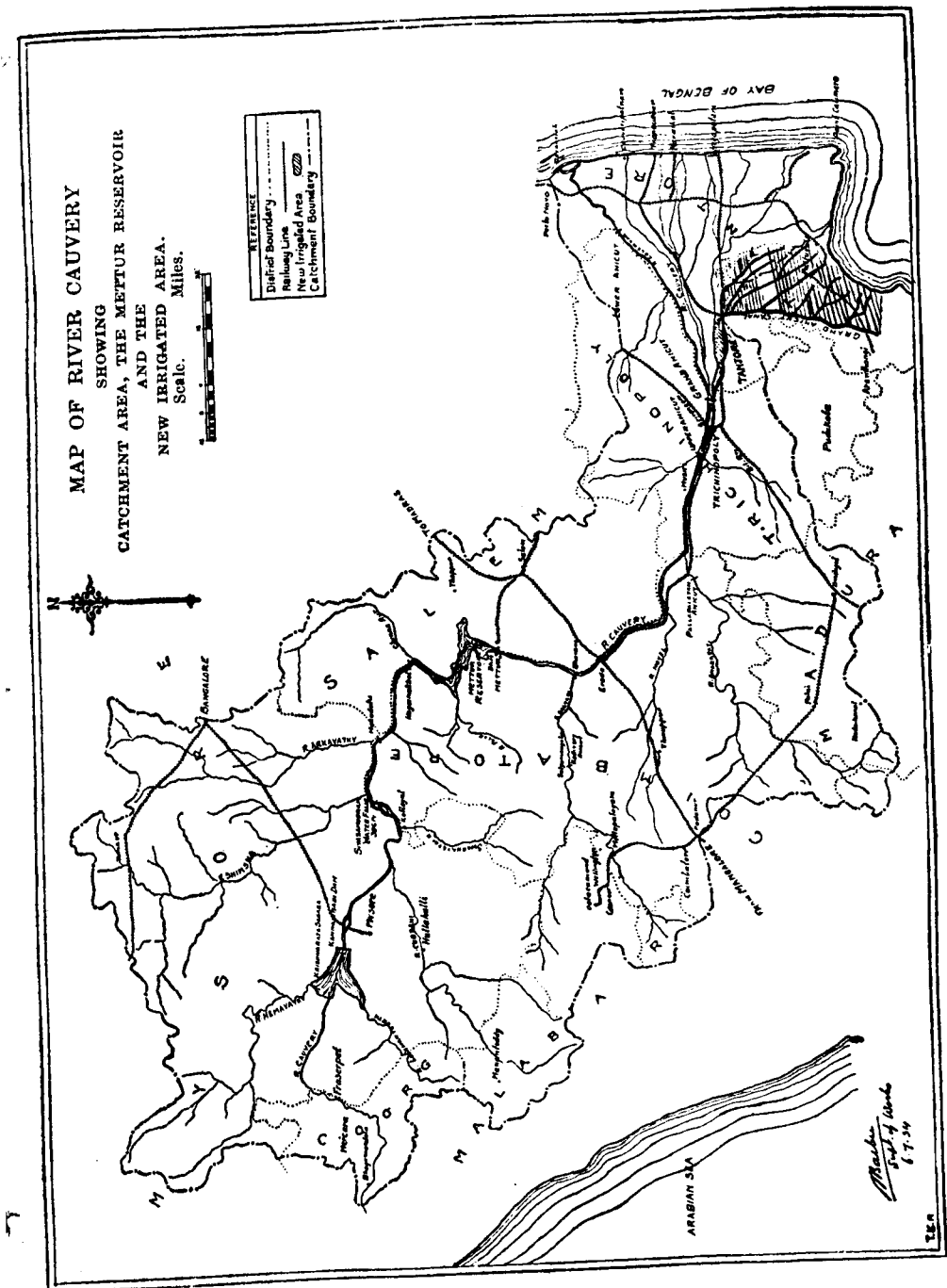
The main conditions imposing a limit to the extension of irrigation are:—(1) the geographical and seasonal distribution of

* Paper read at the Geography Section of the Indian Science Congress, Lahore Session, January 1939.

the rainfall; (2) the configuration of the country; (3) the difficulty of holding up water stored in years of good rainfall as a provision against a year of draught; (4) the character of the soil; and (5) the large number of different states and territories into which the country is divided and sub-divided.

The Tanjore District lies between $9^{\circ} 50'$ and $11^{\circ} 25'$ North and $78^{\circ} 55'$ and $79^{\circ} 55'$ East and has an area of roughly 3,700 square miles. The river Coleroon forms the northern boundary separating it from Trichinopoly and South Arcot districts and on the West lie the Native State of Pudukottah and the district of Trichinopoly; on the South is the Madura district and on the East, the Bay of Bengal. It is a coastal district having two sea boards of nearly 150 miles, the one stretching from the mouth of the Coleroon to Point Calimere in the South (72 miles), and the other from Point Calimere to Palk Strait (68 miles). The district can be roughly divided into three major regions:—(1) *The deltaic portion* is about half the total area of the district and is an undulating alluvial plain with a gentle slope down towards the East; (2) *The non-deltaic portion*, which is similarly devoid of hills, slopes down towards the East and South-east and has an average elevation of about 50 feet above the deltaic tracts. In this region towards the South and South-west of Tanjore City lies the Vallam Table-land; and (3) *the vast salt swamp* from Point Calimere to Adirampatnam—which in some places is 30 miles wide and usually under water for a great portion of the year.

The district known as "The Granary of the South" and the waters of the Cauvery have contributed to the enrichment of its soil and the growth of civilisation. Thus a confirmation of the maxim that civilisation follows rivers is found in this case. The Cauvery rises in the Western Ghats near Mercara in Coorg at a height of 4,400 feet above sea-level and falls into the Bay of Bengal draining nearly 31,000 square miles in its course of nearly 500 miles. The river has three important tributaries, the Bhavani, the Noyel and the Amaravati. From the source of the river upto the head of the delta at the Upper Anicut, the Cauvery has a catchment area of 26,172 square miles. Both the South-west and the North-east monsoons influence the catchment area—the former 15,700 square miles and the latter 10,500 square miles. But lower down the Upper Anicut, the whole area is mostly influenced by the North-east monsoon. The Cauvery delta system is a very ancient one and conforms to what is called the "Direct-flow system". The construction of the Mettur Dam



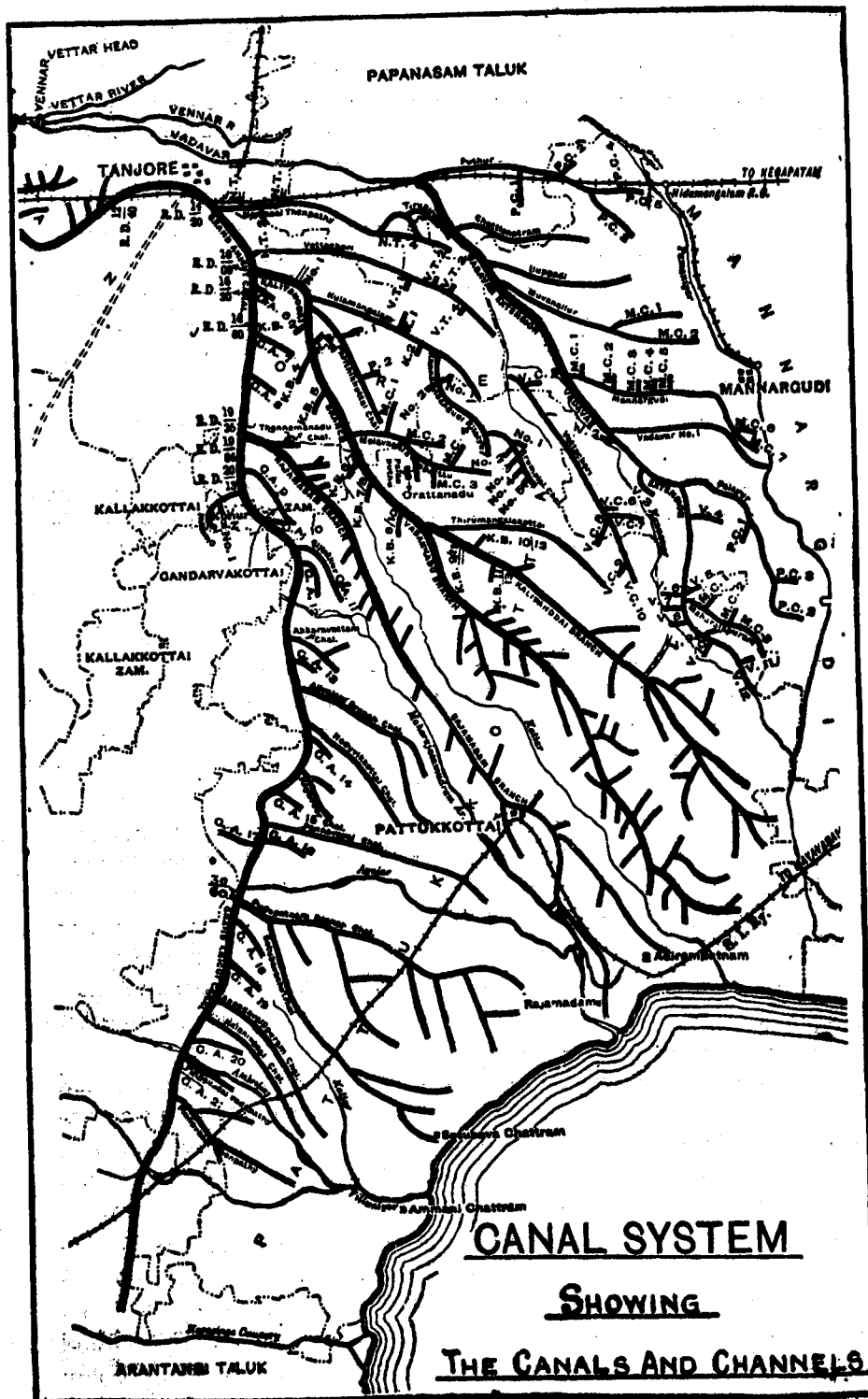
improves it to a "Storage system". The conversion of the Cauvery river system from the inundated to the controlled type has been effected with a view to minimise the dangers to the deltaic tracts during heavy floods and to utilize the surplus waters running to waste in the sea for the benefit of the drier upland tracts of the Tanjore district. Agriculture with the aid of irrigation water, now known by the term "Irriculture", is a very ancient industry in South India. The anicuts constructed by the Indian rulers long before the advent of the English, had subsequently fallen into disrepair owing to the disturbed political conditions in South India and the consequent neglect of settled agricultural pursuits. When the East India Company took over the Tanjore district in 1801, the irrigation facilities had got considerably reduced due to the silting up of the channels and it was left to the late Sir Arthur Cotton to devise measures for removing the difficulties by the construction of the Upper Anicut across the river, 10 miles West of Trichinopoly, in 1836. The good work started by Sir A. Cotton was continued and the work as it stands at present was completed in 1902. It is near the Upper Anicut that the main stream divides itself into two: the Northern arm is called the Coleroon and the Southern arm retains its original name of Cauvery. The two rivers meet again 20 miles lower down and thus the sacred island of Srirangam is formed. The Grand Anicut—1,080 feet long—is the oldest irrigation work in the Cauvery delta and was originally constructed by the Chola Kings and subsequently improved on modern lines in recent years. The object of the Anicut is to prevent the flow being wasted into the Coleroon which serves as a main drainage. At the Grand Anicut, the Cauvery bifurcates into the Vennar and Cauvery proper, and there are works at the head for regulating the flow. After satisfying the requirements of the delta, the surplus is diverted into the Coleroon which by means of the Lower Anicut irrigates 37 square miles in the tail-end of the Tanjore district and a portion of the South Arcot district. The Lower Anicut is constructed 70 miles below the Grand Anicut and 28 miles from the mouth of the river which enters the sea at Devakotta, South of Porto-Novo. It is stated that even in years when no definite supply had been made through the works, there is an adequate flow in the Coleroon to meet the requirements of cultivators under the Lower Anicut system. Though various reasons are given by way of explanation for this fact, it is suspected that there must be some hidden springs in the Coleroon to give such an unfailing supply. The theories of percolation and surplus waters, etc., though they may be justifiable are not entirely convincing.

The ill-distributed rain-fall, the unequal distribution of the number of days of normal flow and the wastage of the surplus water gave the necessary impetus to both the Mysore and the Madras Governments for launching on reservoir schemes. The construction of the Krishnarajasagara Dam by the Mysore Government was followed by the construction of the Mettur Dam by the Madras Government. The experiences of the unprecedented 1924 floods with a discharge of 475,000 cusecs at the Upper Anicut had necessitated alterations in the original dimensions of the Mettur Dam with a view to meet even such extraordinary contingencies. A distance of nearly 120 miles separates the Dam from the head of the delta.

The objects aimed at by the control system are:—(i) the protection to the irrigation works during floods; (ii) provision for improved and regular irrigation facilities to the old deltaic tracts; and (iii) extension of irrigation to the non-deltaic tracts by the utilisation of the surplus water running into the sea.

Canals:—The Grand Anicut Canal the head sluice of which is on the right bank immediately above the right flank of the Vennar Regulator, is intended to irrigate and bring under cultivation 3,01,000 acres of the non-deltaic tract in addition to effecting improvements in deltaic irrigation. The new area is commanded by the Mettur Canal and the Vadavar Extension. The level of the Cauvery at its source as already stated is 4,400 feet above mean sea-level and that of the river bed at the site of the Dam is about 620 feet above mean sea-level. Thus within the course of 250 miles there is a fall of 3,780 feet. The level of the river bed at the Grand Anicut Canal is nearly 196 feet above mean sea-level.

As already indicated, the fall of the land in the non-deltaic portion of Tanjore district is towards the East and South-east. This region is more or less a plain interspersed with spurs and having very gradual fall of 3 to 5 feet in a mile. The Grand Anicut Canal, unlike many of its distributaries, is strictly a contour canal, that is, a canal which avoids short cuts through ridges and embankments and takes a longer course adapting itself to the level of the region and following the contour lines. This fact is borne out by the absence of any but a single off-take from the canal on its right side and by its flow along the ridges and not cutting them. Ellis in his Manual at paragraph 419 lays down certain principles for the lay-out of a distribution system. They are: the economical distribution of water, adequate command and



least interference with natural drainage. In certain cases, the principle of not interfering with the natural drainage is to be given up where it is not otherwise possible to command the land. The modification of the principle indicated above is illustrated by the Canal crossing the Mahasamudram and the Agniar rivers. The distributaries under the Grand Anicut Canal system generally go on ridges so that they command the land lying between the tops of the ridges and the bottom of the valleys between. The valleys or the depressions in the land form the natural drainage courses and interference with the same probably accounts for the ineffective drainage of the area after the construction of the Canal.

The Grand Anicut Canal flows southwards as it issues from the head sluice. Further down it crosses the abandoned course of the old Vennar and taking a sharp bend runs almost parallel to the Vennar, the right bank of the Vennar being the left bank of the Canal. The main Canal is 66 miles long from its head to the Narasinga Cauvery zone in the Arantangi taluk. The further extension of the Canal was not possible due to the conditions of the Mysore-Madras agreement in respect of the distribution of the Cauvery waters, and also the poor soil South of the Narasinga Cauvery zone. The two main off-takes from the Canal are the Kalian Odai and the Rajamadam Channel. The Canal with its distributaries has a total length of 760 miles. The bed-width of the Canal is 180 feet, the full supply depth is 7 feet at the head-works; at the tail-end, the bed-width is only 30 feet and the full supply depth is 5.25 feet. The discharge capacity which at the head is 5,000 cusecs, at the tail-end becomes only 300 cusecs. The bed fall is gradually increased from .15 feet/1000 feet at the head to .165/1000 feet at the tail-end to keep the velocity as high as possible. It should be noted that there have been two deviations from the originally proposed alignment. The first division is in the Canal entering the Tanjore City and the second is in the omission of the part of the Pudukottah State from the ayacut of the Canal. It was first thought that the cost of acquisition of land within the City limits would be prohibitive but this became inevitable by the later deviation necessitated by the difficulties in arriving at a satisfactory agreement with the Pudukottah State regarding the terms of distribution of water.

The Canal before entering the Tanjore district crosses the Sholagampatti Vari, the largest cross-drainage above Tanjore and also cuts the South Indian Railway. The Canal enters the Tanjore district near Budalur nearly 11 miles East of the Grand Anicut and takes an almost easterly course keeping to the South

of the South Indian Railway line. The cutting at Budalur is nearly two miles long and the maximum depth is 17.5 feet. At Ramanathapuram, close West of Tanjore City, it takes a slightly Northern curve to avoid the Vallam plateau which would involve cutting of 44 feet, and cuts for a second time the Railway line. It was in this reach of the Canal system that blasting operations had to be resorted to for cutting through laterite underground, thus entailing the utilisation of manual labour instead of machinery. The Canal then enters the Tanjore City where the maximum cutting is 26 feet. The width of the Canal at this stage where it cuts across the Muhammadan grave-yard, is only 84 feet thus giving a special tapering from 172 to 84 feet in a distance of 440 feet. The depth which even at the headworks is 7 feet had consequently to be increased to 10 feet and the slope of the Canal is also increased to $\frac{1}{205/1000}$ to augment the velocity of the stream with a view to prevent sand and silt deposits. The normal width and depth of the Canal are restored beyond the City limits by means of a reverse taper. Such an increase in depth and velocity inside populous city limits will be attended by greater drowning accidents and more frequent damages to the Canal bund. The latter difficulty has been partially got over by protecting the side slopes throughout. The third crossing of the Railway line is just East of the Railway station and from there onwards the Canal has a southerly course to the East of which lies the new area to be irrigated. This region lies to the South of the delta reaching nearly the sea in the South, extends in the East, upto the Paminiyar and on the West up to the Pudukottah State border. The Canal—after the two principal off-takes mentioned above—crosses several jungle streams which cut across the irrigated area, the chief of such streams being the Kattar, the Maharajasamudram and the Agniar. These streams and cross-drainages are crossed by super-passages, syphon aqueducts and bridges. The Canal runs in high embankments in certain places. After cutting the Tanjore district board railway to Arantangi, the Canal bifurcates into the Ammanichattaram and Tiruvappadi distributary channels.

Vadavar Extension:—Prior to the construction of the Canal, the river Vadavar was irrigating nearly 15,000 acres in the deltaic and non-deltaic portion of the district. Unlike the Grand Anicut Canal which is purely an irrigation canal, the Vadavar in its course of 21 miles from the Vennar to its fall into the Vaduvur Eri serves both irrigation and drainage purposes. It not only takes the surface run-off of its catchment area but also is useful for diverting the surplus waters of the Cauvery during times of heavy

floods. The surplus from the Eri goes by the name of the Kannanar which empties itself into the Paminiyar. Nearly half the waters of the Vadavar were left unutilised and hence an improvement in the canal system was found necessary for commanding a wider ayacut. The extension to this canal system commences just above this outfall into the Vaduvur Eri and is seven miles in length. This extension is intended to irrigate 28,000 acres.

Temperature and Evaporation:—As in the deltaic areas, May and June are the hottest months in this region too. The temperature records maintained at Negapatam show that the average minimum temperature of the place varies from 70.8° in January to 80.2° in May, and the average maximum from 81.5° in December to 97.3° in May. The average annual maximum and minimum temperatures are 89.8° and 75.9° respectively while the annual mean is 82.9° . These temperature records of averages arrived at on the basis of a coastal town like Negapatam cannot correctly indicate the temperature of places in the interior, especially in the non-deltaic area coming under the Canal system.

The reservoir at Mettur with its storage capacity of 93,500 million cubic feet is said to have considerably reduced the temperature of the adjacent places. This is ascribed to the greater evaporation and greater humidity consequent thereon in the atmosphere. The difference in the temperature in the past between deltaic and non-deltaic portion in the district has been accounted for by the vast tract in the former of irrigated land under paddy crop. If the aim of the project in bringing under paddy nearly 3 lakhs of acres is realised, the Canal with its net-work of distributaries must have considerable influence in moderating the temperature in the region.

The absence of temperature records in typical places in the canal zone and the lack of statistics covering a fairly long period could at best lead to only tentative conclusions.

Rainfall:—The function of irrigation is mainly to supplement the deficiency in rain-fall or to conserve rain water in tanks and lakes where it is unequally distributed. Over-irrigation is as injurious as deficiency of rain. Irrigation may tend to minimise the distress of a partial failure but can never be a substitute for rainfall, especially in respect of crops like paddy which for their successful growth require periodical rain in large quantities, as rain water alone contains a larger proportion of oxygen content and is better suited to stimulate the roots to action. Howard writes:

of the South Indian Railway line. The cutting at Budalur is nearly two miles long and the maximum depth is 17.5 feet. At Ramanathapuram, close West of Tanjore City, it takes a slightly Northern curve to avoid the Vallam plateau which would involve cutting of 44 feet, and cuts for a second time the Railway line. It was in this reach of the Canal system that blasting operations had to be resorted to for cutting through laterite underground, thus entailing the utilisation of manual labour instead of machinery. The Canal then enters the Tanjore City where the maximum cutting is 26 feet. The width of the Canal at this stage where it cuts across the Muhammadan grave-yard, is only 84 feet thus giving a special tapering from 172 to 84 feet in a distance of 440 feet. The depth which even at the headworks is 7 feet had consequently to be increased to 10 feet and the slope of the Canal is also increased to $\frac{205}{1000}$ to augment the velocity of the stream with a view to prevent sand and silt deposits. The normal width and depth of the Canal are restored beyond the City limits by means of a reverse taper. Such an increase in depth and velocity inside populous city limits will be attended by greater drowning accidents and more frequent damages to the Canal bund. The latter difficulty has been partially got over by protecting the side slopes throughout. The third crossing of the Railway line is just East of the Railway station and from there onwards the Canal has a southerly course to the East of which lies the new area to be irrigated. This region lies to the South of the delta reaching nearly the sea in the South, extends in the East, upto the Paminiyar and on the West up to the Pudukottah State border. The Canal—after the two principal off-takes mentioned above—crosses several jungle streams which cut across the irrigated area, the chief of such streams being the Kattar, the Maharajasamudram and the Agniar. These streams and cross-drainages are crossed by super-passages, syphon aqueducts and bridges. The Canal runs in high embankments in certain places. After cutting the Tanjore district board railway to Arantangi, the Canal bifurcates into the Ammanichattaram and Tiruvappadi distributary channels.

Vadavar Extension:—Prior to the construction of the Canal, the river Vadavar was irrigating nearly 15,000 acres in the deltaic and non-deltaic portion of the district. Unlike the Grand Anicut Canal which is purely an irrigation canal, the Vadavar in its course of 21 miles from the Vennar to its fall into the Vaduvur Eri serves both irrigation and drainage purposes. It not only takes the surface run-off of its catchment area but also is useful for diverting the surplus waters of the Cauvery during times of heavy

floods. The surplus from the Eri goes by the name of the Kananar which empties itself into the Paminiyar. Nearly half the waters of the Vadavar were left unutilised and hence an improvement in the canal system was found necessary for commanding a wider ayacut. The extension to this canal system commences just above this outfall into the Vaduvur Eri and is seven miles in length. This extension is intended to irrigate 28,000 acres.

Temperature and Evaporation:—As in the deltaic areas, May and June are the hottest months in this region too. The temperature records maintained at Negapatam show that the average minimum temperature of the place varies from 70.8° in January to 80.2° in May, and the average maximum from 81.5° in December to 97.3° in May. The average annual maximum and minimum temperatures are 89.8° and 75.9° respectively while the annual mean is 82.9° . These temperature records of averages arrived at on the basis of a coastal town like Negapatam cannot correctly indicate the temperature of places in the interior, especially in the non-deltaic area coming under the Canal system.

The reservoir at Mettur with its storage capacity of 93,500 million cubic feet is said to have considerably reduced the temperature of the adjacent places. This is ascribed to the greater evaporation and greater humidity consequent thereon in the atmosphere. The difference in the temperature in the past between deltaic and non-deltaic portion in the district has been accounted for by the vast tract in the former of irrigated land under paddy crop. If the aim of the project in bringing under paddy nearly 3 lakhs of acres is realised, the Canal with its net-work of distributaries must have considerable influence in moderating the temperature in the region.

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"The researches of Mr. Harrison and his staff at Coimbatore on the gases of swamp rice soils have drawn particular attention to the importance of the oxygen supply of the roots of the rice crop by means of a slow movement of aerated water through the upper layers of mud in which this crop grows. The roots of rice must have a constant supply of oxygen. As they are immersed in mud and water, the only way this substance can be provided is in solution in the water which must move slowly through the soil"

The Indian Irrigation Commission in its Report states the part played by rainfall in determining the necessity for irrigation in the following words :

"The main factors determining the use and value of irrigation in any part of India, whether from a purely productive or from a famine protective point of view, are the rainfall, soil and the classes of crops suited to the soil, climate and other local conditions. Rainfall may be so abundant and assured as to render irrigation superfluous, and even injurious ; or, though ordinarily sufficient it may be so liable to periodic failure or unseasonable incidents as to call for irrigation as a protection against its uncertainty ; or, it may in all years be so scanty as to make cultivation impossible without irrigation. The soil may be so inferior that the increased yield due to irrigation would not repay the cost of providing it ; or it may be so retentive of moisture as to render artificial waterings unnecessary except in the driest year".

The average rainfall of the Tanjore district from 1870 to 1929 is 44.77" as against an average of 48.6" in the past 8 years. There has been an increase of 4" over the average but in 3 out of the 8 years the rain-fall has been less than the above average. Though the district depends on the South-west monsoon for the commencement of its agricultural operations, it is the North-east monsoon that supplies the deficiency in the direct flow due to the exhaustion of the South-west monsoon. The bulk of the local rain for the upland tracts is brought by the North-east monsoon. In the past few years, a noticeable feature in the rainfall of the district is the late break-up of the monsoon and the abundance of rain in unseasonal times. The district for the purpose of rainfall may be roughly divided into the littoral, central and inland regions. The seasonal distribution is as follows :

Section.	January to March.	April to May.	June to September (S.W. monsoon).	October to December (N.E. monsoon).	Total.
Littoral ..	5.38"	3.18"	9.48"	31.79"	49.83"
Central ..	4.58"	3.19"	12.23"	25.98"	45.98"
Inland ..	3.24"	4.00"	11.17"	19.44"	37.85"
District average ..	2.99	2.99	12.27	26.52	44.77

Thus the coastal taluks of the district receive a greater rainfall than the interior. The Western and central taluks of Tanjore and Papanasam get only an average rainfall of 37 and 39 inches respectively. Though in the taluks of Pattukottah and Arantangi, South of Tanjore there is not great deficiency of rain-fall, and the departure from the average is slight, yet they are very dry taluks. The agriculture practised in 9 out of the 11 taluks of the district depended on the Cauvery irrigation for a very long time. The Grand Anicut Canal system has extended the benefit of Cauvery irrigation to the other two taluks also. At present, the high, upland tracts of the Tanjore and Pattukkottah taluks and a major portion of the Arantangi taluk are left out of the benefits of irrigation from the Cauvery.

In the non-deltaic tracts prior to the construction of the Canal, rain water was collected in tanks. Tanjore and Pattukkottah, the two important taluks of this region, have the largest number of tanks, viz., 199 for Tanjore and 195 for Pattukkottah, i.e., 394 tanks out of 445 for the whole district, the ayacuts of which range from 50 to 500 acres. The cultivation of the region was dependent on rain and its failure resulted in famine conditions. In the hottest part of the year the water stored in the tanks was useful for both men and cattle. Now the Canal takes water direct to most of these tanks thus ensuring a well-regulated supply. But some of the tanks are private and the Canal runs through zamindari tracts. There are differences of opinion between the Government and the cultivators regarding the water-rate to be charged and this has necessitated the cutting off of supply to some tanks. This region which had been depending on rain for cultivation had a variable cultivation season but with the construction of the Canal, the cultivation season has tended to approximate to that in the deltaic taluks. With the regulation of water a greater rhythm and symmetry in the cultivation season throughout the district has become possible. The following observations of Colonel Ellis, who was responsible for the project in its initial stages on the effect of

controlled irrigation on agricultural practices are worth quoting here :

"The existing cultivation customs and season of cultivation (in the district) are those which experience has shown to be more suitable for the raising of wet crops with the existing seasonal distribution of river flow and rain-fall.

The effect of the reservoir on these seasonal supplies will be :

- (a) to secure an adequate supply at an earlier average date than before, both for double and single crop lands, and to guarantee that once such supply is issued, it will not, as at present, be subject to fluctuations of a nature which cannot be foreseen ; and
- (b) to ensure, from the time of transplantation (of paddy), a steady and adequate flow for the irrigated area by impounding excess flow for issue when the natural flow is deficient. The general effect of this alteration on the cultivation practices will be to make transplantation of both double and single crop lands earlier, and this especially applies to the single crop lands in the eastern part of the delta (i.e., the tail-end lands) where transplantation is now delayed on account of the frequent failure in September and October of the flow supply which is generally available in July and August (the South-west monsoon period) thus leaving early transplantation to wither for lack of water before the North-east monsoon rainfall on those lands is available to supplement the free flow supply."

With the development of the area commanded by the Canal, it would be possible to correlate the acreage under cultivation and the output with the amount of rainfall and the irrigation water. The effects of the Canal irrigation on the nature of the soil and the crops grown can be fully ascertained in the light of further experience.

Soil.—Apart from soil survey conducted for purposes of settlement operations, no systematic or scientific survey of the soil seems to have been made prior to the construction of the Canal. As already observed, the deltaic tracts contain rich alluvial loam while the soil of the non-deltaic portion may be described as light brown sandy loam except in the areas lying between the Grand Anicut and Tanjore—the portion north of the Grand Anicut Canal which has red loam and black soil. The alluvial soil of the delta is con-

spicuously absent throughout the region and the red ferruginous type generally predominates. The following table sets forth the percentage of soils for each taluk for wet and dry areas separately. It is interesting to note that regar and alluvial are completely absent in the Pattukottah and Arantangi taluks which come under the Canal irrigation. Here more than 99 per cent of both wet and dry cultivated areas are of the red ferruginous variety and the arenaceous variety is found mostly in the coastal taluks of Negapatam and Shiyali.

Taluk. (1)	Alluvial.		Regar.		Red Ferruginous.		Arenaceous.	
	Wet. (2)	Dry. (3)	Wet. (4)	Dry. (5)	Wet. (6)	Dry. (7)	Wet. (8)	Dry. (9)
Tanjore	32.0	6.0	39.0	10.0	29.0	84.0	..	..
Papanasam	28.6	38.0	68.2	22.4	3.2	39.6	..	..
Kumbakonam	64.0	59.0	36.0	41.0	..	..	6.7	18.1
Mayavaram	70.5	60.8	22.8	21.1	..	..	23.8	46.8
Shiyali	..	..	76.2	53.2	..	..	..	0.4
Nannilam	54.9	55.7	45.1	43.9	..	..	7.6	54.9
Negapatam	..	..	92.4	45.1	..	..	..	..
Mannargudi	..	..	87.3	15.0	12.7	85.0	..	..
Tiruturaipundi	..	..	92.9	61.2	1.1	10.8	6.0	28.0
Pattukottai	..	..	..	..	99.7	99.7	0.3	0.3
Arantangi	..	..	..	..	98.7	86.8	1.3	13.2

The absence of any rocky formation except near Vallam gives a deep soil. Rock soil and laterite are in places interspersed with occasional stretches of black loam, having a quartz substratum. Wells sunk in the area reveal whitish clay beyond a depth of 20 feet but this is absent nearer the surface. This is due to the gradual soil erosion consequent on monsoon rains and uncontrolled run-off. This depletion of the plastic clay makes the soil appear on the surface open, porous and permeable. The necessity for frequent irrigation will be felt in such soil especially when rice is cultivated. One of the imminent problems awaiting investigation and solution is how to render this porous and permeable soil capable of retaining more moisture. This calls for a thorough and scientific survey of the texture and chemical composition of the soil. It is believed that an increase in the humus content of the soil will bring about greater ability to retain moisture.

Canal irrigation and drainage.—In the words of Howard, "Canal irrigation in the hands of the cultivator seems to put a brake on the wheel of life". He is benefited or adversely affected

to the extent of his capacity to use the brake properly. Though irrigation makes up to some extent for poor cultivation, it has to be recognised by the cultivator that cheap and abundant water is a doubtful blessing. Over-irrigation leads to low productivity and constant waterlogging leads to the formation of alkalies and toxins injurious to plant growth. The Royal Commission on Agriculture has the following pertinent remarks on the evils of over-irrigation :

"Many of the troubles which have arisen in the irrigated tracts of India in regard to waterlogging and the formation of alkali lands have been due to failure properly to correlate a new irrigation system to the natural drainage of the tract. We, therefore, consider that drainage maps should be drawn up by competent engineers who possess the necessary agricultural insight. Once these maps have been made, it will be easy to control all such undertakings as the construction of roads, railways, canals and embankments, and to see that nothing interferes with crop production."

Not satisfied with these recommendations, they have further suggested the advisability of the engineers undergoing a short course in agriculture and agricultural graduates taking lessons in applied engineering. The Madras Government for reasons of its own had ignored this wholesome and salutary advice.

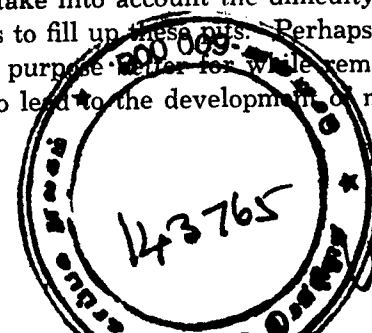
It is with a view to avoid the evils of perennial irrigation that the ancients were satisfied with what is called the basin system which combined both irrigation and drainage. King in the course of a very interesting and elaborate discussion of this problem in his book "Irrigation and Drainage", writes :—

"It is a noteworthy fact that the excessive development of alkalies in India, are the result of irrigation practices modern in their origin and modes, and instituted by people lacking in the traditions of the ancient irrigators who had worked the same land thousands of years before. The alkali lands of to-day, in their intense form, are of modern origin, due to practices which are eminently inadmissible, and which, in all probability were known to be so by the people whom our modern civilisation has supplanted."

The Grand Anicut Canal was never thought to be a drainage work. The jungle streams cutting across functioned effectively as natural drainage channels. No proper arrangements appear to have been made for linking them with the drainage works and thus

to draw off the surplus waters of the irrigation channels and the percolation waters of the area. With the Canal flowing for more than six months in the year and the monsoon rains, the proper drainage of the area has become an acute problem. If it is a ridge canal, the question of cross-drainage work would not arise. But the Grand Anicut Canal being a contour one in its entire length of 66 miles, the difficulty of cross-drainage has been partially got over by syphons, super-passages and syphon aqueducts. The interference with the natural drainage system, the seepages, and stagnant pools formed by borrow-pits have added to the complexity of the drainage problem. Continued water-logging and the existence of stagnant pools have been responsible for the increase of mosquito nuisance and malaria in the region. The records of hospitals in the taluks served by the Canal show an increase in the number of patients treated for malaria and it is apprehended that unless speedy and effective measures are adopted to counteract the spread of the disease, the Canal, while conferring from the economic point of view a doubtful benefit, will prove to be a positive menace to the health and living conditions of the people in the locality.

The difficulties of water-logging in the area would be considerably enhanced if the lay-out of the roads and railways prevent or interfere with the natural drainage. It is a common experience that the Railway Companies in laying out the lines have not paused to consider the adverse effects on the cultivated lands by the embankments serving as barriers against the free flow of water. The proposed Tanjore-Pattukkottah line crosses the Kalian Odai in four places and unless sufficient precaution against water-logging is taken by the Railway, cultivated lands are sure to be affected very adversely. The growth of natural vegetation along the canal routes and the extensive rice cultivation will add considerably to the intricacies of the problem. Dr. Russel of the Rockefeller Foundation while admitting the above facts suggests that air-tight shutters will prevent the percolation of water. The suggestion to fill up the borrow-pits with earth looks rather funny considering the fact that these borrow-pits themselves were formed by excavations for forming and strengthening the embankments. The suggestion does not take into account the difficulty of getting earth from distant places to fill up these pits. Perhaps, the growing of reed might serve the purpose better for while removing the stagnant pools, it might also lead to the development of mat making as a cottage industry.



Crops and vegetation.—Though irrigation is one of the prime needs of agriculture in India, the suitability of the soil, the scientific manuring of crops based upon a careful study of soil composition, proper rotation of crops and the eradication of insect pests are other factors which have a large bearing on the question. There seems to have been no planning in respect of the future development of the area in spite of the emphasis laid by the Royal Commission on Indian Agriculture on the necessity of concerted action on the part of the departments concerned. It is necessary to study the reactions of plant life to canal irrigation. It is only very recently that an agricultural farm was started at Pattukkottah which is engaged in experiments connected with the raising of new money crops like sugar-cane, cotton, groundnut, turmeric, plantains and soya beans. The money crops suggested for purposes of cultivation must have relation to the soil on which they are to be grown and the economic resources of the growers.

As already observed the region was depending mostly on the North-east monsoon for its water supply, but since the introduction of canal irrigation, constant and steady supply of water throughout the agricultural season is ensured. Agricultural practices and the nature of the crops grown are governed by the change in the environment. Till now only dry crops were grown in the area and they were mostly rain-fed. The failure of the North-east monsoon brought about untold misery to the cultivators. The vagaries of the monsoon had been, in certain years, so pronounced that it was feared that famine conditions were likely to affect even the fertile district of Tanjore. Paddy, the staple product of cultivation in the district, is an irrigation crop in the deltaic tracts, and a mainly rain-fed one in portions of the dry tracts. The seeds were broadcast and no nurseries were maintained in the dry tracts. The best yielders, under such circumstances, were the coarser varieties of paddy and the dry crops were Varagu, groundnuts, gingelly, ragi and cumbu. Now finer varieties of paddy are first raised in seed-beds and systematically transplanted as in the delta. In the North-western portion where black soil is found coriander is sown. Of the pulses, red-gram is grown chiefly in Tanjore, Pattukkottah and Mayavaram taluks. Pattukkottah grows also a large quantity of condiments and spices. Under fruit trees and vegetables, cocoanut and jack predominate, the former in the Pattukkottah and Tirutturaipundi taluks, and the latter chiefly in Pattukkottah. If the anticipated conversion of dry lands into wet is fully realised, there will be a shrinkage in the area available for the cultivation of dry crops. Such a conversion is bound to have reaction

not only on the quantity and quality of the produce raised but also on the methods of cultivation adopted. Groundnut is likely to be benefited by canal irrigation making good the deficiencies of rainfall. It may, therefore, be anticipated that both an increase in the yield per acre and an extension of the area cultivated under groundnut will be possible. It is the chief money crop of the district but due to the fall in price the acreage under cultivation in the last decennium is only 67,638 as against 78,985. But the cultivators are to be warned against the dangers of over-irrigation. Over-irrigation and constant water-logging prevent free soil aeration and the assimilation of oxygen by plants and the fixation of atmospheric nitrogen in the soil. Further, the mineral salts so essential for plant growth are entirely washed away and at times they are found in a concentrated form in low lying areas. Plagiol and Storer concluded, as a result of experiments conducted by them, that soils having more than 2% salt are rendered unfit for cultivation. King's remarks on the formation of salt crusts made long ago are still true. He remarks :

"If irrigation is practised during the growing season only, and if this water also is evaporated from the soil in addition to the natural rainfall, it is plain that the content of soluble salts in the soil must increase, both on account of that which may have been in the water applied, and that which this additional water may have been instrumental in producing from the soil on the spot through the processes of weathering. Indeed, the more we study and reflect upon this problem, the more we are led to fear that in all arid climates, where irrigation is practised, it will not be found sufficient to apply simply enough water to the soil to meet the needs of the crop growing upon the ground at the time, but, on the contrary, there must be enough more water applied to take up and carry away into drainage channels and out of the country to the sea not only the soluble salts which the irrigation waters carry, but also those which it causes to be produced from the soil and the sub-soil."

The jack tree which till recently flourished in Pattukkottah taluk and noted for its high quality of fruits is becoming extinct. It is a popular belief that jack thrives best under dry conditions and that the canal water has been responsible for the extermination of the tree which has been a source of subsidiary income to the cultivator. In Malabar, the jack thrives in spite of the heavy monsoon rains but regarding flavour and taste, the Malabar jack

fruit cannot compare favourably with the Pattukkottah variety. Attempts must be made either to preserve the indigenous variety or to introduce another suited to the changed conditions.

Casuarina is another tree which has now been adversely affected by the Canal. In the drier tracts, especially in sandy regions, the tree was grown on soils not suitable for any other remunerative crops. The water requirements of the casuarina are strictly limited to the first few months till the seedlings get fixed in the soil. The percolation of water from the Canal and its distributaries is stated to have arrested the development of the tree to its normal size.

The drier tracts of the Tanjore district were noted for their vegetable and garden produce which were mostly grown for city markets near at hand. Though under canal irrigation the quantity of vegetable produced is increasing yet there has been a considerable falling off in the quality of vegetables. A comprehensive study seems to be necessary before large areas are brought under cultivation of any particular crop.

The fluctuations in the level of the water-table due to Canal irrigation and the response and reaction on the roots of old and new vegetation must be enquired into before formulating any policy affecting the agricultural development of the area in question. It is stated that the water-table in this region has risen to a level of 5 to 6 feet from roots of the plant while in the deltaic Papanasam taluk which has been under irrigation from time immemorial it is 20 feet below. It is interesting to note in this connection that there has been recently a variation in the level of the water-table in the Punjab Canal region and the Government have appointed a Committee for investigating its causes and for suggesting remedies. It is hoped that the findings of the Committee will throw further light on the variations in the level of the water-table, information on which subject has so far been scanty and at best vague.

The Central Board of Irrigation, at its recent deliberations at New Delhi, considered the economic aspect of lining canals with a view to prevent water-logging and to conserve the water let in for irrigation. In the absence of reliable data regarding the loss by seepage, the Board was reluctant to commit itself to any definite conclusion and has deferred the further consideration of the question to a later date. But the Board has been definite from experiments in lining of canals conducted in the Haveli Main Canal that leakage could be prevented by lining canals with reinforced brick

tile cement "sandwich". At the same time it has been pointed out that the canal lining is liable to be blown up when the canal is emptied, due to pressure from subsoil water, especially where the canal runs through an area with a high water-table.

Considering the cost and also the fact that in the area under consideration the water-table is within six feet, and water will be flowing in the canal only during six to seven months in the year, it would be inadvisable to resort to this method of lining the canals with a view to avoid seepage.

In some canal areas in North India (chiefly in United Provinces and the Punjab) staunching of canal beds and canal sides and the prevention thereby of seepage has been tried by substituting the impervious sodium clay for the porous earth, since sodium-clay has the merit of possessing "self-healing" properties even where punctures are caused in such clay soil. This method of lining and staunching would seem to afford a cheaper alternative and how far this can be tried with advantage in the Grand Anicut Canal area is to be seen.

As has already been pointed out, irrigation by itself cannot bring about prosperity to the agriculturists. The necessity for the improvement of the soil by increasing its humus content is great. In the absence of forests, improvements in this direction cannot be effected. Indigo, sun-hemp and other varieties of green leaf manure may be sown and cultivated. Even here cattle nuisance has to be contended with. Chemical manures are costly and it is believed that they have only a transitory effect in improving the crops on the land without bringing about the desired improvement in the soil itself. Oil cakes and fish guano are other manures usually thought of but the difficulty of crushing and exporting the oil and the non-availability of fish guano in sufficiently large quantities militate against the use of these manures. So, the agriculturist is thrown on his slender resources of farm-yard manure on which also a heavy strain is imposed by way of domestic fuel. The insufficiency of manure and the poverty of the soil had been hitherto made up in the canal region by the periodic migration of herds of cattle and sheep from the border district of Ramnad. These herds were in great demand for hire just before the commencement of the cultivation season. Hence the cost of manuring by this method becomes prohibitive for the average agriculturist. This intense demand just before the cultivation season is due to the fact that long exposure to sun and rain tends to reduce the efficacy of the droppings of the cattle as manure. The poor soil and the

extension in the area of rice cultivation are likely to increase the cost of cultivation. Moreover, the continued fall in the price of agricultural commodities especially of paddy is another factor which tends to discourage further extension of wet cultivation. But Mr. Howard in his book "Crop production in India", makes the following statement regarding extension of rice cultivation with increased irrigation facilities.

"In the deltaic tracts of the peninsula, the extension of irrigation facilities has always developed the cultivation of rice rather than the production of sugar. So far, the scientific basis of this marked preference for paddy has not been investigated. It is probable that the ryots' preference for rice has a real scientific basis. Paddy lands are self-sufficient as far as nitrogen is concerned. Sugar-cane needs expensive nitrogenous manure".

Though this statement may be true of the deltaic tracts, it is not true of the canal region. Sir Arthur Campbell in inaugurating the works pointed out the potentialities of the new area and refuted the theory of over-production of rice in the Tanjore district due to canal irrigation. His contention is based on the fact that the population of the presidency in a period of 50 years has increased by 51% while the crops with and without irrigation have increased only by 43% and 29% respectively. Further, taking the 1928 to 1933 figures, he proves that the area under sugar-cane has increased by 36%, plantain by 14% and paddy only by 4½%. But this line of reasoning is fallacious in that rice is grown very extensively and sugar-cane and plantains are money crops which tend to extend under irrigation facilities. The fact that the abandoned tank beds even when offered under most favourable terms are not demanded and that there is lack of response in utilising the canal water for purposes of wet cultivation go to prove that under the present level of prices, the agriculturist is reluctant to grow any new crop. The area actually irrigated by the canal at the end of the 4th season is only 96,000 as against a forecast of 1,04,300 acres. The following figures relating to the acreage brought under cultivation after the Canal has been opened for irrigation speak for themselves:

	1933-1934.	1934-1935.
Vadavar ..	13,889	22,134
Grand Anicut Canal ..	22,845	62,314
	36,734	84,448

The forecast that the new area would be fully developed in 1943-44 is bound to fail considering the pace of development due to economic depression. The expectations of the authors of the Grand Anicut Canal system may not be realised even in the distant future due to the low agricultural prices, the cost of converting dry lands into wet, the heavy manuring which wet crops require, the low economic resources of the cultivators and the speculative factor in respect of the yield.

Cattle.—The cattle of the district are considered comparatively poor. Occasionally cattle are imported from Salem and other districts. Draught animals are purchased and exchanged at the annual fair held in Neerathanallur where cattle are brought for sale and exchange from great distances. The location of this market for cattle is interesting in that it is situated between two rivers—the Cauvery and the Coleroon—and is also within easy reach of the border district of Trichinopoly. Cattle are kept there for nearly 3 months in the year and the arrangements for the fair are in the hands of the local boards. In the forests of Vedaranyam, a wild species of draught animal is caught and domesticated. They are of a short stature and lightly built, and therefore considered more suited for drawing carts than for ploughing. The cattle epidemic, except for occasional outbreaks, is not prevalent in the district. Before the canal construction, the cattle in the upland tracts suffered from want of water even for drinking. This led to rinderpest. The high percentage of cultivated area to the arable area due to the popularity of rice cultivation, the absence of sufficient grazing grounds and the failure on the part of the cattle owners to raise fodder crops, the promiscuous breeding and common grazing are factors that have contributed to the poor variety of cattle. (In 1931-32 the acreage under fodder crops was 659 acres only, i.e., .0004 per cent of the total area sown. In 1936-37 this has dwindled to 29 acres, i.e., .00002 per cent). The low acreage of work turned out per pair of tilling cattle is due to the heaviness of the soil especially in wet cultivation. Another interesting feature in respect of the cattle figures for this district is the disproportionately large number of animals kept compared with the grazing and fodder available. The cattle are mostly ill-nourished and under-fed and there being no proper or adequate provision for stalling them, the cattle suffer in winter when there is standing crop on the land. Very often the cattle are housed along with men in residential quarters. The main food of the cattle is the paddy straw.

Since irrigation facilities are provided during 7 months of the year, it may be possible to increase the fodder supply in the canal area. Suitable crops to serve the purpose of rotation and also of cattle food may be tried in certain localities. The Government has recently prohibited the assignment of porambokes and waste lands in this area. Evidently, the Government wants to take advantage of the increased price that the lands are likely to fetch when the region is fully developed. But before adopting such a short-sighted policy, it would be advisable for the Government to encourage a controlled system of common grazing ground in and near the villages. It is unwise to depend on the vagaries of Nature but deliberate, systematic and planned attempts should be made to grow grass as is being done in military grass farms. From experiments conducted on a large scale in Hoshiarpur (Punjab), it was seen that grass farms were self-supporting and a ready market always existed for grass. Moreover cutting grass for cattle instead of allowing the cattle themselves to graze on the grass farm resulted in better yield of grass. It is within the experience of the villagers that if bulls and cows are allowed to graze first and then goats and sheep, it is more economical and at the same time a larger head of cattle can be fed thereby with less loss of material.

Intimately connected with the cattle problem is the question of controlled grazing or stall-feeding. The Indian peasant is neither efficient nor rich enough to resort to stall-feeding as the peasant in Denmark. Thus livestock management is an intricate problem with the Indian.

With a view to stimulate the growth of fodder and manure crops, the Government would be well-advised to adopt a differential rate of assessment starting in the initial years with a nominal kist, and exempting areas sown with such crops from water cess altogether.

The Tirutturaipundi taluk with its 13,354 acres of waste lands easily occupies the first rank in respect of cultivable wastes available. Next comes the Tanjore taluk with 9,382 acres. The taluks of Mannargudi, Pattukkottah and Arantangi are next in order. Ignoring nearly the 3,000 acres which have neither irrigation nor proper drainage facilities, the rest of the waste lands in the above taluks can be considered as potential sources to which Tanjore and neighbouring districts can easily look up for the supply of cattle food.

Fishery.—It is stated by the Director of Fisheries that the Mettur Reservoir holds out immense possibilities for developing pisciculture. In the course of his report, he instances the case of Mr. H. S. Thomas who got about 100 lbs. of fish per acre in a shallow artificial tank at Vallam without in any way impairing the productivity of the tank. According to this estimate, the reservoir is likely to bring in a revenue of 2½ crores per year from fish alone. But a modest estimate of 5½ lakhs per year is made by the Director himself. In addition to this, the Canal region will provide a subsidiary source of income to the fisher-folk in the area. The fish generally, it is stated, has a tendency to travel upstream. As the Canal is not at all connected with the sea, the possibilities of sea fish travelling upstream are very meagre. Further sea fish do not find fresh water conditions, especially when the supply is not perennial, suitable for their healthy breeding. Some of the tanks in the area are directly linked up with the canal system. The village tanks may be tried as breeding grounds for suitable varieties of fish and experiments in this direction have far-reaching possibilities of success. Hitherto, no systematic attempt has been made to rear fish in village tanks. It was left to the off-chance of fish coming along with the freshes of the year.

In the Canal region, the right to catch the fish seems to have been auctioned to the highest bidder in the past 3 years. It is understood that the Government has recently stopped altogether the system of leasing fishing rights. The damages caused to the Canal and tank bunds by the fishermen in the course of their operation are stated to be very heavy thus necessitating annual repairs to the bunds and beds. This seems to be a flimsy reason for giving up altogether a revenue and deprive the fisher-folk of an income.

Population.—According to the 1931 census, the population of the district was 23,85,920—an increase of 2.4% over the 1921 figures. The population of the Presidency during the same period increased by 10.4%. In point of density of population, the district occupies a second place among mufassal districts, the first being East Godavari. Except in Arantangi, Pattukkottah and Tirutturaipundi taluks, the population is very dense having its highest density in Kumbakonam taluk—(55 for every 20 acres cultivated) and the lowest in the Tirutturaipundi taluk (28 for every 20 acres cultivated). It is worthy to note that the greatest density of population in the drier tracts is 400 per square mile while the minimum for the delta is 700 per square mile. It is estimated that if the new area of 625 square miles is fully developed it will attract 200,000 in-

habitants. The present low density of population both in respect of superficial area and cultivated area is due to the infertility of the soil and its inability to support a larger head of population per acre. In spite of its sparse population the dry tracts of the district have been contributing whenever monsoons failed, a large number of emigrants to the Federated Malay States and Ceylon. J. C. Molony, in his Census report for 1911, laid stress on the tendency of population to concentrate in rice cultivating areas. The reason for this is that rice cultivation offers not only better and greater opportunities for employment but has also ability to maintain a larger head of population. Although dry crops demand an intenser labour through out the season, the number of labourers required is generally small as compared with wet crops which engage a larger number of labourers, though spasmodically, at certain definite periods of cultivation, such as transplantation and harvesting. This peculiarity of wet cultivation in respect of labour requirements renders possible the periodic migration of labourers from dry to wet areas. From 1930 onwards there has been a greater concentration of population in the Canal area due to the influx of labourers mostly from the Odda community of Salem for work in connection with excavations of the Canal and its distributaries. The slump in rubber also led to the repatriation of a large number of emigrants from the Federated Malay States and arrested the outflow of labour. The figures of returned emigrants from Malaya and also of assisted emigrants from the Negapatam Port are instructive in that the exodus is great in seasons of drought and less under fairly prosperous conditions.

With an extension in the acreage of wet cultivation, there is scope, for employment at least during a part of the year, for the bulk of the labourers in the Canal area. But due to the slow progress in this direction, the periodic migration of agricultural labourers from this area has not entirely stopped.

Communications.—In spite of the fact that the Cauvery with its net work of distributaries including the Grand Anicut Canal system covers almost the entire district, yet none of them having been designed for navigation purposes can be used as means of communication.

The important towns and centres of the district are connected either by roads or railways. No other district in the Presidency is so traversed by a net work of railways and inter-connected by roads as Tanjore. The local boards maintain 2,331 miles of roads of which 540 miles are metalled. In point of communications the

rich deltaic tract has been more developed than the non-deltaic area. The Mettur Canal area cannot boast of many good roads. The porosity of the soil, the loose sub-soil in many places, the absence of road paving materials and the lack of a steady supply of commercial crops for transport have prevented the formation of good roads. The single line of railway takes a tortuous course connecting the important taluk centres. In the absence of well-developed commercial centres, this is but natural. It is doubtful whether the present communication facilities will be sufficient to meet the demands of a developing area as the one in question. It is understood that the railway authorities are considering the feasibility of connecting Pattukkottai, the hub of the Canal system, with Tanjore town, forming as it were a Chord line. If the proposal materialises, quicker and cheaper transport would be available to the agriculturists and merchants in the area. As, however, the proposed railway route is almost parallel to and in close proximity with the main road between Pattukkottai and Tanjore, it is a matter for consideration how far the competition from lorry and bus transport would affect the earnings of the railway. At present, country carts are taking up transport of produce to the railway stations near at hand. The laying-out of the new line and the development of roads are likely to decrease the importance of existing methods of transport. The Government of Madras has sanctioned one lakh of rupees for laying out new roads and developing the existing roads by removing dead ends in places where the roads have fallen into disuse. Among the important roads under construction in the new area are the following:— (1) Orathanad to Vaduvur; (2) Orathanad to Tirumayyam; (3) Orathanad to Mannargudi; and (4) Papanad to Madukur. There is the possibility of Orathanad which was comparatively insignificant till now of developing into a nodal centre for the Canal area.

Considering the large quantity of Tanjore rice exported to Ceylon annually, it will be worth investigating whether a shorter and cheaper water-route from Point Calimere to Jaffna cannot be thought of for the expeditious transport of rice. The Vedaranyam Canal which skirts the eastern coast of Tanjore and is about 30 miles long is navigable by flat-bottomed boats and is utilised at present for removing salt from the Vedaranyam swamp to Negapatam and other places. With the development of the Canal area and of Point Calimere as a port, the circuitous land route taken by Tanjore paddy to its market can be avoided.

The principle underlying the development of communication is that there should be least interference with drainage or agriculture. In this connection Howard makes the following observation:—

“While communications in the shape of railways and roads are essential in the modern state, nevertheless their construction must conform to the natural drainage of the country and there must be no interference with agriculture”.

Some recent changes in the irrigation method:—The Mettur Canal has brought about a change in the prevailing practice regarding the supply of water to fields. Hitherto the responsibility for the maintenance of field channels was solely that of the ryots. The land over which a field channel passes belongs generally to the owner of the field. This system led to two difficulties, *namely*, the course of the channel was determined by the requirements of the most influential land-lord in the area and not by the level of the country, and there were frequent obliterations of and interferences with the channels. A reference to successive Settlement Reports supports the conclusion that original beds of channels have been appropriated and converted into fields, leading to the great inconvenience of the owners of fields lower down. The Government, therefore, had to subsequently acquire lands and dig channels afresh in the interests of the land-lords further down. In the Canal area, however, with a view to bring about rapid development, the Government have adopted a different policy. Suitable levels for field channels are taken and the water is taken not to the limit of each field but is made available for irrigating in blocks of not more than 25 acres. The ryots are expected to put up the necessary earth-work for the formation of field channels and bhothies at their own expense. Permits are issued for taking water from the 25-acre-block limit down the field channels. The Government, it is understood, has extended the application of the permit system for a period of 5 years to the cultivators under the Lower Anicut Canal also.

The Government regulated the flow during the several months of the year as dictated by the requirements of the cultivators under the various irrigation works by G.O. No. 2671/1, dated 6th December 1933 and this has been later amended by G.O. No. 402, P.W. (Irrigation), dated 27th February 1937, in the light of difficulties experienced in the first few years of canal irrigation. Elaborate rules are also framed to regulate the supply in times of

floods and droughts. The following tables give the normal requirements in the respective months of the year by the Cauvery, Vennar, Grand Anicut Canal and the Lower Anicut:—

Period.	Cauvery.	Vennar.	G. A. Canal.	Total.
	Cusecs.	Cusecs.	Cusecs.	Cusecs.
June second half	5,900	4,600	1,800	12,300
July 1st to 5th	7,147	6,353	1,800	15,300
July 6th to 15th	7,147	6,353	3,686	17,186
July second half	10,677	9,323	3,686	23,686
August first half	10,620	9,380	3,686	23,686
August second half	10,658	9,342	3,466	23,466
September first half	8,793	7,707	3,466	19,966
September second half	7,149	6,351	2,600	16,100
October first half	12,500		2,090	14,590
From October 16th to January 31st.	(Supply required will depend on the state of the north-east monsoon rainfall.)			

Normal requirements at the Lower Anicut.

	L.C.A.	S.A.
16th to 30th June	290	
1st to 15th July	1,256	
16th to 31st July	1,800	100
1st to 31st Aug.	2,162	300
1st to 15th Sept.	1,800	200
16th to 30th Sept.	1,544	200

(After the 15th of October, supply required will depend on the north-east monsoon.)

Effect on deltaic tracts.—The Mettur reservoir with its net capacity of 93,500 million cubic feet is intended to protect the already irrigated area both from floods and droughts and also to afford irrigation to new lands without at the same time impairing the efficiency of irrigation of the older delta. This view is supported by the figures relating to the discharge of water at the Upper Anicut. It is said that the surplus water which goes to waste is alone utilised and that only 16 per cent of the flow is diverted into the Grand Anicut Canal. But the cultivators in the deltaic tracts complain of the shrinkage in the volume of water supplied to them and the present system of irrigation interferes with their normal agricultural operations. During the natural flood season under the direct flow system, agricultural operations commence almost simultaneously both at the head and tail of the

delta area. Thus with the first freshes in the river there is bound to be an all-round and sympathetic activity throughout the entire villages. There is, however, much truth in the complaint that the control system makes the tail-end cultivator wait indefinitely long for commencing agricultural operations or in some years deprives him of irrigation facilities altogether. So there is considerable uncertainty regarding the method of cultivation to be adopted and the crops to be raised. These difficulties are due to the considerable loss in transmission of water since the soil is parched up at this time and the tanks are also flushed. Evidently the regulated system is based on calculation of "duty" but in practical agriculture the requirements of the soil and the nature of the crops grown and other complex matters tend to create a variation between actual requirements and the "duty" arrived at. The errors in calculation in the "duty" have also been responsible for the failure of the control system to meet the requirements of agriculture especially in critical times. Dewan Bahadur R. Narasimha Ayyangar, a former Chief Engineer to the Government of Madras, in his Curzon lectures points out how mistakes on the part of the engineers have made the position of the agriculturists in the delta in certain years precarious. He refers to the reduction in the number of the vents in the Low Level Supply Sluice in the Mettur Dam which was made on the presumption that the occasion for the use of the greater number of vents originally provided for may not arise at all and dependence on the working tables prepared by the officers of the department led to serious consequences in 1935. To quote his words, "we actually found however... that the low level sluices could not meet the demand.... at a critical period during the transplantation season, even though they (all the vents) were fully open". Added to this, the popular misconception that the greater the irrigation the greater the produce has to be removed, if the "duty" is to approximate to the actual needs. The difficulty of the tail-end cultivators is more pronounced in the case of double crop areas under paddy. Hence in a year where there is a shortage in the supply of water due to failure of monsoon, they meet the needs of the situation by resorting to Udu cultivation. This system is not so advantageous as the double crop in respect of yield, yet in periods of drought this is the only crop that could be thought of. This method of cultivation, however, requires heavier outlay for periodic and effective manuring. The tail-end taluks are affected by floods in seasons of heavy rain and starved for water during drought. They are perforce driven to the necessity of raising such varieties of paddy as are conditioned by the seasonal

variations. In this respect, the cultivation of paddy in some of the villages of Shiyali taluk adjacent to the sea is interesting to note. These villages are subject to tidal action from October to December and the yield in the first (Samba) crop is low. After December, the lands are flushed out with fresh water from Cauvery channels and a special variety of Kar crop known as *Kullakar* is raised and this crop is irrigated with the help of water from the South Rajan Channel of the Coleroon.

Another complaint of the delta cultivator is that the freshes in the rivers are no longer charged with alluvium as in pre-reservoir years, that the construction of the Krishnarajasagar in Mysore (more familiarly known as the Kannambadi Dam) and later the Mettur Dam have considerably reduced the alluvium content. For the Government it is contended that the construction of the Dam has no direct bearing on the reduction of alluvium since the sediment is contributed mostly by the Amaravati and Bhavani which join the Cauvery lower down. The sediment contents of the waters of the Cauvery and of its tributaries have been tested and the conclusions arrived at form the basis of the official version. On the other hand, the fact that it is estimated by the Government that the effective storage capacity of the Mettur Reservoir will be reduced in a period of 50 years by about 10 feet in height due to accumulation of silt, etc., at the bottom, would seem to suggest that the contention of the delta cultivator is at least partially correct. In view of the conflicting and contradictory theories regarding silt-deposition by rivers, the dry and wet silt theories and the differences in the figures arrived at by engineers in charge of the Cauvery and the Bhavani, it is rather difficult to hazard an opinion on the subject. It has, however, to be admitted that there is such a marked difference between the clear waters in the rivers in the post-reservoir period as compared with the muddy-looking water surcharged with sediment in the pre-reservoir years which the Tanjore ryot may be taken to have bargained for. This leads one to the conclusion, in spite of the averments of the departmental officials to the contrary, that the sediment content is now on the decrease. The Government of Madras has under consideration another Project known as the "Lower Bhavani Project" by which it is proposed to divert the waters of the Bhavani for irrigating mostly the dry crop area of Coimbatore district. If that scheme materialises, as it is likely within the next few years, there is a certainty of further reduction in the silt carried by the Cauvery to the Tanjore district.

The ultimate effect of such a state of things will be the gradual deterioration of the soil of the Cauvery delta which is growing rice from times immemorial without the necessity for manuring.

A greater volume of water was passing through the Coleroon and sand also in large quantities was carried down the river to the sea. But with the limitation and regulation of water in the Coleroon, and the diversion of water into the new region, larger quantities of sand are now brought down the Cauvery or deposited by its distributaries in the lower reaches of Tanjore. This phenomenon was noticed several decades ago even before the Mettur Reservoir was constructed and has been given as a reason for the greater and more frequent flooding of the deltaic region. It is believed that the neglect of what are called "Manal-pokees" (sand vents) a characteristic feature of the older irrigation system is the cause of the gradual and noticeable rise in the bed level of the rivers in the Tanjore District. It is doubtful whether this aspect of the question has received that amount of careful consideration and examination which it deserves at the hands of experts.

The delta itself being only the result of gradual deposits and accumulations by rivers, the danger of the rivers overflowing their banks and in places submerging the delta is very great. A more than usual flood will result in considerable loss to life and destruction to property.

Conclusion.—From this survey and from experience of Canal irrigation elsewhere, it is not possible to definitely assert that the Canal irrigation under all circumstances is an unmixed blessing. The beneficial effects on the productive and protective character of irrigation projects are dependent upon numerous factors. Unless a comprehensive investigation over a large span of years on the possibility of developing new areas or giving adequate protection to arid regions is made, irrigation projects are likely to prove more a success from the engineering point of view than from the practical and economic aspect. In almost all the new canal regions in India, the formation of alkalies in soils and the outbreak of Malaria subsequent to the active functioning of the canal as such have become common features. A rage for new irrigation projects has been the characteristic of the years following the recommendations of the Indian Irrigation Commission appointed by Lord Curzon. "Every engineer worthy of the name, in service in the P.W.D., had a scheme ready which he put forward for the consideration of Government and some had a very large number of such schemes". But the one fundamental and salutary principle under-

lying the recommendation was lost sight of by many of them. "Storage is so costly even in the most favourable circumstances that very few irrigation works that depend on it are remunerative", was the caution of the Irrigation Commission itself. The Linlithgow Commission on Agriculture in India with the weighty recommendation before them of the Irrigation Commission, suggested the utilisation of sub-soil and spring water. Presumably with the completion of the Lower and Upper Bhavani Projects, the optimum point of utilisation of the Cauvery waters would be reached and any further extension of irrigation project would ultimately prove a costly failure, the crushing burden of which will have to be borne by posterity. Evidently this aspect of the question has led the Government to reject the more ambitious Kattalai Canal Scheme designed to irrigate about 50 per cent more of the cultivable and irrigable area than that under the Grand Anicut Canal. Recently the land-holders under the Amaravati river are agitating for the further utilisation of the waters of the river in their own area by the construction of irrigation works. Hence, further extensions of irriculture will be possible only by educating the cultivator to adopt more economic methods of irrigation and by reducing the loss in transmission to the minimum and by facilitating the gravitational flow of water in the channels.

EXPLANATION OF TERMS.

Ayacut.—The area commanded by an irrigation source.

Duty.—The number of acres that could be irrigated for a given quantity of water. (1. cusec.).

Cusec.—Multiplied by $60 \times 60 \times 24$ gives the c. feet of water passing through a spot in a day.

Critical velocity.—The rate of flow of water at which the sediments and other matter are not deposited. The nature of the soil, the velocity of the flow and the weight of the suspended matter are factors that have to be taken into consideration in arriving at the critical velocity.

THE AGRICULTURAL CALENDAR OF THE TANJORE DISTRICT.

Month.	Normal weather.	Agricultural Operations.		Effect of abnormal weather on crops.	Proportion sown or harvested to the total Dt. figures.	Remarks.
		Delta.	Non-Delta.			
January.	Light showers—cold and dewy nights—North-east monsoon exhausted	Harvesting of Samba & Ottadan—Groundnut. Sowing: Gingelly, Kullakar in Shiyali.	Harvesting: Samba and Ottadan and Groundnut. Sowing: Gingelly.	Heavy showers affect Samba harvest—Light showers favourable to Cholam and Gingelly. Absence of rain facilitates paddy harvest.	Harvesting: More than half of monsoon groundnut and 1/2 of Samba. Sowing: Gingelly— $\frac{7}{12}$	No sowing in Arantangi — Harvesting Kar, Ragi & Groundnut
Feb.	Dew continues. No rains. Fairly hot days and cold nights.	Harvesting: Samba, Ottadan and Red-gram. No sowing except of Kullakar in Shiyali.	Harvesting: Samba and Red-gram. Sowing: Gingelly and Kuruvai in Arantangi.	Moderate or heavy rain injurious to paddy harvest—staple crop of the district.	Harvesting: Red-gram— $\frac{1}{2}$ Samba— $\frac{1}{2}$ Sowing: Gingelly— $\frac{1}{60}$	Harvesting of Poombalai in Pattukkottai
March.	Days are getting hot—Dew disappearing.	Harvesting: Samba & Red-gram. Sowing: Kullakar.	Harvesting: Samba and Poombalai. Sowing: Kuruvai in Arantangi.	Rain injurious to paddy harvest which is concluding.	Harvesting: Samba— $\frac{1}{6}$ Red-gram— $\frac{1}{6}$	
April.	Hot season begins—Nights are not bad.	Harvesting: Gingelly Sowing: Summer groundnut.	Harvesting: Kuruvai and Poombalai—Gingelly. Sowing: Summer Groundnut and Ragi.	Rain makes soil lose fertility—Gathering of straw adversely affected. Benefits summer groundnut, garden crops, etc.	Sowing: Ragi— $\frac{1}{60}$ Summer groundnut — $\frac{1}{4}$ Harvesting: Gingelly— $\frac{1}{20}$	
May.	Hot month—Westerly winds during latter half indicates break of S. W. monsoon.	Harvesting: Gingelly and Kullakar.	Harvesting: Kuruvai.	Excessive rain prevents soil aeration and prevention of absorption of nitrogen from the atmosphere.	Harvesting: Gingelly— $\frac{1}{2}$	No sowing. Dry cultivation will be postponed if no rain falls
June.	Hottest month—High winds—S. W. monsoon commences by the 15th. Rivers and Channels opened.	Harvesting: Kullakar. Generally no agricultural operations. After the 15th Kuruvai seedlings in dry lands.		Rain favours ploughing of wet and dry lands—Filling tanks in the non-deltaic area—raising Kuruvai seedlings in the Cauvery delta.	Harvesting: Kullakar very small.	Practically no agricultural operations.
July.	S. W. monsoon progresses.	Harvesting: Summer Groundnut. Sowing: Samba seedlings—Transplantation Kuruvai seedlings.	Harvesting: Summer Groundnut. Sowing: Kuruvai, Samba and Ottadan.	Excessive rainfall prejudicial both to Kuruvai crop and Samba seedlings. Moderate rain beneficial to them and to the cultivation of dry crops.	Harvesting: Summer groundnut — $\frac{1}{4}$	
August.	Continuance of the S. W. monsoon.	Sowing: Kuruvai, Samba and Ottadan and dry crops.	Sowing: Ragi, Kambu, Red-gram, Groundnut, Gingelly, Samba and Poombalai in Pattukkottai.	Heavy and continuous rain affects Samba nurseries and the dry crops sown. Absence of rain affects Kuruvai—tanks are dry.	Sowing: Samba— $\frac{1}{6}$ Cumbu— $\frac{3}{4}$ Ragi— $\frac{3}{10}$ Red-gram— $\frac{5}{6}$ Monsoon groundnut — $\frac{5}{6}$ Gingelly— $\frac{1}{6}$	Ragi harvested in Arantangi.
Sept.	S. W. monsoon gives moderate rains.	Harvesting: Kuruvai. Sowing: Cumbu and dry crops.	Sowing: Kuruvai, Ottadan, Samba, Red-gram and other dry crops.	Ripe Kuruvai crop affected by continuous rain — Moderate rain beneficial but absence of rain adversely affects standing crops.	Sowing: Samba— $\frac{1}{6}$ Cumbu— $\frac{1}{4}$ Ragi— $\frac{3}{6}$ Red-gram— $\frac{1}{6}$ Monsoon groundnut — $\frac{7}{7}$ Gingelly — $\frac{1}{30}$	Kuruvai harvest in Tanjore and Mannargudi.

THE AGRICULTURAL CALENDAR OF THE TANJORE DISTRICT (Contd.)

Month.	Normal weather.	Agricultural Operations.		Effect of abnormal weather on crops.	Proportion sown or harvested to the total Dt. figures.	Remarks.
		Delta.	Non-Delta.			
ct.	The setting in of the N. E. monsoon in the middle of the month.	Harvesting : Kuruvai and Cumbu. Sowing : Samba.	Harvesting : Kuruvai and Cumbu. Sowing : Samba, Ragi and Poombahal.	Absence of rain facilitates Kuruvai harvesting — Moderate rain beneficial to standing paddy crop.	Harvesting : Cumbu— $\frac{3}{4}$ Kuruvai— $\frac{1}{80}$ Sowing : Samba— $\frac{1}{4}$ Ragi— $\frac{1}{80}$	
iv.	N. E. monsoon active —Damp weather—at times cyclonic.	Harvesting : Cumbu, Ragi, Kuruvai. Sowing : Samba.	Harvesting : Ragi, Cumbu, Gingelly. Sowing : Samba.	Absence of rain causes a disease 'Soorai' —moderate rain beneficial — Heavy rains submerge tail-end lands and affect standing crops.	Harvesting : Cumbu— $\frac{1}{4}$ Ragi— $\frac{3}{10}$ Gingelly— $\frac{1}{120}$ Samba— $\frac{1}{12}$	
c.	N. E. monsoon continues —Cold weather sets in—Nights dewy.	Harvesting : Groundnut. Sowing : Gingelly.	Harvesting : Kar, Groundnut, Ragi, Gingelly. Sowing : Samba (Arantangi).	Heavy rains affect standing crops and harvest of ripe crops —Moderate rain beneficial — Absence favours spread of Soorai.	Harvesting : Ragi— $\frac{1}{12}$ Monsoon groundnut — $\frac{2}{4}$ Gingelly— $\frac{1}{5}$ Sowing : Gingelly— $\frac{1}{6}$	Gingelly harvested in November & December in the delta tract. Sown in December & January & harvested in April & May. In Arantangi sowing of Samba in November & December.

REFERENCES.

- Howard.—"Crop production in India."
- Ellis.—"Manual of Engineering".
- "Souvenir of the Mettur Dam".
- "Curzon Lecture—Madras University." By Dewan Bahadur R. Narasimha Ayyangar.

REPORTS.

- Indian Irrigation Commission.
- Royal Commission on Indian Agriculture.
- Settlement Report, Tanjore—(Jackson).
- Season and Crop—Tanjore.
- Census—1911, 1921 and 1931.
- Statistical Atlas—Tanjore—(1936).

Historical Geography of Mylapore, San Thome and Adayar

By

PROF. V. RANGACHARYA, M.A.,

MYLAPORE

Mylapore is the southernmost village of Madras excepting the picturesque Adayār suburb. Tradition makes it a very ancient village which came to have its name from the fact that Pārvati performed penance here in the form of a peacock (*Mayūra*, Tam. *Mayil*) before her eventual wedding with Śiva.¹ Historically, Mylapore is connected earliest with the great Tamil writer Tiruvalluvar whom the majority of scholars have placed in the 2nd century A.D. but whom I have assigned to the first century B.C. A temple dedicated to Tiruvalluvar is the monumental evidence of this connection of Mylapore with one of the greatest Tamil luminaries. Some scholars have identified Mylapore with Ptolemy's Malliarppa; and there is every plausibility in the identification. Ptolemy's reference corroborates the importance of the place in the second century A.D. Later records call it Calamina,² which has been supposed to be a corruption of Coromandal or Chōḷa-maṇḍala.

EARLY HISTORY

It is remarkable that apart from the Śaṅgam tradition, the earliest traditional fact given regarding Mylapore is to the effect that St. Thomas was buried there, giving rise thereby to the name San Thome to its eastern part. The tradition, staunchly believed in by the Catholics, is not recognized as genuine by all scholars. An extensive literature³ has grown on the subject, the major portion of which indicates religious enthusiasm more than the critical spirit; but the existence of a continuity of tradition locating St. Thomas remains in the site over which the Mylapore Cathedral has been built seems to be a fact. Some enthusiasts see in the

Alfred legend of a Christian mission to the east an evidence of the visit of the British Christians to the place in about A.D. 880. Still others maintain that the *Betumash* of the early Arab travellers and geographers of the 9th and 10th centuries is derived from a word indicating the Church of St. Thomas. To the Nestorian Christians who constructed the monastery on the St. Thomas Mount has been attributed the establishment of a chapel over 'St. Thomas' tomb; and in the 13th century Marco Polo refers to the death of the apostle from a fowler's arrow at the Little Mount and presumably his tomb at San Thome. Still later, Joseph of Cranganore (15th century) and Barbosa (16th century) mention it. Throughout this period, thus, it has been maintained, there was a small Christian colony; but San Thome became important and eventful in history only with the advent of the Portuguese in the beginning of the 16th century.

THE PALLAVA AND CHŌḼA PERIODS

It was in the early Paurāṇic age, the age when the Pallavas ruled over Tonḍamaṇḍalam, that Mylapore came to be that prominent centre of Śaivite worship which it remains today. The temple which was constructed then and which has been lost in the later renovations, has been dedicated to Śiva under the name Kapāliśvara and to Pārvati under the name of Karpagavalli, while sub-shrines were also set up for the dancing Vināyaka and Subrahmanya under the name Sundara-vēl. A tangible clue to the prominence of the place we have in the psalms and traditions connecting it with the great saint Gnānasambanda. He is further said to have brought back to life the daughter of a local merchant whose remains had been kept in a vessel. A little shrine in the western gate of the temple has been dedicated to this lady, and she is seen to rise from a pot. Obviously Mylapore temple was well known in Pallava times though the buildings existing at present were later works.

There are no inscriptions in the Mylapore temple which throw light on the subsequent history of Mylapore; but a few epigraphs at Tiruviḍavandai and Tiruvorriyūr give some tantalising information regarding the place. The record⁴ at Tiruvorriyūr says that, in the time of the Pallava king Kampavarman (9th century) a resident of Mayilarpil, made the gift of a lamp. The inscription⁵

1. *Educational Review*, October, 1928.

2. See Col. Love's *Vestiges of Madras*, Vol. I, pp. 287, 297 and Vol. II, p. 97.

3. *Vide India and the Apostle Thomas* by Medleycott, 1905, see note 10.

4. Cg 1058 in the *Topographical List of Madras Inscrns.*, by Rangacharya.

5. *Ibid.*, Cg. 198.

at Tiruvīḍavandai says that, in the time of Rājārāja I (985—1013) a merchant of Mayilarpil in Puliyūr Kōṭṭam, gave to the local temple an endowment of a lamp. The former of these records says that the amount was deposited for interest with the assembly of Maṇali which belonged to Tiruvorriyūr. These show that Mylapore was known as Mailarpil in those days and that it was prosperous enough to have rich merchants. The villages of Maṇali, Puliyūr (near Māmbalam) and Tiruvorriyūr figure in the inscriptional records of the early and middle ages; and Mylapore was a religious centre in the midst of equally important centres of Śaivism. The temple of the neighbouring village of Tiruvānmiyūr⁶ figures in a record of later Chōla times in the Triplicane temple.

The Mylapore of Pallava times was also associated with the development of Śrī Vaiṣṇavism. The Vaiṣṇavite Peyālvār was born there, according to legend, in a well. The tradition of the identity of the well is by no means unanimous. It has been located at two places at least in Mylapore⁷ and in the Peyālvār Street at Triplicane as well. The tradition is of value in showing that Mylapore was not sectarian, and that people of different persuasions lived there and contributed to its prosperity.

THE PORTUGUESE ADVENT

The history of Mylapore and San Thome is obscure during the next few centuries; and we get into an era of greater light with the advent of the Portuguese. According to an inscription on a stone⁸ built in the south wall of the Luz Church, Mylapore, it was built by some Portuguese in A.D. 1516. The story is that a few storm-tossed Portuguese mariners vowed to build a church to the Virgin if they were saved from the fury of the elements; that they saw a guiding light flashing out from land; that, steering towards it, they came to the shore; and that, pursuing the light further for a mile into interior, they arrived at the spot where it went out, and built there the Franciscan Luz Church or the Church of our Lady of the Light."

If the inscriptional date 1516 is genuine the Luz Church would be the earliest Portuguese monument in Madras; but its genuine-

6. *Ibid.*, Ms. 333 (241 of 1903).

7. One of these is in the Madhava Perumal temple, and another at a short distance from it.

8. It is to this effect: Fre Padro De Antougio Religio observata De. S. Franco Edificon Eston Ingraja De nossor santra Da Luz Em 1516.

ness has been seriously questioned.⁹ Gaspar Correa, who visited San Thome in 1521, makes no mention of the Luz Church. He further says that Friar Pedro de Atougia was Warden of St. Francis only in 1544. An official report of 1779 assigns the foundation of the Luz and San Thome Churches to 1516 and observes that, of a number of churches built by the Franciscans the Luz Church was under their control at that time. In 1888 Casimero de Nazareth also wrote to the same effect. But the traveller Cunha Rivaro, who visited the place in 1863, refers to the 'Franciscan inscription and says that its correctness was doubtful and that it was, like the earlier portions of the church itself, a work of the 18th century. Col. Love therefore concludes that the Luz Church did not exist in 1516; that the inscription is not authentic; that it was subsequent to the rise of San Thome and developed after 1547, when a stone cross was discovered at the Mount, but earlier than 1582 as Gasparo Balbi saw it then.

The Portuguese advent to San Thome, according to the above conclusion, was earlier than the building of the Luz Church. Danvers assigns the first arrival of the Portuguese to 1504, but without authority. Gaspar Correa, who was in India from 1512 to 1561 and who has much to say about the relics of St. Thomas, seems to assign the settlement to 1522. In 1507, he says, the Viceroy Francisco de Almeyda heard at Goa from some native Christians that a chapel of the Apostle Thomas existed on the Coromandel Coast. The Viceroy sent four men to inquire about it. The information was found to be true and accordingly reported to the King of Portugal. In 1517 two Portuguese businessmen¹⁰—Diogo Fernandez and Bastiao Fernandez—who had visited Malacca and Pulicat, heard of the chapel and visited it. They saw there an old church-like building, 12 cubits long, with nave and aisles, and with timber roofs and pillars. "A sacristy beyond, 5 cubits long, had a dome surrounded by a dwarf spire rising to

9. As by Col. Love in his *Vestiges of Madras*.

10. The statement of Fernandez, as recorded by Rev. Vicar Gaspar Coelho, in 1543, is given in the original and English translation by Rev. N. Figueirado in a pamphlet published at Mylapore in May 1934. This pamphlet also contains two other documents on the relics and the stone cross given by Dom Frey Andre, Bishop of Cochin in 1601, on the basis of the information he gathered. The pamphlet also contains an introductory account of the connection of St. Thomas with Mylapore by the Editor and an Appendix on *The Ancient Monastery of Mylapore* by Dr. P. J. Thomas of the Madras University.

a height of 30 cubits. Crosses and peacock in plaster constituted the decoration. This structure was believed to be the sepulchre of the saint. A similar chapel, a pistol shot away, was said to mark the grave of a Native prince who had been converted to Christianity by the apostle” The two Portuguese reported the matter to Goa, in 1521. At the same time, Gasper Correa himself reached the place, together with a party of fifteen, and made excavations there. It is said that he discovered the remains of a prince named ‘Tani Mudalayar’ and a stone inscribed with the words: “I give one-tenth of income from trade both by sea and land to this Holy House, and, so long as sun and moon endure, I enjoin on my descendants to maintain it under pain of maledictions.” Correa executed some repairs, and made some additions to the chapel.

In 1522, the Governor of Goa, Dom Durat de Menezes, directed a certain Manuel de Frias to make enquiries, and at the same time sent a missionary, named Alvaro Penteado, to the place. The San Thome cathedral contains the tomb of one Antonio Penteado; and this person might be a member of the family of the Padre referred to in 1522. We are told that Penteado desired to build a monastery, but got no encouragement from De Frias; and so proceeded to Goa and thence to Portugal in order to persuade the king to carry out his project. In 1623, the king of Portugal accordingly ordered a strict enquiry to be made. Meanwhile, the Portuguese Governor had sent a few men to carry out some repairs. These were now met by the agent, Manuel de Frias, and extensive repairs were carried out, besides the building of new chapels. A broken lance¹¹ was discovered during the excavations and taken to be the instrument with which the saint had been killed. In the same year Penteado returned from Portugal, became the local vicar, and took charge of the holy relics.

The monastic establishment founded about 1522 soon became the nucleus of a town. In 1540, the infant settlement ran a serious danger of destruction. Correa tells us¹² that, during that year, Manuel da Gama was sent from Goa as captain of the coast with instructions to dismantle the church and settlement and bring the people away. Obviously this was not done.

11. The pamphlet of Rev. Figueirado gives illustrations of the finds discovered in 1523.

12. *Vestiges*, I, p. 291.

The next date of significance in the history of San Thome is 1547. This year, the famous ‘bleeding cross’ at the Little Mount, with its Pahlavi inscription, was found by some excavators. A Brahman interpreted this as an archaic inscription mentioning Saint Thomas’s death at ‘Antenodur’, and his burial at ‘Maile’ or Mylapore. We now know, on the authority of Dr. Burnell, that this inscription belongs to the 8th century; that it is in Pahlavi; and that it simply mentions the crucifixion of the Christ. But the Brahman’s interpretation made an impression on his contemporaries, and led not only to the building of the Church at the Little Mount, but to the growth of San Thome as the reputed burial-place of the saint.¹³

The phenomenal growth of San Thome is said to have given rise, if we are to believe Manuel Faria de Souza (who published a work called *Asia Portuguesa*¹⁴ at Lisbon in 1666-75), to an interesting episode in 1558. A Portuguese who cared more for self-respect than his religion, we are told, persuaded Ramaraya of Vijayanagar to march against the town, telling him that its plunder would be worth two millions. At the head of 500,000 men, Ramaraya is said to have marched against the place. Peter de Ataide asked the people to defend themselves in vain, and so went away to Goa. Rama Raya was received by the people with a present of 4,000 *ducats*, but he asked the citizens to produce all their valuables before him. On seeing that the total wealth was not above 80,000 *ducats*, he had the false informer torn to pieces, restored the citizens to liberty, and gave back their property. A single silver spoon which was missing was found out, and given to its owner! We do not know how far this is true.

We understand from Caesar Frederike¹⁵ (who travelled in the East from 1563 to 1581) that, by 1567, San Thome was a big and prosperous place, with a very busy trade. This traveller observes that ‘the House of the Blessed Saint Thomas’ was a church of great attraction venerated even by the ‘Gentiles’ as the scene of the great miracles of the apostle. He describes the Portuguese city as the fairest, though not the biggest, in the Vijayanagar dominions.

13. Col. Love observes: “Correa says that a signal fire was kept burning nightly on the Mount for the benefit of Mariners, who, seeing it, ‘strike their sails and make obeisance’.” (*Vestiges*, I, p. 291).

14. This work was translated from the Spanish by Captain John Stevens, 1694. Col. Love quotes from it in *Vestiges*, I, pp. 243-4. Faria was not quite correct or consistent.

15. *Purchas, his Pilgrims*, Reprint of 1905, Vol. X; *Vestiges*, I, 291-2.

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He dwells, with admiration, on the skill and daring with which the owners of the Masula boats carried goods and things to and from the ships of merchandise, and landed or laded them. Outgoing goods, he says, were covered with ox-hides, so that they did not run the danger of being drenched when carried to the boat.

Another Venetian, Gasparo Balbi¹⁶ by name, who was a dealer in gems by profession, and who left Venice for the East in 1579, refers to the fortifications and churches of San Thome, indicating its growth into big dimensions. Balbi arrived at San Thome from Negapatam, after touching Mahabalipuram on the way, on 30 May 1582, and stayed there for a year. He says that the St. Thomas Church faced west, and had a low gate on the fortified sea-side which even horses could enter but with difficulty. Besides the Church of St. Thomas, which was under a Vicar sent by the Archbishop of Goa, there were three others. One of these was Franciscan, and well served by the Capuchins. Another was known after John the Baptist, and full of the Fathers of St. Paul of the Company of Jesus. Balbi says that it was built during his stay, and that a piece of timber miraculously cast out by the sea and measuring exactly what was needed for the church, was used for the purpose. He refers to another Jesuit church of the Fathers of St. Paul, dedicated to our Lady and identified by Col. Love with the Mae de Deus Church which exists even now in a dense grove of palms to the west of the high road to Adayār. Balbi says that 'the Gentiles' were converted and baptised largely in this church. Still other churches referred to by Balbi are those of Our Lady of Light at Luz and of St. Lazarus which has been identified with the existing church of St. Lazare a few yards south of San Thome, to the west of the road to Adayār and south of the Mae de Deus Church of which it is a chapel of ease even now. Balbi describes San Thome as a fair city equal to any he saw in his country. Its houses, he says, were joined in such a way as to succour one another. He refers to the native town (of Mylapore), which had mud walls, and which had an 'Adicario' who gave justice to its soldiers and other inhabitants.

THE BISHOPRIC ESTABLISHED (1606)

Till 1606 San Thome was part of the diocese of Cochin. In 1606, the bishopric of Mylapore was instituted under the jurisdic-

tion of the Archbishop of Goa, and Dom Fr. Sebastia de S. Pedro became its first Bishop.¹⁷ He is called Dom Frey Sebastian of St. Peter in some records. In 1613, he recognized, in a formal grant, the great services rendered by the Jesuit order to the Church in converting numerous souls by their behaviour, doctrine, preaching and example, and acknowledged their right to the proprietorship of the Church of Madre De Dios (i.e., Mae de Deus). The Jesuit Rector at the time was Fr. Nicholas Tevente. The church and its appurtenances were in Jesuit hands till the suppression of the Order in 1775. The Bishop's stipend was about £350 per year. The first Bishop of Mylapore seems to have not only encouraged the Jesuit endeavour to convert 'the gentiles,' but to have renovated the Church of St. Thomas. From the researches of Rev. James Boyle Col. Love infers that "prior to 1552 an Augustinian church was erected a few yards to the west of the original chapel, and that, about 1606, when the bishopric was founded, the space intervening between the two buildings was roofed in. The composite structure formed the old cathedral till 1894, when the whole was demolished to make room for the present edifice, which includes within its walls the area occupied by the earlier sections."¹⁸

OBSTACLES TO FURTHER PROGRESS.

We have reasons to believe that the growth of San Thome would have been even more phenomenal than it was but for some troubles it had. These troubles were both internal and external. In the first place there were quarrels amongst the Portuguese themselves. Faria Y Sousa says¹⁹ that they killed one another without any regard for human or divine laws, so that even 'the Moors and Gentiles abominated their wickedness'. Another trouble is said to have arisen from the neighbouring 'blacks', by whom we have to mean the agents of Vijayanagar, as Mylapore was at this time the seat of an Adhikāri of that State. We do not know why there was hitch between San Thome and 'the blacks'. In 1614 the latter are said to have constructed a barricade and to have thrown 10,000 shots into the place from a pagoda near St. Francis—presumably the Kapāliśvara shrine—but were compelled by Captain Emanuel de Frias to surrender their fort for want of water.

17. *Vestiges*, I, pp. 303-2.

18. *Ibid.*, p. 292.

19. *Vestiges*, I, p. 296.

16. *Purchas*, 1905, Vol. X, pp. 146-8; *Vestiges*, I, pp. 292-3.

THE PROSPERITY OF MYLAPORE IN EARLY 17TH CENTURY.

Mylapore is referred to by Thomas Herbert²⁰ in 1628. In 1635, Capt. Pedro Barretto de Rezende Private Secretary to the Portuguese Viceroy,²¹ describes it as a prosperous place, under Vijayanagar. The 'king of Bisnaga', he says, was the son of a king who formerly ruled over the whole of Hindustan but had lost much of his power and "passed through divers vicissitudes, so much so that on one occasion he had to escape in a bundle of soiled linen which a washerman, called in these parts *mainats*, was taking to wash; and having grown up in hiding, recovered part of his kingdom by force of arms with the help of a faithful subject". De Rezende presumably refers to Emperor Rāma (1620-30) who came to the throne after a celebrated war of succession following an incident similar to the one referred to by him, and described by the Portuguese writer Barrados; but the Captain seems to be quite inaccurate in his historical allusion. What he observes regarding the condition of Mylapore is very interesting. The Vijayanagar emperor is said to have appreciated peace and valued the friendship with the Portuguese though for reasons of self-interest. With business acumen the Rāya is further said to have encouraged the construction, along the outside walls of San Thome, of a number of houses in stone and mortar "with orchards producing excellent fruit." It is obvious that Mylapore had the cultivation of fruits as one of the sources of its prosperity. "All the Indian fruits can be grown here" says De Rezende, "because the climate is good and very salubrious. The inhabitants enjoy sound health, the land is fertile, and abounds in all the necessities of life, everything being extremely cheap." He further observes that the stuffs of Mylapore were of the same texture as those of Negapatam, and that the coloured cloths were better than the similar products produced elsewhere as they were dyed with the never-fading colours obtained from Manār and Ceylon. Mylapore seems thus to have been industrially well off in the early part of the 17th century.

20. He was Secretary to a Persian embassy, and did not personally visit South India. He was in the East from 1628 to 1629, and on account of his travels was published in 1634. Herbert says that the relics of St. Thomas were carried in 1517 to Goa and preserved there! See *Vestiges*, I, pp. 296-7 for bibliographical history and extracts.

21. Two versions of his work are available—one in the British Museum and the other in the Lisbon National Library. Danvers first noticed it in his 'Report on the Portuguese Records relating to the East Indies' (1892). The British Museum version has been translated by M. Lopes, Vicar-General of San Thome. Col. Love quotes from it. Vide *Vestiges*, I, pp. 277-8.

THE SAN THOME FORT.

Rezende gives an elaborate description of the fortification of San Thome and its apparently fourteen²² bastions. The fort-wall followed the line of the houses, the doors of which were almost washed by the waves. The sea, he says, was constantly advancing in consequence of a prophecy of the saint. The wall was five yards high including its parapets which were ten spans thick at the top. On the sea face it had three bulwarks. On the north there was a bastion known after St. Dominic and protected by breastwork and artillery. On the south was a bulwark known after St. Paul. Before the northern bastion was one of the four gates of the city with a watch-house at the top, protected by two guns. Further on, was the Santiago Bastion with a postern. Then followed the bastions of Antonio da Costa, St. Augustine, and the Blacksmiths, the last of which was in the west-north-west towards the land. "Fronting the land," continued Rezende, "is the gate of St. Francis, one of the four with a new bulwark". Then comes another stretch of wall with the large bastion of Francisco d'Almeida. Further on stands that of Salvador de Resende, and then that of Joam dos Reis de Sousa. Behind this, still nearer, is the bastion of the Mae de Deus, which is in a line with that of St. Paul. These, with the breastwork and watch-house, make twelve. The bastions are built at 100 paces more or less along the sea face, and on the land side at distances of 70 or 80 paces, and all flank the walls adjacent to them." The city had 30 guns of iron and one of brass, which were from three to nine pounders. There was also another big gun which was built up. There was plenty of ammunition. The residents were all Portuguese, and numbered 120. There were also 200 'Black Christians', married and capable of bearing arms. The servants of the Portuguese were also well armed and good shots. Besides, there were 500 musketeers for garrisoning the place. The captain of the city was a nobleman in whom great trust was reposed. The city was constantly harassed by the Dutch from the side of Pulicat, 'seven leagues off'. There was no harbour for the ships, and so those sent from Goa rarely returned thither without loss and damage. Outside the town there were many Christians, 600 of whom were fishermen, and the rest servants of the city people. The former were Mukkuvans by caste, and had the reputation of good seafaring men capable of serving in the vessels cruising

22. He is not very clear as to this number. See *Vestiges*, Vol. I, p. 300 for the plan of San Thome about 1635 after Rezende.

ing on the coast. The biggest salaried official at San Thome was the Bishop. He had a stipend of two thousand cruzadoes (£ 350) per year, paid from Goa. The Captain of the city received an equal amount. Rent was paid to 'the Lord of the soil' up to half the customs revenue of the sea gate. The clergy of the Cathedral had an income of 300 *pagodas* from a village granted by 'the lord of the land'. It was not much, but the people were well off, as living was cheap. The convents and churches of St. Dominic, St. Augustine, and St. Paul, with their orders, lived on alms within the city. "St. Dominic and St. Paul were probably near the bastions in the northern and southern faces which bore corresponding names. If so, a church of St. Dominic, now a nunnery, which stands near that of the Rosary, must be of more recent construction. St. Paul's was perhaps near the site of the chapel now called St. Rita's attached to St. Peter's Seminary." (St. Rita's was finished, as an inscription on a stone over its east portal shows, in 1740 when Father Gaspar dos Reis, born in San Thome, was the Vicar). The Augustinian church is believed to have been adjacent to the Cathedral. Besides these, there was a 'Church of Our Lady' which has been suggested to be the same as the present 'Rosary Church,' which bears the date 1635 on its portal. The churches outside the walls were those of St. Francis (probably near the gate of that name in the west), the Luz, Mãe de Deus, and St. Lazare, the history of which has been already traced.

It may be pointed out that there are a number of memorials in memory of the Portuguese men and women who died for their country. J.J. Cotton gives, up to 1642, thirteen inscriptions of this character, the earliest being that of a Riuvas de Sequeira on 3 September 1557 (except the tomb of St. Thomas in A.D. 68). There is nothing of interest in these. It may be pointed out however that in one of them a Kōja (Armenian merchant) occurs. Another is that of Antonia Penteado already mentioned. An epitaph of 1635 refers to a person of importance on the Tinnevely Fishery coast, shortly to be the scene of Xavier's labours. Altogether, the number of monuments of interest is surprisingly small.

In 1637 there took place an important event in the religious history of San Thome. On the death of the 3rd Bishop, Dom Paulo d'Estrella, the see was not filled up, and it remained vacant till 1693 when Dona Gaspar Alvares was consecrated in the revived see.

The Dutch aggressions had a grievous effect on the trade and prosperity of San Thome, as records dated in 1635 and later show,

Still, in 1637, the king of Portugal ordered 'the Captain General of Meliapore' to use every possible means to prevent the establishment of a factory by the English at Covelong, 17 miles further south.²³ In 1639, however, when Francis Day was about to plant the Madras settlement, the Portuguese were more friendly and even urged Day to establish the projected factory at San Thome itself; but this was due more to the desire to keep the British under the Portuguese control than to any real friendliness.²⁴ Albert de Mandelslo,²⁵ who wrote just at this time, says that San Thome was not very great but that the houses were of stone and well-built; that the Church had no steeple but could still be seen at a distance; that there were 600 Portuguese there besides some Armenian merchants; that as the king of Portugal sent no magistrate to keep order it was daily subject to disorders; and that Mylapore, which he wrongly located at a little distance to the north of San Thome was fallen from the pristine glory it had when it was the capital town of the Kingdom of Narsinga (Vijayanagar). Mandelslo refers not only to the Pagan but the Mahomedan population at Mylapore, which seems to indicate that, owing to the weakness of Vijayanagar, the Muslims were beginning to make advance into the further south of the Peninsula.

We have thus far traversed the history of Mylapore and San Thome down to the foundation of Madras in 1639. The latter fact had a direct bearing on the history of these places. The Portuguese at San Thome were invited by the new White Town authorities to settle there like Englishmen, and many took advantage of the offer. The result was the further desertion and desolation of San Thome. And it is remarkable commentary on the religious sense of the Portuguese that, within a few months of their settling in the fort, they succeeded in having the Capuchin Church of the celebrated Father Ephraim de Nevers established in the fort. The worthy Father was venerated by one and all; and always served as mediator between the English and the Portuguese of the fort as well as San Thome.

And indeed the necessity for such an interference existed from the very beginning. The nearness of the settlements could not but give rise to unpleasant relations. In October 1640 Day,

23. *Vestiges*, I, p. 303.

24. *Ibid*; O.C. No. 1718, dated 25th October 1639.

25. Mandelslo was in India in 1638-40. His *Travels* was published in London in 1669 in the form of a translation by J. Davies.

Cogan and others wrote from Masulipatam to Surāt promising not to be offended with 'the Portugalls' even if they took their cloakes or 'neerer garment.' A month later they wrote to say that Julio Munis da Silva, the Governor of San Thome, was 'of good neighbourhood'. Still, only a few days later, they wrote that the Portuguese of San Thome did their best to oppose the formation and progress of the Madras Fort, but that the progress of the fortifications had attracted 300 or 400 families of weavers, painters and other artificers to come and live at Madras thereby leading to its great expansion. In January 1642 the Surāt Agent complained to the Directors that the Portugalls' had a sinister moral influence. Many idlers, men and women, crowded from San Thome into the fort, and the influence of the latter on the soldiers' morals was by no means healthy. Once, in August 1642, three Portuguese soldiers who belonged to the Armada sent for the relief of San Thome, came into the British town, drank in an arrack-house in the company of a Dane, and, losing all balance, assaulted him and wounded him in seven places. One of the two British soldiers who were sent to prevent the scuffle was killed on the spot by Anthony Myrando, the most deadly of the guilty gang who had already committed, as he himself confessed, seven murders in the Portuguese town with immunity. The man was caught and, in spite of importunities from San Thome for his release, was shot down in the presence of the British *corps du guard*. The drastic act made the Portuguese vagabonds a little sober, and gave some immunity to the Fort. It was indeed necessary, say the Company's records; for within the few months' stay from May to August 1642 the soldiers of the Portuguese Armada at San Thome had committed an incredible number of crimes and murders.²⁶

It seems that Cogan was censured by the company for establishing the new settlement. In September 1642 he and two of his colleagues justified their wisdom in a letter to the company. In the course of it they said that the San Thome Portuguese were subject at the time to the Nāyakkan of Tanjore; that he put in, almost monthly, a new Governor to collect the customs from the Portuguese; that it was impossible, on account of the greed of the Indian chief, to reside in that city; and that, above all, business men must, in order to be successful there, be stick-free and shot-free, and also such as could digest poison as it was 'the daily practice in San Thome', where there was no such thing as justice.

26. See *Vestiges*, I, p. 43.

They assured the Directors that they always tried to avoid brawls and blows with the Portuguese, and that there was no failure on their part to be as friendly as possible with them.

In 1646, we find from the records that there was a trouble which did not fortunately become serious. In that year the Vijayanagar ruler, Śrī Raṅgarāya, was overthrown by Golkonda, and the country covered by old Tondamaṇḍalam changed hands from the Hīndus to the Moslems. Thomas Ivie, the Company's Agent at Ft. St. George (1644-8), made himself friends with the new power. In 1646, Mir Jumla, the Golkonda General, pitched his camp in the neighbourhood of Mylapore, and undertook a siege of San Thome. Ivie placed a gunner and several soldiers at the disposal of the Moslem General. The terrible rise in prices and other hardships led to many Portuguese women leaving their husbands and families for Madraspatam. The Portuguese resented all this,²⁷ and a tussle followed between the two nations. Fortunately, it did not become serious. In 1647, San Thome lost 15000 people by death in a severe famine. Col. Love suggests that it must then have had four times the population of Madraspatam (about 75000).

In 1649, there was once again trouble. "According to Manucci, the Capuchin friar Ephraim wrote to Manuel Mascarenhas, Governor of San Thome, in regard to ecclesiastical abuses prevailing in the Portuguese town. Personal discussion was invited but Ephraim, on proceeding to San Thome, was seized near the Luz Church, while he was still in native territory, and dragged through the streets to the Jesuit College, where he was heavily ironed. After an interval, he was put on board ship, still fettered, and taken to Goa to be tried by the Inquisition on charges of heresy. There he remained in confinement until November 1651. Greenhill, having in vain remonstrated against this high-handed action, retaliated by arresting and confining in Fort St. George the chief ecclesiastic of San Thome." (Love, p. 101). In a letter to the Company in December 1661, the Agent refers to 'the bad conduct' of the Friars of San Thome and to the captivity of Father Ephraim; and adds that, as all representations failed, they arrested the Pādri Governor of the Convent of Friars at San Thome. In June 1651, the latter escaped, and so the hopes for father Ephraim's

27. Letter of Maximilian Bowman (26 Novr. 1646). See *Vestiges of Madras*, I, p. 78-9. The flight of Richard Cogan to San Thome, his conversion to papacy, may be regarded as a counter stroke on the part of the Portuguese.

liberation were practically lost. The Portuguese Government, however, liberated him for the sake of peace, as they maintained. An agreement was then arrived at with San Thome, consisting of several articles, for the preservation of mutual peace. The fugitive of either party, whether slave or free, was to be resorted. If any married woman fled from one place to the other, contrary to the will of her husband, she must be restored on his request. This was not to apply to the case of a woman who did not live with her husband who was absent from his proper dwelling. A slave flying to the other place must be similarly restored to his master, and a debtor could be taken from one part to the other only when there was the certainty of safe conduct being given him by the man in whose power he was. Past disagreements and injuries were to be buried in perpetual silence as if there had never been any. From the moment of the 'signment' of these articles, they were to truly, firmly and faithfully continue in sincere love and amity! The agreement was signed by Henry Greenhill and two of his colleagues for the English, the Pādri Governor and the Captain General of San Thome, and Captain Franciscas Vera de Figueredo, a man who was known to the English and who acted as the emissary in the whole transaction, for the Portuguese. As the result of this agreement, Father Ephraim returned to Madras in April 1652.

The establishment of peace between San Thome and Fort St. George in 1652 did not after all bring about a revival of the prosperity of San Thome. Its subsequent history was one of rapid decline, thanks mainly to the progress and rivalry of the Dutch. In 1644, the Indian merchant 'Mollay' had been very loyal to the Rājā of Vijayanagar, and helped him to subdue the subordinate chiefs, as the result of which he was made his treasurer and, as the British at Madras feared, 'the Governor of all the sea-ports even to the very verge of Ceylon.' The Dutch subsequently became friends with the Sultan of Golkonda who, as has been already said, took over this part of the country from Vijayanagar about 1646. The Dutch and the Moslem rulers attacked San Thome, each being desirous of being the master of it.²⁸ In 1662 the Moslems succeeded in starving the place into submission. The population in the

28. The Madras Records tell us that in 1656 Mir Jumla's nominee as the Governor of Poonamalli and San Thome was a Bola Rao (Balliraw). He was a source of constant troubles, like his master, to the English too. Apparently Mir Jumla's occupation of San Thome was as much inspired by the desire to control his own turbulent servant as to have the Portuguese city.

main then flocked to Negapatam in the first place and then to Madras, contributing to the numbers as well as wealth of the latter. It seems that, in 1662, when there was alliance between Catherine of Braganza and Charles II, San Thome instead of Bombay would be given as the dowry for that Princess. It is very interesting to speculate what would have taken place if this had been done. We know that they would have gladly helped San Thome against the Sultan but for the fear of his turning against them. Francois Martin, later on the founder of the French settlement of Pondichery, who had been a resident at San Thome for twelve years before the Moslem occupation, gives a detailed account of the fall of San Thome in May 1662. This remained a MS till it was published by Col. Love, in his 'Vestiges of Madras'.

THE MOSLEM OCCUPATION AND ITS EFFECTS (1662-72).

The Moslems of Golkonda held San Thome from 1662 to about 1672, when they were ousted by the French. The place declined under Moslem occupation. A Spanish Friar of the name of Dominic Navarette, who was at Madras in 1668, says that he was refused admittance into San Thome and had to content himself with a view of its fine walls and buildings from the gate.' A Frenchman Francois L'Estra²⁹ who accompanied the French expedition to the Indies in 1671 writes of the Moslems in San Thome and they seem to have constructed fresh fortifications. The western gate was built after the annexation of some land further west as far as practically the present Arundel Street and this area covered three times the area of Madras. The sea-face was constructed with stones taken from neighbouring temples. The Moslem occupation led to the decline of Portuguese life in various ways. A large number of them were expelled and they had to find refuge in the fort. They received welcome from the English who, owing to the need for men in service, particularly that of defence, welcomed them. The Directors were rather alarmed at this but the Company's agents pointed out that as soldiers they were likely to be faithful owing to their hostility to 'the Moores'. According to an Indian writer of 1670 the number of Portuguese that took refuge in the fort was about 3000, while there were only 300 Englishmen. The English

29. Besides Navarette and Francois L'Estra there were others who came to Madras during this period. John Nieuhoff (1662) gives a sketch of the churches and the magnificent works of the Portuguese in the past. Thomas Bowray (1669), a free mariner, describes a visit to the Mount and its religious significance.

did not only receive the Portuguese but once at least thought of purchasing San Thome as the result of the scuffle between Winter and Foxcroft. Instructions from home were to the effect that negotiations for that purpose were to be inaugurated in case Winter refused to yield; but his submission made it unnecessary.

THE RUIN OF ST. THOMAS' CHURCH.

The Moslem occupations also affected the fortunes of St. Thomas Cathedral and other churches injuriously. According to Portuguese records they razed the church to the ground leaving only the walls of the sanctuary, "a very narrow chapel built by the Saint himself." The church was rebuilt after 1683, when the Portuguese received permission from Golkonda to rebuild the city and, in 1893 it was pulled down for the construction of the present extensive Cathedral, the centre or transept of which was located over the Apostle's tomb.

THE FRENCH CAPTURE OF SAN THOME (JULY 1672).

We now come to a new epoch in the history of San Thome, namely, the French attack and capture of it in 1672. It was on 10th July of this year that Admiral De La Haye anchored before San Thome. He received promises of supplies from the English in the Fort, but was refused permission to land by the Moslem Governor of San Thome. As the French had been treated ill at Masulipatam by the Sultan of Golkonda, the Admiral thought that this was a favourable opportunity for retaliating on him. He therefore opened fire from the ships, and pushed through the surf to the shore. Another attack was launched on 14th July. It was successful. The town was taken and plundered, though the Moslem Governor's residence alone brought some spoils, and the *Te Deum* sung for the first time in the Cathedral. The victor was congratulated by two members of the Madras Council, sent by Governor Langhorn.

THEIR FORTIFICATIONS AND DEFENCE—WORKS

The French seem to have numbered about 600. After the occupation of the city, they took steps to strengthen the fortifications against a re-attack on the part of the Moslems. They mounted guns on the bastions, strengthened the walls on the west side (which seem to have extended somewhere between the present bazaar and Arundel Street), and founded a market outside the west gate for getting supply from the local people. The old bas-

tions were renamed *Porte Royale* (in the west); *Colbert* (S.W. Angle); *St. Louis* (N. W. Angle); *De Rebre* (N. face); the *Dauphin* (north-east); *Caron* (south); *De La Haye* (south); the *L'admiral* (south-east); the *Bourbon* (middle east); the *Francois* and the *major* (north and south of the *Bourbon*), etc. Several extensions like the *Marin* and *Portugais* beyond the south-west bastion and the redoubt *Sans Peur* near the bank of the river (which is now a backwater) were also among their works. The fort had already extended to the west as far as Arundel Street, and from the northern entrance to the town to some distance north of the *Adayār* river. The French constructed a ditch and rampart around the Fort, traces of which are lost, "unless the masonry debris which covers the eastern slope of the sandhill on which the town is built is a relic of demolition." The French also constructed an outer line of entrenchment, with block houses at intervals. It extended to near the *Adayār* backwater, then a river which debouched at the northern end of the existing rifle range. It may be pointed out here that the *Bourbon*, defending the middle of the east face and the sea-gate, contained the flagstaff, the pole of which exists now, misnamed or misconnected with the Dutch and more probably Moslem or French.

THE FIRST MOSLEM COUNTER-ATTACK (SEPTEMBER 1672 TO MARCH 1673).

About the close of July, the Moslems began the counter-attack upon the French occupiers.³⁰ A force of 1500 men posted at Kodambakkam (literally, border village) established a blockade, and prevented the importation of provisions. On 24 August, a detachment of 2000 troops appeared in the vicinity, and set fire to detached houses. De La Haye made a sortie against them, and occupied and fortified the *Kapālēsvarasvāmi* Temple, which was about 400 paces beyond the western walls. On 3 September, the Moslems succeeded in investing the place. It was at this time that De La Haye demolished the houses near the walls for military purposes, and raised the redoubt to the south in order to protect the fishing village (now called Domingo street), and named it Fort *Sans Peur*. British Madras sent provisions, but the Moslem occu-

30. The chief authorities for these events are: Fryer, whose '*A new Account of East India and Persia*' was published in 1698; Francois L'Estra, a traveller and eye-witness whose *Relation on Journal d'un Voyage* was published at Paris in 1677; and Francois Martin's *Memoire* which is summarised by Col. Love (*Vestiges*, I, 313-6).

pied the Pārthasārathi Temple, and prevented any more supplies by land, so that it had to be sent by sea in *catamarans*. In the subsequent days, the Moslem fire was opened from the small temple near Chitrakulam. It was guided by three generals named "Babasaheb, Trimourboursouraja and Mondelnaigue", of whom the first was the chief. Much fighting took place in the area now covered by the streets of Mylapore, the details of which it is unnecessary to repeat here. It is enough to say that, thanks to reinforcement from Porto Novo, Masulipatam, etc., and thanks to their gallantry, the French were able to hold their own. One interesting incident in the midst of the engagements was the use of a big gun by the Moslems, which threw stone balls of great size. The gun was known as 'La fleche de Ram', and it was destroyed by the French for the sake of which a thanks-giving service was held in the Cathedral. One of the Moslem Generals, Mondelnaigue, was killed; and the other two, being wounded, they had to retreat for a time to 'Pondemalion' (Poonamalle). On one occasion, De La Haye destroyed the Moslem field works, and occupied the pagoda of Triplicane in the face of the protests of the British, as there was then a doubt as to whether it was owned by the British or the Moslems. After occupying the Triplicane Temple, De La Haye was requested by Langhorn not to take any military action in the neighbourhood, as the British claimed it. Thus, by March 1673, the French were victorious in the field.

SECOND MOSLEM ATTACK WITH DUTCH HELP (AUGUST 1673—AUGUST 1674).

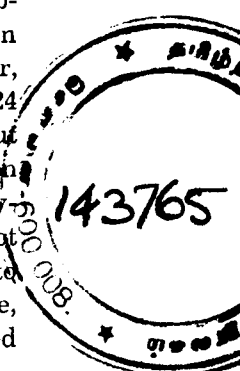
There was peace during the next five months. During this period, De La Haye went to Masulipatam in order to negotiate a treaty with the Sultan for the grant of San Thome formally to the French. He was not successful. On the contrary, he found the place, on his return, attacked by the combined forces of the Moslems and the Dutch. It is unnecessary to give details of the military actions which followed. It is enough to say that the Dutch and the Moslems were able to put even Madras to trouble from their camp in the Triplicane Temple, from which shots were fired occasionally into the fort. The 'Moors' and the Dutch carried fire and havoc as far as the villages south of San Thome which they burnt. It may be noted that in several skirmishes in the course of these engagements the bridge now known as Barber's Bridge figured. The bridge then crossed a drainage channel, which is at present extinct except near the bridge where it has been adapted to the course of the Buckingham Canal. Often in the sight of

Triplicane, naval manoeuvres took place, and the people of Fort St. George and of the neighbourhood crowded to the shore to view the battles between the Dutch and French vessels. The gallant De Robrey, the defender of San Thome, was killed by cannon shot, and buried in the Cathedral; and his tomb is practically the only interesting monument left by the French at San Thome.³¹ It is unnecessary to give details of the other incidents in the second siege of San Thome. The Moorish cavalry occupied the Luz Church, and harassed the French occupiers. The latter's position became precarious. The treasury was exhausted. Assistance was solicited from the Nayaks of Madura, 'the Duke of Ginji' (Sir Khan Lodi), and the Zamorin of Calicut. Eventually, on January 3, Martin had to leave the place for Pondicherry, of which he was destined to be the maker. Blockaded by Dutch ships at Triplicane, with no money to pay the soldiers, with no provisions obtainable in spite of skirmishes into the enemy's quarters, subjected to losses by cyclone, deserted by sailors, men and even leaders, De La Haye had eventually to write to the Dutch officer, Pavillon, at Triplicane, suing for peace. It was concluded on 24 August 1674. By it De La Haye was to surrender the place, but to be allowed to depart with all honours of war, and given even facilities for being taken to France. The Treaty caused annoyance to the Moslems, as it was concluded with the Dutch and not themselves; but the Dutch gave San Thome a few days later to Golkonda. Abul Hassan invited De La Haye to enter his service, but he declined. He reached France in May 1675, to be received well by the king and die in his service.

THE SULTAN OF GOLKONDA DESTROYS SAN THOME FORT (1675).

The handing over of San Thome to the Sultan of Golkonda in 1674 was followed by the demolition of the fortifications which had been built by the various rulers in the past. It may be mentioned that Governor Langhorn was very much interested in moving the Sultan to do this work of destruction. There was a proposal in December 1674 to restore it to the French for a lakh of rupees. The Dutch, however, persuaded Madanna, the celebrated minister of

31. Col. Love notes with surprise that though many officers and men must have been buried at San Thome during the French occupation, there is not a single monument extant. I may draw attention to the fact that the European tombstones found in the innermost parts of the Triplicane temple were obviously placed there during the time of the French occupation.



Golkonda, to oppose the scheme with success. It was this failure that led Martin to found Pondicherry in the ground granted by Sher Khan Lodi, on behalf of the king of Bijapur a few months back. Thus, thanks to the endeavours of both the English and the Dutch, San Thome and its fortifications were ordered to be destroyed by the Sultān. Even the churches and principal buildings were included in this vandalistic work; but fortunately, there was some check to the work of destruction shortly after. The "interposition of the Moslem Governor of San Thome, who represented that the demolition of so fine a town would be contrary to the royal interests and would also prove a costly operation," led to their being spared. Langhorn supplied 200 able coolies for the purpose of demolition, but did not take a very active part, as he was afraid of embroiling the Company with the French and the Portuguese who, for historical reasons, had claims on the place.

INDIAN INFLUX INTO MADRAS PATAM.

Thus ended the military episode of French occupation and Moslem conquest of San Thome. One result of it was a large influx of Indians of the place to Madras. Their advent led to the building of houses in such a way as to give rise to the Right and Left Hand caste disputes in 1698 and later on; but Madras prospered, and took the place of San Thome as the primary city of trade in this part of the world. The inhabitants of San Thome,—the Portuguese, Moslems, Hindus and people of other nations—were exceedingly poor, and there was no hope of the place ever recovering its ancient glory. Even the very stones of the destroyed fortifications helped the English in renovating occasionally their works in Fort St. George.

THE BRITISH NEGOTIATIONS FOR RENTING SAN THOME OUTWITTED BY THE PORTUGUESE (1677-84).

In 1677, Governor Streynsham Master negotiated with Golkonda for renting outlying villages like Egmore, San Thome and 'Tiruvatore'; but was not successful in gaining his object. The Sultān had given it in farm to the well-known merchant Verona. In 1678, Master renewed the attempt. The minister, Madanna, said that he would grant the prayer provided a payment of 3000 pagodas was made for the issue of the grant of the rentals of San Thome and Egmore. The sum was paid, but still the negotiations fell through. In the meanwhile, Lingappa, the Governor of Poonamalle, prevented the free importation of grain into the city, and his Collector

of the customs gave notice that he would not permit any goods or provision to come into Madras. Master had to assert his right by force, and pull down the houses of the watchmen of San Thome and Triplicane. When Verona's tenure ended in 1684, Master made still another effort. He was now prepared to check the growth of a Moslem San Thome, in case it was not granted or leased to him, even by force. As a matter of fact, the serious obstacle arose from the Portuguese residents of Madras who wanted to get the place back from the Moslem and settle there once again. Indeed, in 1687, they hoisted their flag at San Thome, thinking that their object was already attained. But in 1688 the kingdom of Golkonda was conquered and annexed by the Mughals; and Governor Yale entered into negotiations with the Grand Mughal. As the result of this, San Thome, together with certain dependent villages, was promised to the Company for a rental of 3000 pagodas per annum. At the last moment, however, the Portuguese snatched the prize and outbade the English. The Portuguese thus once again settled in the dismantled and ruined city. As a matter of fact, their power was confined to the European quarter, and they were tyrannised by the Mughal Havildār.³²

ANGLO-PORTUGUESE HITCHES AND MOSLEM REOCCUPATION.

The Portuguese occupation of San Thome caused unpleasant relations between them and the English. In 1694 a criminal fled into the Portuguese town, and the English demand for his surrender was refused. Thereupon Governor Higginson ordered the arrest of any San Thome Portuguese in Madras. Hitches like this³³ followed; and on January 8, 1697, the affair was settled by the Mughal officials from Arcot occupying San Thome themselves! The fortifications which had been left undemolished were now completely destroyed, and the materials were useful as quarries for the neighbourhood. Thus passed away for ever the Portuguese part in the history of San Thome. The Portuguese dwellings are now surrounded by Muhammadan houses, and the Portuguese ceased to count for ever. In 1702 Diwan Muhammad Sayud built a rampart of earth round the Moslem and Portuguese quarters. Perhaps it was in his time that the streets Poñpalli, Chinnapalli etc.,

32. In 1694 the Havildar or Governor, whose jurisdiction extended as far as Pulicat was Haji Muhammad Ali.

33. See *Vestiges*, I, p. 575 for examples.

arose in San Thome as the result of the large number of Moslem parts which came into existence.

RELATIONS BETWEEN THE FORT AND THE RESIDENTS OF SAN THOME

In 1700 a remarkable quarrel arose between the Bishop of Mylapore and the Council. Bishop Gasper Alfanzo, the fourth of the line (1693-1708), sent a notification to the Pādre Friar Michael Angeles in the Fort, asking him to read certain things on pain of excommunication. The Council resolved that the Bishop had no power whatever over the clergy or laymen in Madras. To prevent irregularities in future, the Council ordered that neither the then Pādre nor his successors could read any paper directed by any Bishop without the sanction of the Governor. In 1701, a Roman patriarch who arrived at Pondicherry sent some presents of chocolate, oil and wine to the Madras Governor, and asked Pādre Michael to present himself at Pondicherry. Pitt accepted the presents, but ordered the missionary not to go. The result was, the Bishop of St. Thome placed the Capuchins of the Portuguese Church in the fort under an Interdict. The quarrel lasted for years, till in 1715 the Capuchins recognized him. Similarly, in the time of Governor Pitt, several strikers who took refuge in San Thome were supported by the Nawāb's agent, and Pitt threatened to retaliate.

HISTORY FROM 1700 TO 1749.

The first half of the 18th century saw the growth of the Nawābs of the Carnatic. The period ended with the Carnatic succession war, the rise of the French, their capture of Madras and their eventual fall. In 1749 San Thome was granted to the English. The same fate befell Mylapore, the main Moslem City. In 1709³⁴ Governor Pitt had requested Siyāuddin Khān, the Steward of the house-hold of Shāh Alam, who was known to Governor Pitt, and whose wife was living at San Thome, to give him the town of Mylapore and 'Tiruvattore' pointing out that, while they were of no use to the Emperor, they would be of great value to the business of the Company. Mylapore was not however granted at that time; but 'Tiruvatore' Nungambakkam, and three other villages were granted for 1,500 pagodas per annum. Mylapore therefore had continued to be the seat of a Moslem Havaldār, and very often the

Nawāb was there. In October 1749, however, the English³⁵ eventually obtained it from Nawāb Muhammad Ali, whose Diwān Sampāti Rāo played a conspicuous part in the transfer. In the same year Mambalam and several other villages were, as has been shown elsewhere, also acquired.

(To be Concluded)

34. See *Vestiges*, Vol. II, p. 21.

The Use of Pictures in Teaching Geography

A Talk to Teachers.

By

MRS. P. S. SUNDARA RAJ, M.R.S.T., F.R.G.S.

There is no need for me to stress the value of pictures in teaching geography, or indeed any subject. Children take a natural delight in pictures, and in using pictures we are only enlisting the child's own natural predilections. Seeing, learning and enjoying may easily be combined into one process in the child's mind by a teacher who knows how to use pictures correctly in her lesson.

Apart from the natural pleasure of children in pictures, there are other advantages in their use that will at once occur to you.

Pictures convey correct ideas, where a description might be misunderstood. Teachers in England who have to teach the Bible, for instance, could give many examples. I am quite sure that many an English person, reading the story of a lame man who picked up his bed and walked away with it, pictures the recently cured cripple as staggering along under a great four-poster bed, with the mattress and blankets and pillows. No English child can think of a bed except in the form of an iron or wooden bedstead. To sleep on a mat on the ground would be an impossibility in the English climate. For such children a picture would at once convey something that mere descriptions could never give. In the same way, Indian children are likely to misunderstand descriptions of life in England, which would immediately become clear if a picture were shown.

Further, these correct ideas are quickly conveyed by means of a picture. The attention of the children is much more easily secured. What is even more important, the information thus obtained is generally retained. Recent experiments conducted in America seem to prove that lessons taught by a cinema film was remembered much better than those taught in the ordinary way. If we try to think back ourselves to childhood's days, I am sure some of our ideas would still clothe themselves in the form of pictures seen very long ago. I believe that if, for example, you were to ask me what a canyon was, the word would suggest

picture of the Grand Canyon of Colorado that was in my school geography book, rather than the real canyons I have seen in more recent years. So strongly are impressions held, when conveyed in picture form in childhood.

These then are the advantages of using pictures. The children enjoy the lesson and are more attentive: they gain correct ideas quickly and are saved from obtaining erroneous impressions. What they learn through pictures they are likely to retain.

These advantages, however, must not blind us to the fact that pictures by themselves are not sufficient. They must be supplemented by descriptions. A picture is an appeal to the eye alone. It represents an object in a static condition at a single moment of time. A picture of a tropical forest, for example, may show us the colours and the forms of trees and plants. It cannot convey to us the heavy scents of the flowers, the damp smell of undergrowth, the constant flicker of light and shade. The forest is not still; it is full of busy life. Myriads of living creatures are going about their business, and some creatures not so tiny. The forest is not silent either. At night, even more than by day, it comes to life. It may seem to be quite still, but if you have ever spent a single night in the depths of the jungle, you will know that it is full of sound. Patches that appear to be shadows, or bushes or the tree-side, when closely watched, reveal themselves surprisingly as deer or other animals, so cleverly concealed by this background that only the keenest and most experienced eyes can detect them. Now these impressions can never be given by a picture. The picture at best is only the supplement of a good description. In the same way, a picture of a desert, with its bare spaces and stark shadows, may give some impression of the heat and emptiness of the desert by day; but of the intense cold at night? What of the mirage that lures the traveller on! These cannot be shown in a picture. A picture of an iceberg gives a very good idea of what an iceberg is like, but not even a cinematograph can reproduce the peculiar colour, the strange green-blue that changes moment by moment as the great monster comes swiftly across the ocean. It certainly cannot reproduce the icy blast that comes down with the icebergs from the cold northern waters. A description must certainly accompany the picture.

Pictures have many advantages, but they have their limitations. The teacher who has provided pictures for his or her class has not thereby done all that is necessary.

Pictures for use in teaching geography may be divided into three main groups: large pictures, for use during the lesson, which must be clear enough for every member of the class to see; smaller pictures, which may be hung on the wall for the pupils to see after the lesson, or even as ornaments; and finally very small pictures for the pupils to use individually. If the school has a lantern, or an epidiascope, of course, quite small pictures may be enlarged so that the whole class may see them at one time.

The geography teacher must always be on the look-out for material in the form of pictures. Large pictures will generally have to be specially bought. Some may be made or copied by a teacher who has a liking for drawing and some skill in art. Smaller pictures are obtainable in all sorts of ways. Children must be set to collect pictures just as they collect objects for the school museum. Newspapers, magazines, calendars, advertisements, picture postcards, the wrappers of tins and packages, will all provide material. Many governments, municipalities and railway companies also issue beautifully got up books and pamphlets. A large and interesting collection can thus be easily gathered. The teacher who has a camera can be on the look-out for suitable subjects. Now the whole value of such a collection—and this is most important—the whole value of the collection lies in its orderliness and availability for use. Half a dozen pictures, thoroughly understood and selected with a definite purpose in view, are of infinitely more value to the teacher than a drawer full of miscellaneous pictures which have never been classified or arranged. Mount your pictures and classify them—the pupils can very well do this. As material accumulates, and possibly becomes excessive, old and worn pictures can be rejected; and others re-classified. The essential thing is to know what pictures you can have or where to find them.

The small pictures must be carefully sorted and classified. They can then be arranged in books, according to subjects. Loose-leaf books may be easily made in the hand-work class, or letter files may be used. Some pictures will serve more than one purpose. For instance, a view of the Swiss Alps may be required for a lesson on Switzerland, a lesson on mountains, or a review of Europe. Another way of using small pictures is to mount them in the form of zig-zag books. The classification may be done in any way useful to you. Each book may represent a country, or a continent, or natural features such as mountains or river valleys. Occupa-

tions make another classification, such as rice-cultivation in different countries, wheat-lands in North America, Europe and Asia, and so on. The important thing is to know what you have and be able to find it when required. All this is work which the pupils themselves will gladly do. As material accumulates, it should be weeded out, so that the collections are always manageable.

So much for collecting materials. Now comes the problem, how to use it.

Certain principles are necessary, whether we use large pictures for class demonstration, or small ones for the individual children.

The first is, do not show too many pictures at a time. Two or three are enough. If the children are given too many they will only retain a confused memory. This does not mean there is no place at all for the cinema film or for the showing of a set of slides on certain occasions. But I am now dealing with actual lessons on specific themes. For such lessons, two or three pictures are quite sufficient. Secondly, see that your pictures do illustrate exactly what you want them to illustrate. You must decide before you use the pictures exactly what purpose they are to serve. Ask yourself, "What does this picture show? Does it show it clearly enough? Does another picture show it better?" The pictures that are left mounted on the wall or in albums for the pupils to study after the lesson should not only have the title, but should also state quite clearly what they are supposed to show.

Thirdly, have a definite place for studying the pictures selected for the lesson. I will say a little more about this later. Just now I want to say a few words about how to use pictures in the actual work of teaching.

1. Certain typical scenes may be mounted and framed and left permanently as decorations in the class-room or geography room. These need not be very large pictures, but they should not be too small. Under this head would come scenes taken from the big regional divisions of the World, such as a typical hot desert, a tropical forest, and so on, or some of the main occupations such as rice-growing, lumbering, wheat-fields, etc. These are things which every geography course, whatever the syllabus in use, is likely to include. Such illustrations may well therefore be kept permanently in view for constant reference.

2. The large pictures should be mounted on cloth or cardboard. They may be used at the beginning or the end of the lesson, or in the course of it. Vary the procedure. The teacher,

for instance, might show a picture, or two or three pictures, of life in Japan. When the children have sufficiently studied the pictures, the teacher may then allow them to give their impressions. The teacher's business will then be to gather up or arrange what the children themselves have found out. On the other hand, the teacher may give the lesson, as we say. In this kind of lesson the teacher begins, say, with a little boy or girl of Japan, shows the picture and describes it. Then will follow his house, with a picture to illustrate it, and then perhaps pictures of his father and mother, Japanese children at play, and so on. The third method is to introduce pictures at the end of the lesson, gathering up and focussing all that has been said.

Small pictures are difficult to use in class-teaching. If you have a number of copies of the same picture it is easier, but even then the teacher can never be certain that all the children are looking at the single point in the picture. They are very useful for children to study in their free periods. A set of small pictures may sometimes be passed round at the close of a lesson.

It is well sometimes to have several illustrations of the same thing. A mountain, for instance. There is no really typical mountain, and if you want to avoid teaching the children to think of one particular form only as a mountain, it is necessary to give several pictures of mountains. Other examples will occur to you when several pictures are really necessary.

But there are other ways of using pictures. Pictures make excellent examination questions and revision tests. The teacher may show a picture and ask the class to write a description of it. After a lesson, or a series of lessons, on a particular country, or commodity or other subjects, the class may be given pictures and asked to answer certain questions by way of revision. I have not myself seen a picture used in an examination paper, yet this type of question has been used in other countries, and is specially useful in the early stages. There is no reason why you should not introduce pictures into your class and promotion tests. Suitable pictures would be those of Eskimos, a Canadian wheat-farmer, Arabs drawing water from a well or other people from the main regions of the world. Suitable questions would be, "Look at the men (or women, or children) in the picture. In what part of the world do they live? How do they obtain their food? How do they travel?" At a later stage a little more may be demanded, and rather more difficult pictures may be used. For still more

advanced pupils, questions on land forms, rivers, surface-relief and similar subjects may well be based on pictures.

Another type of question would be to show a fairly wide stretch of country and ask the pupils to describe the view they would obtain from a given point, or to describe what they would see if they walked from one given point to another. The grand result of such questions is that they pin the pupil down to particular and actual things. Geography may so easily consist of generalities and definitions. A test paper set in this way will compel the pupil to be definite and to refer to actual facts, and the teacher will see at once whether the child really understands what he has learned or is merely reproducing something that he has learnt by heart.

Pictures may also be shown without titles and the children asked to say what country, etc., they represent. Pictures previously shown, with similar ones added may be shown again by way of revision or testing, or both together. In this way, the memories of the children are refreshed and the teacher at the same time can find out what facts have remained most prominently in the minds of the pupils. For this kind of exercise larger pictures may be used and the whole class take part. Pictures may also be used as observation contests—to see which side can find out the most facts in a given picture.

Books of pictures may be kept for use on rainy days when some pupils cannot go out to play, or for free periods. The children can then choose their own books and look at the pictures as they like.

Another use for pictures, although I do not propose to discuss this in detail, is to make them the basis of geography handwork, or other craft activities. Costumes may be designed and made, and dolls dressed, models built and so on. With young children particularly, time must always be given for such activities, and pictures are essential for this work.

A very important use for pictures is in connection with maps. Here again it is very easy to take refuge in generalities. By maps I mean all kinds of maps, not only physical. Take climate, for example. How easy it is, for example, to draw a map showing so many inches of rain on one side of a mountain range, and so much on the other side, and how glibly pupils can answer questions on climate. I remember very well, years ago, in the Vosges moun-

tains in France, how striking it was to see the vineyards climbing up one side of the mountain and the pine forests up the other side. If I had seen it represented on a model or in a map, I am sure I should have thought it was a little artificial, made to illustrate a theory. Yet it was there before my eyes in actual existence. I probably learnt about such things at school, and drew rainfall maps, but I never really grasped the extraordinary contrasts that could exist on the two sides of a mountain range, until I saw it for myself. Most of us, and certainly most of our pupils, will have to be content with pictures of most of the world. Let us see to it that not only Standard II with its stories of children in other lands, but equally the VIth Form studying erosion and climate and other abstruse branches of geography, have plenty of pictures. Speaking of erosion reminds me of a cinema film I saw not long ago in which what had been among the richest farm lands of Canada and the U.S.A., were shown literally blowing away. It was a terrible picture, and could not be forgotten. In the same way, as far as possible, physical maps should be compared with actual photographs of the country represented. If you have a lantern, the two, picture and map, can be shown together in an ideal way, both drawn on the same slide. But even without a lantern, pictures and maps can be shown together to the class. Especially is this method useful when teaching contour maps.

Earlier this evening I said that a picture by itself was not sufficient. It must be accompanied by description. This is where the teacher has to play an important part. Showing a picture to the class does not mean that the teacher may do less preparation but rather that he or she will have to do more. The teacher with a picture before the class cannot take refuge in generalities. You may talk quite convincingly about, say, the prairies of Canada—great stretching plains, scattered towns, lovely farms, and so on. All quite correct. And the pupils will reproduce it. Put up a photograph of a lovely prairie station. At once you are pinned down to actualities. What is that strange building? No such building can be seen in India or even in England. What is that little box nailed to a post near the railway line? What is that machine actually doing? Perhaps the description with the picture is sufficiently exhaustive to answer all these questions. Very likely it is not, and the keen eyes of the children will pick out some detail that you will have to explain to them. The teacher who uses pictures therefore needs to know a great deal more and to make more useful preparation than the one who relies on generalities, and who thinks that if children learn a definition their minds are quite clear about any fact.

How is the teacher to obtain this information? Firstly, by reading. Secondly, by reading. Thirdly, by reading. And when you have done that, read again. Read newspapers. Read magazines. Read travellers' descriptions. Read guide books. Read novels. Recently the newspapers and magazines were full of descriptions of the visit of the King and Queen to Canada. Of course they travelled under special conditions, but nevertheless those articles provide a great deal of material for building up a mental picture of Canada. In the same way, some great events in some parts of the world may call forth a number of newspaper and magazine articles that will furnish up-to-date knowledge. There are good geographical magazines that deal in popular fashion with countries and people and occupation and industries. Especially I commend to you the reading of novels. Frequently a good novelist who sets his story against a background will import into his descriptions an emotional content that makes them far more alive even than a traveller's description. His canvas will be small, of course; only large enough to make a background for his characters to move and live, and possibly only one section of the people may appear, but remembering these limitations, we can add very considerably to our descriptive ability by careful study of the best novelists of the present day. Of course we shall not look to Dickens for a description of London or to Thackeray for modern Virginia. Recently I read an English translation of a very long Russian novel. Most of it was painful, even unpleasant, reading, but I received an impression of a certain part of Russia that cannot be compared with anything I had previously read. Similarly, a magazine that I had picked up quite by chance gave me a picture I had never before possessed of the annual breaking of the ice on the Vistula. Moreover, the world is constantly changing and our information must be up-to-date. So I would say, read and read and read again. A geography teacher who does not read, or who reads only the prescribed text-book, will only become staler and staler, and not even the brightest of pictures will make his or her lessons anything but stale.

Now we have to remember that a child does not necessarily see in a picture just what an adult sees. All our past knowledge, all our previous experience, are focussed on the picture as we look at it. When we look at a picture we see it coloured by the emotions born of past experience but not evoked by the picture. Let me give you a somewhat extreme example. The thing which to me, to me, I repeat, most recalls the spirit of the great prairie lands of Canada is the letter box nailed to a post at lonely

cross-roads or near a tiny railway station. So scattered are the lonely farms that no postman could visit them and deliver his daily letters. So at some point on the road a box is fixed up wherein the postman may place the letters for the farm and where he will find the letters ready for him to carry back to the post office for mailing. A picture of such a box at once calls up to me the idea of the loneliness of the farms and the great distances between them. I think of the people who will come to take their letters from that box. Here is a farmer, perhaps, who long ago fled from persecution and danger in Central or South-Eastern Europe. His children are growing up free Canadian Citizens, and he takes from the box a letter in a language his children cannot read, sent by friends and relatives from that old land in which his childhood days are spent. Or a young man comes, just starting a new life, but eager still to receive news from his parents in their cottage among the hills of Scotland, I could look at such a picture, simple as it is, for a long time, and image after image would come into my mind. But show that picture to a child and ask him what he sees, a box, nailed to a post. His literal mind may even lead him to count the nails by which it is fastened. He may tell you the box is crooked, and if pressed, will search for still further details to recount. The real significance of any picture is likely to elude the literal mind of the child. Therefore in preparing the lesson a definite plan must be followed. The essentials must be brought into prominence. In the lesson this can be done by discussion or description by the teacher. Other pictures which the children examine out of class must be adequately described and the essentials brought to their attention.

Two other aspects of this subject I should like to mention. One is the opportunity of teaching appreciation of the natural beauty of landscapes in colour and form. A landscape may be represented on a map, or by a picture. A map gives us very little idea of the beauty of a countryside, though a geographer who has seen much of the world and who is skilful at reading maps may, by putting together what the maps tell him of rainfall, climate and the physical conformation of the country gain some idea of the picture it presents to the eye. Pictures, however, especially coloured ones will reveal many of the beauties of the world. Pictures of the beauties of landscape may evoke in children a desire to protect that beauty.

Finally, pictures are a means of cultivating the imagination. Children naturally think in pictures. Adults tend to lose this

ability. But it is something well-worth preserving, and to the teacher of geography, a necessary asset. If you have lost it, you must regain it to be a successful geography teacher. For your pupils it is just as necessary, and a skilful use of pictures will enable them to retain this precious attribute of childhood.

Select Contents

The Geographical Journal: July 1939.

Exploration in the Lesser Sunda Islands—By H. A. Brouwer.

Practical Regionalism in England and Wales—By E. W. Gilbert.

The Geographical Journal: August 1939.

The Polar Front and its Place in Modern Meteorology—By C. K. M. Douglas.

The Geographical Magazine: August 1939.

A Hundred Years of British Farming—By Prof. J. A. Scott Watson.

The Saxons of Transylvania—By Christopher Hankey.

Giant Fish Traps of Siam—By W. B. M'Quitty.

The Modern Indian of the American South-West—Dr. Ruth Underhill.

The Geographical Magazine: September 1939.

Australians at Home—By Michael Terry.

Free China's New Gateway—By Gerald L. G. Samson.

Places and Products: VIII. Portland Stone—By J. E. Mallory.

A Mountaineering Adventure in the Karakoram—By R. A. Hodgkin.

The Scottish Geographical Magazine: July 1939.

The Natural Vegetation of Scotland: Its Character and Development—By H. Fairhurst.

Human Geography, History and Sociology—By Prof. C. Daryll Forde.

Geographical Review: July 1939.

Agricultural Land in Proportion to Agricultural Population in the United States—By Richard Harshorne.

The Soils of the Tropics: A Review—By Robert L. Pendleton.

Indian Information Series: August 1, 1939.

New Iron and Coal Deposits in India: Gold Prospects.

Proceedings of the Royal Geographical Society of Australasia, South Australian Branch for 1937-38.

Monsoonal Australia—By J. A. Prescott.

The Value of Geography to the Community—Dr. Charles Fenner.

News and Notes

Three meetings of the Association were held during the quarter in which three lectures were arranged for teachers of Geography. On 29-7-'39, Miss E. D. Birdseye gave a talk on "Asking Questions in Geography"; on 19-8-'39, Mr. N. Subrahmanyam lectured on "Map Work in Teaching Geography"; and on 9-9-'39, Mrs. P. S. Sundara Raj spoke on "The Use of Pictures in Teaching Geography."

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The new *Elementary School Syllabus in Geography* recently issued by the Department of Education has been found to be unsatisfactory; and protests have been raised against its introduction in several quarters. We have no doubt that the Director of Public Instruction, to whose notice the matter has been brought, will take early steps to get it suitably revised.

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There appears to be a general feeling that the *S. S. L. C. Geography* is in urgent need of overhauling; and we could point to some of its objectionable features, such as unequal mating with History, with no means of knowing the candidate's performance in the Public Examination, with only an hour's paper to meet which difficulty short tests have been introduced, study of pure regional geography only to the neglect of General Principles (Part IV of the original syllabus being omitted); and now comes the latest reform in the shape of the portion for the public examination being confined to Eurasia only to the neglect of the other continents (which form a 'B-Group' within the subject). In short the 1929 scheme and syllabus have by successive tinkering become in 1939 very lop-sided indeed. Probably it is not opportune to ask for or attempt any change now, as the Reorganisation of Secondary Education is now on the anvil and everything will go into the melting pot.

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It is pleasing to note that at long last the Madras University *Diploma Course in Geography* has come to be popular, as measured by the strength of the class this year. It is hoped that it will continue to be so at least until such time that Colleges provide for teaching Geography in the Degree Course. The Geography Departments of Training Colleges have now a better chance of getting

students qualified in the subject, and schools a better chance of having fully qualified teachers of Geography.

As few Andhra students have so far taken advantage of the training afforded by the University Diploma Course in Madras, it is desirable that the *Andhra University* institutes its own Diploma Course so that Andhra graduates seeking admission to the Geography Department of the Training College, Rajahmundry, may get the requisite preliminary qualification in subject-matter before undergoing the teachers' training.

We are glad to note that the *University of Mysore* is taking further steps to implement its former resolution to introduce Geography by bringing into their academic bodies draft schemes for Intermediate, B.A., and B.Sc., Courses with the intention of starting it at the Intermediate stage in the Academic year 1940-41 and carrying it right along.

Arrangements for holding the 27th Session of the *Indian Science Congress* at Madras in January 1940 are proceeding apace; and the Executive Committee and the various sub-committees of the Reception Committee are busy working out the preliminaries. Among the longer excursions to be organised in connection with the Congress are those to Mahabalipuram, Gingee, Mettur Dam and Madura, besides short local ones.

The proposal for an *All-India Geographical Society*, mooted first at the Calcutta Session of the Science Congress in 1938 has not so far materialised itself; and there has been little response from the several provinces and states, the chief reason being probably the absence of strong Geography Departments in most of the Indian Universities. It is hoped that in the coming session of the Congress at Madras, some progress may be made towards the realisation of the proposal.

Closely connected with the previous question is the urgent need for an *All-India Geographical Journal*, which can well be the organ of such an All-India organisation. Geographical research is yet in its infancy in this country; and it is only through societies and magazines that a proper fillip can be given to it.

The XVth *All-India Educational Conference* will be held at Lucknow (and not at Patna as originally decided), on December

27-30, 1939. Dr. Sir S. Radhakrishnan will preside over the Conference. An All-India Educational Exhibition will be held along with the Conference in connection with which excursions will also be arranged.

The Report of the *Patna College Geographical Society* for 1937-39 shows a record of useful activities carried on under the direction of its energetic President, Prof. Z. Ahsan. Among the extraordinary meetings of the year is an interesting debate reported in it on "*Flood Control in Bihar*", presided over by Mr. J. B. Sen, Parliamentary Secretary to the Government of Bihar.

While some parts of the country like Bihar and Bengal have problems connected with flood control, Madras in common with certain other drier parts of India have problems of their own, suffering from the vagaries of the monsoon. The water-supply of Madras and certain other towns is threatened; while famine conditions prevail in the country-side.

The principal map production office of the Survey of India, the *Photo-Litho Office*, whose machines pull out annually more than 3,000,000 impressions valued at over Rs. 3,00,000, celebrates its jubilee this month (September). Of the original contributions of this office, mention may be made of the direct zinc printing process, now known throughout the world as the "*Vandyke Process*", which was evolved at this office, and is named after the late Mr. F. R. Vandyke, Manager of its Lithographic Branch, who was responsible for the discovery.

A grim war has broken out in Europe, whose magnitude, developments and repercussions are too early now to gauge. The map of the Continent is being re-drawn, though no one can foresee at present the shape that it will finally assume. Various and far-reaching will be the effects of this war in most countries of the world.

Says *The Times of India*, in a recent issue:—"From India's point of view, there is one great difference between this war and the last. In 1914 the industrialisation of the country was in its infancy and the cutting off of European supplies of manufactured articles meant complete dislocation of our economic life.

"To-day, however, conditions are different. Indian industries have made vast strides in the past two decades. To mention only

a few staples; India is now virtually self-sufficient in such important commodities as cement, sugar, soap, matches and shoes. She has also considerably expanded her production of other essential articles: iron and steel, cotton textiles, paper, chemicals, rubber products (tyres, etc.), the simpler types of electrical equipment (bulbs, switches and fans), and so on.

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"The result is Indian economy has not been gravely dislocated by the war. On the contrary, if she can manage to buy the necessary machinery and plant from the United States, there is every chance of a number of new secondary industries being established in the near future * * * * Here is a big opportunity for Indian enterprise".

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Reviews

Beginning Geography in Africa and elsewhere. By V. L. Griffiths and Abd el Rahman Ali Taha. (London, Evans Bros., Ltd.), price five shillings.

In reviewing this book a geography teacher is tempted to begin by stealing Mr. Fairgrieve's summing up from the Foreword and say that "it is extraordinarily good geography and it is extraordinarily good teaching. It is easily the best book of its kind that any teacher of juniors can obtain, and while it was written in and for schools in the Sudan, its principles and methods can be adapted readily to any other area".

Syllabus makers and teachers in India are very keen on what they were pleased to call "local geography". It is certainly local, but in my experience it is rarely geography. To learn the names of all the stations on the S.I.R. main line by heart is not exactly geography, though it is exactly what I have heard in school. Children do not need to come to school to learn the way from their house to the bazaar. The real purpose and value of teaching local geography is abundantly made clear in this book. Further, the way to teach it is dealt with in great detail. It is easy to put down in the syllabus, "visit the local market", or the post office, or the mosque, but I have yet to meet the village teacher who knows how to make such a visit into a real geography lesson. In this book such visits are made into lessons full of interest and profit. None of the small but so often baffling problems that confront the ordinary teacher of the ordinary junior class seems to have escaped the attention of the enthusiastic but essentially practical authors of this admirable book.

The connection between geography and civics is clearly brought out, though unfortunately the pundits who have settled the course which our elementary schools must now follow seem to find such a closer connection between civics and human physiology than they do between civics and geography.

The series of lessons on map making is remarkably clear. It is here more than anywhere that the average village school entirely misses its opportunity. Step by step the significance of a map is unfolded, and it is safe to believe that children will not leave the Sudan schools thinking that the North is somehow the top of the world or that North America is about the same size as their local

district because the wall maps of the two areas are the same size. The present reviewer, looking back over the junior classes she has taught is only sorry that such a book as this has never come her way before. It is full of stimulating and helpful ideas and it makes clear some of these difficulties that teachers contend with year after year without solving them. No book could better serve its particular purpose that this does, and no training school should be without a copy. Although it is called, "Beginning Geography," teachers of senior scholars could not read it without profit to themselves and their classes. In short, it is a book that cannot be too highly commended.

The World in Outline. By E. D. Laborde. (Cambridge University Press). Price, 6sh. 6d.

This is a text-book of world geography suitable for use by candidates in secondary schools preparing for the School Certificate Examinations. Though the Continents are arranged in the conventional order, the teacher can take them in any order he likes, as there is no gradation of difficulty in treating them. The characteristic features in each land mass have been specially emphasised; and the treatment is comprehensive, clear and interesting. The skeleton outline of physical geography appended at the end can serve for revisional purposes after the world study is completed. A special feature of the book is the copious illustration in the shape of numerous simplified sketch-maps, special diagrams and good pictures. When the Matriculation takes the place of the S.S.L.C. Examination in Madras, as it is shortly expected to do in the proposed reorganisation of the Secondary Education, whatever be the syllabus, so far as the study of the regional geography of the world is concerned, the volume under review can serve as an admirable text-book.

The World. By Thomas Pickles. (London, J. M. Dent & Sons.), 1939. Price 4sh. 6d.

This text-book of world geography provides a survey of the world, which must form the main body of any secondary school course in Geography. The volume is divided into two parts: the first part deals with general world geography, the topics treated being the following:—the world as a globe, the major natural regions, land forms, map-making and map-reading, and sources of power and metals. These fundamental topics are presented less in an academic way and more in a manner calculated to arouse

the interest of the pupils by e.g., introducing some illustrative details from common experience to explain some of the more difficult topics. Similarly, in the study of the natural regions, instead of presenting at the outset a complete, complex and confusing map, each region is introduced by a special map, while subsequent maps revise and extend the knowledge thus gained. Again in the study of each natural region a few typical products have been dealt with instead of a long and wearying series of world distributions.

The second part of the book provides a rapid survey of the outstanding features of the regional geography of the continents—Europe the most complex continent being placed last. But as there has been no grading according to difficulty, the sequence can be altered to suit any school course. The volume is well illustrated with a number of good sketch-maps, charts and pictures; and is suitable for use in high schools.

Modern Geography—Book I: Foundations of Geography.
By D. M. Preece and H. R. B. Wood. (University Tutorial Press, London). Price 3sh. 6d.

This is an excellent text-book of general geography, dealing with the essential principles of both physical and human geography, and forms a good companion volume to regional geography books. In fact, as the Preface states, it is "the first of a series of six books designed to meet the needs of pupils, preparing for the school certificate and other examinations of similar scope." We wish to state, however, that it would have come in better as the last book of the series; or what amounts to the same thing, that it is studied at the end of a good course of regional geography in school, though the principles may be learnt progressively each year of the course. For the Intermediate Course, however, it affords an admirable foundation for further advanced study of the subject. The treatment is systematic and comprehensive; and the volume is copiously illustrated with useful maps, diagrams and pictures.

Lands beyond the Border. By Dewan Bahadur H. L. Kaji. (Humphrey Milford, Oxford University Press, Indian Branch), 1939. Price Rs. 3.

This companion volume to the author's Principles of General Geography is original in its conception of giving to Indian students a synthetic idea of lands beyond the Indian border and across the

Indian seas. In recent years there has been evinced in this country a growing interest in the lands adjacent to it and in those which have a special connection with Indians. The book under review is, as the author says in the Preface, "an attempt to place within the easy reach of the student a small volume which provides material not only for a geographical study, regional and economic, of these countries, but also discusses briefly their progress and problems with special reference to the interest they have for India". The Indo-centric perspective, as opposed to the Brito-centric, planned in the Introduction and worked out in the volume is refreshingly original and should make it peculiarly interesting to Indian students of Geography. Beyond the land border, countries from Arabia to Japan have been brought within the purview of the book; and across the seas lands of the Eastern sea-board of Africa from Egypt to South Africa as well as Ceylon and East Indies have been included. Australia has naturally been left out of lands of Indian interest. Both for its right perspective and its clear treatment, the book may be read with profit by students of geography in Indian Universities.

Collins—Longmans Study Atlas. By K. H. Huggins, J. M. Parrish, D. A. Workman and J. C. B. Redfearn. (Wm. Collins Sons, & Co., Glasgow & Longmans, Green & Co., London), 1939. Price 3sh. 6d.

Planned, compiled, drawn and produced under the direction of a joint advisory board of experts—a geographer, a technician, an educationist and a cartographer, this Study Atlas gives extraordinary good value for the price. In producing it their one aim is stated to be "the presentation, in a simple form in which they can be easily assimilated and used as a basis for all school geography, of a careful selection of the most significant facts about the earth as the home of man". And this aim, we are sure, has been admirably fulfilled. It is pleasing to enumerate below some of the several good features of this excellent school atlas:—

1. Precision and clarity of all details.
2. Stress on areas and regions rather than on boundary lines.
3. Omission of dispensable details.
4. Several double-page maps to show relationships better.
5. Seven-colour printing, affording a greater range of pleasing tones without confusing the eye.
6. A uniform system of colour layering.
7. 28 photographs to provide vivid illustrations of geogra-

phical aspects which cannot adequately be expressed in words or maps.

8. Double-page world maps presenting fundamental facts of general world geography.
9. A summary diagram to bind together information from the separate maps in relation to the major regions.
10. About 1,100 exercises, designed to familiarise the student with the uses of the Atlas.

The substitution of an Indian section in place of the extensive section on Britain in an Indian edition should make this valuable atlas still more valuable for use in Indian schools.

The Southern Continents and North America (in Telugu). By Eva D. Birdseye. (Macmillan & Co., Madras), 1939. Price 12 as.

This is the first volume of a series, prepared in accordance with the recently revised S.S.L.C. Syllabus in Geography issued by the Madras Educational Department. The authoress, who is an experienced teacher, has treated the subject in a simple and practical manner with proper emphasis on essentials: and the language is simple and clear. The exercises given at the end of each chapter help to revise as well as to supplement the matter; and references are given to additional reading from original sources. The book is illustrated with a number of useful sketch-maps, diagrams and pictures.

Food, Clothing and Shelter Series: Book I (in 3 parts also); *Hunters, Shepherds and Farmers* (Tamil), 3½as., 4as., 4as.

Providers of Food, Clothing and Shelter: Book II (in 3 parts also), (Tamil), 3¼ as., 4as., 4as. By Mc D. Robison (Macmillan & Co.).

These are Tamil editions of the Geography books in English by the same author reviewed in a back number of this Journal recently. They form an admirable series of graduated reading books in geography for elementary school children, written in easy Tamil, printed in bold type and well illustrated. A novel and helpful plan is followed in all these books. Each lesson is divided into two parts: In the first part certain information is given in order that the pupils may acquire geographical knowledge; in the second, exercises are given to test and fix

this knowledge, which may later be applied by the pupils to problems of ordinary life.

These books have been specially written for pupils with little or no experience of varying lengths of daylight during the year, and of the intense cold and stoppage of plant life during winter. Ceylon instead of England has been used as the home of the pupils; but the books can be used with great advantage in Tamil schools of South India as well, as the climatic conditions are exactly similar, variations in seasons being expressed more in differences of rainfall than of temperature.

Cost of Living in the Co-operative Villages. By the Audit Union of the Workers' Agricultural Co-operative Societies, Ltd. (Tel-Aviv, Palestine).

This is a brochure issued by the Audit Union of the Workers' Agricultural Co-operative Societies, at Tel-Aviv in Palestine, giving a statistical and closely reasoned account of the researches carried out in 38 out of 82 Jewish villages in which co-operative agricultural farming is carried on. The cost of the main items of living in these villages is compared with that in some of the older countries like Bulgaria, Poland, Sweden and U.S.A.

The following statement regarding the adaptation of the dietary of the Jewish immigrants to geographical conditions is very interesting:—"In Northern and Central Europe the consumption of meat, milk and potatoes ranks high. In the Mediterranean countries these commodities have a rather limited consumption and are supplanted by a high consumption of bread and vegetable oils. This is natural, as this region is famed for its olive oil, while the cultivation of potatoes is centered in Northern and Central Europe. On the other hand, the goat is the commonest domestic animal in the herds of the Mediterranean countries, whereas in Northern and Central Europe the cow predominates, hence the disparity in the consumption of milk and meat. In addition, the colder climate tends to increase the consumption of foods of animal origin, while the warmer climates tend to raise the consumption of vegetable foods.

"Geographical conditions are also responsible for certain other characteristics in the diet of the farmers in different countries—as for example in the high consumption of fish in Italy.

"With regard to the Jewish co-operative villages, these occupy an intermediary position between the diet of farmers in Northern

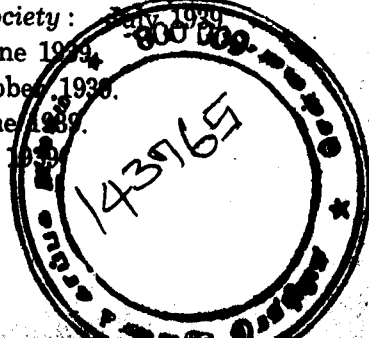
Europe and those of the Mediterranean countries. This is only natural, inasmuch as to a great extent they are natives of Europe—Poland, Germany, etc., who have settled in Palestine, a Mediterranean country.

"They arrived here with dietetic habits of European origin, a product of European climate and conditions, i.e., a high demand for potatoes and foods of animal origin, and are now gradually adopting a typical Mediterranean diet of oils, vegetables, and fruits as a substitute for meat, potatoes, etc."

Regarding the development and establishment of the co-operative villages, the book concludes that "the members of the villages are gradually adapting themselves to local conditions, and after the first years of suffering and privation they at last reach a stage where they can provide themselves with the necessities of life to at least such a degree as the farmers of highly developed agricultural countries, as Switzerland and Holland. * * * * * Thus we may say, in summing up, that the co-operative villages have gone far towards economic stability, and that it is hoped such progress will continue to be made."

Books and Journals Received

- Beginning Geography (In Africa and Elsewhere)*: By V. L. Griffiths & Abd el Rahman Ali Taha.
- The World*: By Thomas Pickles.
- The Southern Continents & North America (in Telugu)*: By Eva D. Birdseye.
- Food, Clothing & Shelter (In Tamil)*—3 parts: By L. Mc D. Robison.
- Geology & Allied Sciences—A Thesaurus*: By Walther Huebner.
- The Foundations of Geography*: By Preece and Wood.
- Lands beyond the Border*: By Dewan Bahadur H. L. Kaji.
- Collins—Longmans Study Atlas*.
- The World in Outline*: By E. D. Laborde.
- The Progress of Research on Indian Soils*: By B. M. Thirunaranan.
- Cost of Living in the Co-operative Villages in Palestine*.
- Stray Thoughts from Abroad*: By M. B. Pithawalla.
- The Cradle of Sind*: By M. B. Pithawalla.
- Bibliographie Cartographique Francaise—1937*: By Comite National de Geographie Francais.
- Proceedings of the Royal Geographical Society of Australasia—South Australian Branch*: 1937-38.
- Southern India Commerce*: May, June and July 1939.
- The Geographical Magazine*: July, August and September 1939.
- Indian Information Series*: July to September 1939.
- Journal of the Bombay Historical Society*: March 1939.
- The Himalayan Journal*: 1939.
- Nagari Pracarini Patrika*: Vol. 44, parts 1 & 2.
- Indian Culture*: April 1939
- The South Indian Teacher*: June, July & August 1939.
- Kalaimagal*: June, July, August and September 1939.
- Educational India*: July, August and September 1939.
- The Geographical Journal*: July, and August 1939.
- Geographical Review*: July 1939.
- Foldrajzi Kozlemenyekek (Hungarian Geographical Review)* Vol. LXVII, Nos. 1 & 2.
- The Educational Review*: June, July, August and September 1939.
- The Indian Educator*: July and August 1939.
- The Indian Journal of Political Science*: July-September 1939.
- The Quarterly Journal of the Mythic Society*: July 1939.
- Indian Co-operative Review*: April-June 1939.
- Visvabharathi Quarterly*: August-October 1939.
- Journal of Annamalai University*: June 1939.
- Scottish Geographical Magazine*: July 1939.



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